

## Effect of an Educational Training Program on Improvement of Pediatric Nurses' Practice Regarding Cardiopulmonary Resuscitation

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### Abstract

**Background:** the ability to respond quickly and effectively to a cardiac arrest situation rests on nurses being competent, prepared and up to date in the emergency life-saving procedure of cardiopulmonary resuscitation. **Aim of the study:** was to identify the effect of an educational training program on improvement of pediatric nurses' Practice regarding cardiopulmonary resuscitation. **Subjects and Methods: Research design:** A quasi-experimental study design was conducted to carry out this study. **Setting:** The study was conducted at pediatric intensive care unit, neonatal intensive care unit and emergency department in pediatric hospital at Zagazig university hospitals. **Subjects:** 103 nurses who were working in the previous mentioned setting. **Tools of data collection:** A structured observational checklist for nurses' practice and educational training program to train nurses regarding cardiopulmonary resuscitation were used in the present study. **Results:** the study revealed that no one of the studied nurses had good practice score before implementation of the program. This percentage increased to 100.0% immediately after implementation and then decreased to 86.4% at follow up phase of the program. **Conclusion:**, it can be concluded that educational training program had improved the studied nurses' practice regarding cardiopulmonary resuscitation. **Recommendations:** Based on the results of the present study continuous formal training programs for updating the knowledge and practice of nurses working with pediatric patients about CPR was recommended.

**Key words:** cardiopulmonary resuscitation, educational training program, nurses

### Introduction

Cardiopulmonary arrest is the unexpected shutdown of the circulatory system and/or the respiratory system, resulting in insufficient supply of oxygenated blood to vital organs. The main clinical signs are consecutively as follows: absence of cardiac sounds and pulse (immediately), loss of consciousness (after 10 sec.), interruption of automatic breathing (after 15-30 sec.) and mydriasis (after 60-90 sec.). Without external intervention within the first 4 min, irreversible brain damage occurs, whereas after 10 min, brain death occurs <sup>(1)</sup>. worldwide, millions are dying each year due to preventable and reversible critical illnesses, including circulatory shock and respiratory failure. The World Health Organization

estimates that more than one-third (16 million) of global deaths each year are from cardiovascular diseases and more than a third of deaths each year in children under 5 years of age (3.3 million) are from acute respiratory failure and shock<sup>(2)</sup>. The incidence of cardiac arrest among infants (children below the age of 12 months) is 72 per 100,000 infant-years and account for approximately half of all cardiac arrests among children. Their survival is dismal at approximately 5%. Bystander cardiopulmonary resuscitation (CPR) improves survival after cardiac arrest. Despite the proven role of CPR in improving survival, most children suffering from cardiac arrest do not receive bystander CPR <sup>(3)</sup>.

Early initiation of cardiopulmonary resuscitation and defibrillation are critical for reducing mortality and morbidity in patients after cardiopulmonary arrest. For every minute that CPR is delayed, the likelihood of survival decreases by as much as 10%. Thus, guidelines recommend routine training in CPR for healthcare providers to improve performance and patient outcomes<sup>(4)</sup>. The training concepts are divided into two main roles for nurses. The primary role is basically to provide basic life support care during resuscitation. The secondary role consists of crash cart awareness, equipment familiarity, skills in handling the equipment, defibrillator safety, accurate documentation and participation in the post-resuscitation care and debriefing<sup>(5)</sup>.

For best survival and quality of life, pediatric basic life support should be part of community effort that includes prevention, early cardiopulmonary resuscitation, prompt access to the emergency response system and rapid pediatric advanced life support, followed by integrated post cardiac arrest care. Rapid and effective bystander CPR can be associated with successful return of spontaneous circulation and neurologically intact survival in children following out-of-hospital cardiac arrest<sup>(6)</sup>. Of all healthcare professionals, nurses are often the first to discover a patient of cardiopulmonary arrest (CPA) in any part of the hospital, be it the "emergency" or the "in-patient" wards. Therefore, it is needed to say that their competency in cardiopulmonary resuscitation is a critical factor in determining successful outcomes in patients who develop CPA. We have different patient care areas. The emergency and intensive care unit are the places where most of the cardiopulmonary arrests are witnessed as the critically ill or injured children are admitted or transferred to these areas. Therefore, the competence of the nurses posted in these acute care areas became very important<sup>(7)</sup>.

Because of the nature of their profession, nurses spend significant time alongside patients and are often the first to attend at in-hospital cardiovascular arrests; they are thus the ones who respond by providing CPR. The nurse plays a vital role in the efforts to resuscitate a patient. As mentioned, the nurse often is one first assesses the patient initiates CPR calling of the team. The patient's primary nurse should be present to answer questions about the arrest. Roles of the nurses who respond to the arrest situation include continuing CPR, monitoring heart rhythm and other vital signs, defibrillating, administering drugs, recording of events, controlling any crowds, and notifying the attending physician and family members<sup>(8)</sup>.

It is imperative that a nurse remains certified in CPR. Changes in the sequence and content of CPR courses and guidelines are often made based on the most recent research on clinical outcomes and best practices. Check the American heart association's web site on regular basis to review any changes made on CPR guidelines. Implement only the most current guidelines for the best possible outcome and a coordinated team effort. It is the responsibility of the nurse to stay competent, confident and ready to respond within a team to acute pediatric emergency<sup>(9)</sup>.

### **Significance of the study:**

The ability to respond quickly and effectively to a cardiac arrest situation rests on nurses being competent in the emergency life-saving procedure of cardiopulmonary resuscitation. So, cardiopulmonary resuscitation training is mandatory for nursing staff and is important as nurses often discover the victims of in-hospital cardiac arrest. There is universal evidence to suggest that CPR knowledge is poorly recalled by nurses. Acquisition and retention of CPR knowledge and skills are vital in ensuring that nurses can respond quickly and effectively to patients in cardiopulmonary arrest. CPR training is now a requirement in all hospitals/universities

that offer health related courses. The aim of CPR training is to ensure that nurses not only acquire CPR knowledge and skills, but that they also retain this knowledge to be able to respond competently and confidently to a life threatening cardiac arrest situation.

### **Aim of the study:**

#### **The aim of the study was:**

To identify the effect of an educational training program on improvement of pediatric nurses' Practice regarding cardiopulmonary resuscitation.

#### **Research hypothesis:**

Nurses' Practice regarding cardiopulmonary resuscitation will be improved after implementation of the educational training program.

#### **Subjects and Methods:**

##### **Research design:**

A quasi-experimental study design was used to carry out the present study.

##### **Study Setting:**

The study was conducted in pediatric hospital at Zagazig university hospitals in the following departments:

- Pediatric intensive care unit (PICU).
- Neonatal intensive care unit (NICU).
- Emergency department.

##### **Study Subjects:**

All nurses who were working in the previous mentioned settings (totally 103), Pediatric intensive care unit (38), Neonatal intensive care unit (46) and Emergency department (19).

##### **Tools for data collection**

##### **Tool I: An interview questionnaire**

A questionnaire interview was developed by the researcher, designed in Arabic language to collect the required data and include characteristics of the studied nurses included: Age, sex, educational level, years of experiences, marital status, department, attendance to any workshop or congress about cardiopulmonary resuscitation and previous performance of CPR and hesitation.

##### **Tool (II): A structured observational checklist for nurses' practice**

An observational checklist was developed by the researcher guided by the American Heart Association <sup>(10)</sup> to evaluate nurses' performance during cardiopulmonary resuscitation.

##### **Scoring system:**

The scoring system was developed by the researcher, each correct step done completely took two points, done incompletely took one point and zero for wrong one. Total score of practice was 164 marks distributed as follows:

- Verify the scene is safe for you and the victim (2 marks)
- Check for responsiveness (6 marks)
- If the victim is not responsive, shout for nearby help. Activate the emergency response system via mobile device (2 marks)
- Assessment of breathing and pulse (12 marks)
- If the victim is breathing normally and a pulse is present (4 marks)
- Steps of recovery position (18marks)
- If the victim is not breathing normally but a pulse is present (10marks)
  - Head tilt- chin lift (6 marks)
  - Jaw thrust maneuver (6 marks)
  - Mouth to mouth breathing for children and adults (14 marks)
  - Mouth to mouth and nose for infant (8 marks)
  - Bag mask ventilation technique (6marks)
  - Pocket mask ventilation technique (12 marks)
  - If the victim is not breathing normally and has no pulse (10 marks)
    - Infant (1 rescuer) 2 finger technique (16 marks)
    - Infant 2 thumb encircling hands technique (2 rescuers) (14 marks)
    - Chest compression for child and adult (14 marks).

The total score of nurse's practice was classified as follows:

- Good > 75%
- Fair 50 – 75 %
- Poor < 50 %

### **Educational training program Development**

Educational training program was developed to train nurses regarding cardiopulmonary resuscitation.

#### **General objectives of the program:**

The educational training program aims to improve nurses' Practice regarding cardiopulmonary resuscitation.

#### **Specific objectives of the program:**

At the end of this educational training program, nurses would be able to: -

- Acquire knowledge about cardiopulmonary arrest and pediatric assessment triangle.
- Perform steps of cardiopulmonary resuscitation.
- Perform high quality CPR for infant and children.

#### **The educational program was developed through four phases as follows:**

##### **(I) Assessment Phase:**

The educational program was constructed for the assessment of nurses' practice. The assessment was performed before the implementation of educational training by interviewing each nurse individually to assess their practice (pretest) by using tool1 and tool II after explaining the aim of the study and had their approval to participate in the study.

##### **(II) Planning Phase:**

Based on the results obtained from the interview sheet and observational checklist (from pilot and assessment phase) as well as reviewing the related literature the educational training program was developed by the researcher. Detected needs, requirements and deficiencies were translated into aim and objectives of the educational training program. The contents of the educational training program were selected on the basis of

identified needs. Teaching methods were selected to suit teaching in small groups in a form of lectures, group discussion, demonstration and redemonstration. Teaching materials were prepared as infant CPR manikin, ambobag, video tapes, colored poster and handout that covered theoretical and practical information.

##### **(III) Implementation Phase:**

- The educational program of this study was implemented through five sessions in which nurses given the program individually and small group according to their availability and spare time completing their activities in the NICU and PICU units while the emergency department the program given in the cold days. The length of each session differed according to the content and nurse's responses and ranged 20-30 minutes.

- The first session about definition, importance of CPR and cardiopulmonary arrest, the second session about pediatric assessment triangle, the third session about steps of cardiopulmonary resuscitation and artificial breathing, the fourth session about high quality CPR and the fifth session about revision theoretical and practical parts of educational training program.

- Each session started with a summary of the previous session and the objectives of the new one. Sessions were explained in Arabic language and simple English terms that suits the level of nurses' education. Motivation and reinforcement during a session were used in order to enhance nurses' learning. The content of each session was described in (Appendix III).

##### **(IV) Evaluation Phase:**

In this phase every nurse of the studied sample were interviewed individually immediately after implementation of the educational training program to assess their knowledge and practice (post test) by using tool1 part two and tool II.

Also after 2 months later the nurses of the studied sample reassessed for their knowledge and practice (follow up) by using tool1 part two and tool II.

#### **Content Validity and reliability:**

The structured interview sheet and observational checklist were developed after a thorough review of the related literature and then reviewed by 5 experts in nursing and medical staff including: Three professor of pediatrics medicine, one lecture of community health medicine at Faculty of Medicine and one professor of medical surgical nursing at the Faculty of nursing. The recommended modifications were done and the final form was ready for use. Content reliability of the tool was done by using Cronbach's Alpha test reliability coefficient. The reliability of nurse's practice assessment tool (Observational checklist sheet) used was 0.74 which indicates accepted internal consistency of the used tool.

#### **Field work:**

Data collection took a period of six months from March to August 2017. After getting the official permission the pilot testing of the study tools was done and analyzed. For the nurses in the emergency department the researcher started the data collection for 3 days per week on the cold days (Sunday, Tuesday, and Thursday) from 10:00 a.m. to 12:00 p.m. for morning shift and from 2:00 a.m. to 3 p.m. for afternoon shift. For the nurses in the NICU and PICU, they met by the researcher 5 days per week from Saturday to Thursday from 11:00 a.m. to 1:00 p.m. for morning shift and from 3:00 a.m. to 5 p.m. for afternoon shift. The researcher interviewed the nurses individually and in small groups according to their availability (after providing nursing activities of the unit). The purpose of the study was explained briefly to nurses, and obtained their verbal consent.

#### **Pilot study:**

A pilot study was conducted on 10% of the nurses to assess the applicability of

the data collection tools arrangements of items, estimate the time needed for each sheet and the feasibility of the study and acceptance to be involved in the study. Subjects who shared in the pilot study were included in the main study sample as no radical modifications were needed on the study tools.

#### **Administration and Ethical consideration:**

An official permission was granted by submission of an official letter from the Faculty of Nursing to the responsible authorities of the study setting to obtain their permission for data collection. All ethical issues were taken into consideration during all phases of the study: the researcher maintained an anonymity and confidentiality of the subjects. The inclusion in the study was totally voluntary. The aim of the study was explained to every nurse before participation and an oral consent was obtained. The nurses were notified that they can withdraw at any stage of the research; also they assured that the information obtained during the study will be confidential and used for the research purpose only.

#### **Statistical analysis:**

Collected data were coded, computed and statistically analyzed using SPSS (statistical package of social sciences), version 16. Data were presented as frequency and percentages (qualitative variables) and mean  $\pm$  SD (quantitative continuous variables). Chi square ( $\chi^2$ ) was used for comparison of categorical variables, and was replaced by Mont Carlo Exact test if the expected value of any cell was less than 5. Student's t test was used for comparison of continuous quantitative variables (two groups) and one way anova (F test) was used for comparison of continuous quantitative variables (more than two groups). Correlation between two quantitative continuous variables was done by using Pearsons' correlation. The difference was considered significant at  $P \leq 0.05$ .

**Results:**

**Table (1)** shows the characteristics of the studied nurses. Regarding to age, it was found that 47.6% of the studied nurses aged less than 30 years and 24.3% of them aged more than 40 years with mean of age  $32.41 \pm 9.4$  years. It was revealed from the same table that 47.5% of the studied nurses had diploma degree, and 35% had finished their education in technical institute of nursing while 17.5% had bachelor degree of nursing. The same table also showed that 35.9% of the studied nurses had less than 5 years of experience, 10.7% had years of experience from 5 to 10 years and 53.4% of the studied nurses had more than 10 years of experience with mean of experience  $11.7 \pm 4.8$  years.

The studied nurses' previous training program was illustrated in **table (2)**. It was found that 13.6% of the studied nurses never attended any previous training program about cardiopulmonary resuscitation and 62.9% of them trained just one time. The same table also showed that 30.1% of the studied nurses never perform cardiopulmonary resuscitation and when asked about the reason 51.6% reported lack of experience. Regarding to hesitation for doing CPR, 65.0% of the studied nurses not hesitated while 35.0% of them hesitated and they mentioned the cause of hesitation as follows Lack of efficiency, Lack of self-confidence, fear of infection and fear of hurting the child 55.5 %, 30.5 %, 2.7 %, and 52.7 % respectively.

**Table (3)** portrays the impact of an educational training program on the studied nurses' practice regarding cardiopulmonary resuscitation. It was found that there was statistically significant improvement throughout the three phases of implementation of the program regarding to all steps of CPR.

The impact of an educational training program on nurse's total practice score was illustrated in **table (4)**. It was

revealed that no one of the studied nurses had good practice score before implementation of the program. This percentage increased to 100.0% immediately after implementation and then decreased to 86.4% at follow up phase of the program. The difference was statistically significant (p value  $< 0.01$ ).

**Discussion:**

Cardiac arrest was defined as the sudden cessation of cardiac activity, associated with very high morbidity and mortality in adults as well as children. Nearly, 40% of cardiac arrests occur in hospital of which only 27% are reported to survive. Providing high quality CPR, is one of the most important factors documented to influence these survival rates (Sankar et al) <sup>(11)</sup>. Cardiopulmonary resuscitation is a foundational medical emergency procedure and treatment performed manually to preserve intact brain function until further measures were taken to restore spontaneous blood circulation and breathing in a person who has cardiac arrest (Sarfo and Akumiah) <sup>(12)</sup>.

Ronald and Robert <sup>(13)</sup> mentioned that CPR is an essential skill for all health care professionals, especially nurses. It can be a lifesaver when applied by a competent and skilled person during resuscitation. The CPR procedure is a coordinated integration of chest compression-induced circulation, rescue airway and breathing management whereby priorities are determined by evidence from literature and practice and required professional and good training nurses.

The cornerstone of providing high quality CPR therefore, lies in the education and training of healthcare professionals involved in the care of sick children. Of all healthcare professionals' nurses are often the first to discover a patient of cardiac arrest in most emergency wards owing to the nature of their duties (time bound administration of medications or

monitoring vitals). Therefore it is needless to say that their competency in CPR is a critical factor in determining successful outcomes in patients with cardiac arrests <sup>(11)</sup>.

### Characteristics of the studied Nurses

As regard to nurses' characteristics, the present study revealed that slightly less than half of the studied nurses aged less than 30 years and the minority aged from 30 to 40 years. This result matched with Alshonee et al <sup>(14)</sup> who conducted a study to determine the effect of educational training of cardiopulmonary resuscitation on nurse's practices regarding cardiopulmonary resuscitation in pediatric intensive care unit and emergency department in El-Mobarra Hospital affiliated to the Health Insurance at Tanta City, found that more than one third of the nurses aged from 25 < 30 years old while the minority of the nurses was more than 35 years old. Similarly with El- Meanawi <sup>(8)</sup> who conducted a study to assess nurses performance during cardiopulmonary resuscitation in intensive care unit and cardiac care unit at the Alexandria main university hospital, reported that less than half were in the age group (20 – 26years).

The results of the present study showed that less than half of the studied nurses had diploma degree and one third had finished their education in technical institute of nursing while the minority had bachelor degree of nursing. This due to shortage in the number of the qualified nurses who were always busy with administrative duties that was considered one of the main factors which affect on the quality of care provided to children. It was agreed with El- Meanawi <sup>(8)</sup> who mentioned that the more than half had secondary school in nursing. As well as Alshonee et al <sup>(14)</sup> who found that two thirds of nurses graduated from secondary nursing school while quarter of them had completed university nursing education.

In a study conducted to investigate the factors which influence the attitudes of nursing staff towards initiating CPR

and in using an automatic external defibrillator on an out of hospital victim of cardiac arrest by Kozamani et al <sup>(15)</sup> found that two third of the sample had attended a basic CPR-AED course . This result goes in line with the current study; most of the studied nurses had attended previous training programs about cardiopulmonary resuscitation. While, contradicted with Elazazay et al <sup>(16)</sup> who conduct a study to determine the effect of cardiopulmonary resuscitation training program on the knowledge and practice of nurses working at Tanta who revealed that two third of the studied sample didn't have previous training about CPR.

The results of the present study showed that half of the studied nurses had more than 10 years of experience while one third of them had less than 5 years of experience. This result was matched with Ehlers and Rajeswaran <sup>(17)</sup> conducted a study to assess registered nurses' CPR knowledge and skills in Botswana reported that most respondents 2 to 10 years' experience. As well as Abd El naeem et al <sup>(18)</sup> who conduct a study to Identify the effect of teaching program on knowledge and skills regarding automatic external defibrillation among nurses working in emergency unit at Assuit University Hospitals and found that nurses had work experience more than 5 years.

Mäkinen et al <sup>(19)</sup> reported that nurses hesitate to start CPR and do not necessarily use defibrillators in resuscitation situations because of lack of confidence, the fear of harming the patient, and perceived difficulty in interpreting electrocardiograph rhythms. This perceived reluctance to perform defibrillation may be due to individual or organizational attitudes, which have been shown to influence professional behavior. The results of the present study illustrated that about one third of the studied nurses didn't perform CPR and hesitated to do CPR due to lack of experience and two third of the studied nurses trained just one time. This finding explained why there was deterioration of knowledge and skills of the nurse due to the fact that nurses were not practicing

the procedure so nurses should receive continuous training program about cardiopulmonary resuscitation.

### **Nurses' Practice Regarding cardiopulmonary resuscitation**

The results of the present study illustrated that there was significant improvement of nurses' practice throughout program phases. Before implementation of the program, all of the studied nurses had poor practice score. This may be due to lack of knowledge, guidance and supervision from the head nurse on nurses' performance as this was the major role and become busy with administrative duties and absence of standardized guidelines the nurse can use to review any procedure. Although the majority of the studied nurses attended previous BLS training courses and just trained one time on CPR, which highlights the fact that retention of skills following BLS training sessions was lost with time and emphasizes the importance of identifying and implementing appropriate corrective measures such as mandatory BLS renewal policy.

While after implementation, all of them had good practice. This could be due to the success of educational training program in improving nurses' performance about CPR, also nurses were interested and had internal motivation to acquire skills about CPR. On the other hand, their performance declined at the follow up phase of the program due to lack of reinforcement, continuous training and their inability to remember the exact sequences of the procedure.

These findings matched with Sankar et al <sup>(7)</sup> who carried out a study to compare the impact of a training program in pediatric cardiopulmonary resuscitation on the knowledge and skills of in-service and preservice nurses at prespecified time points and Ehlers and Rajeswaran <sup>(17)</sup> who found that the skill scores of CPR improved immediately after training. Also, this was supported by Nori et al (2012) who conducted a

study to determine the extent to which nurses acquire and retain CPR cognitive knowledge and psychomotor skills following CPR training courses and found that the baseline psychomotor skills were improved after training with a subsequent decrease in 2 years.

In a study conducted to assess the knowledge, attitude and practice of BLS and compare it among trained and untrained the undergraduate-level medical, nursing students and junior doctors, Yunus et al <sup>(20)</sup> found that knowledge and practice skills of BLS/CPR were poor in medical and nursing although they have shown an excellent attitude towards it. These findings agreed with the results of the present study as all the studied nurses had poor practice before implementation of the program. In the same context, Hamed <sup>(21)</sup> who conducted a study to assess performance of nurses during Cardio pulmonary resuscitation for patient with cardiac arrest in intensive care unit and cardiac care unit in Benha university Hospital found that nurses in both units had unsatisfactory performance regarding to CPR.

Similarly, Toubasi et al <sup>(22)</sup> conducted a study to assess the effectiveness of a BLS simulation training on Jordanian nurses' skill improvement in cardiopulmonary resuscitation and found that nurses had better scores after the BLS training program and there was a statistically significant difference which suggested the effectiveness of the BLS simulation program in improving the skills. Also Yeung et al <sup>(23)</sup> who conducted a systematic review of the published literature on the use of CPR feedback/prompt devices during training and actual resuscitation attempts agreed with this finding and noted that an increase in BLS skills after completion of a BLS simulation training program.

Regarding to nursing practice about safety of the scene, there was a significant improvement of nurses' practice throughout program phases.

This matched with Alshonee et al<sup>(14)</sup> who found that the majority of the studied nurses done this practice correctly "verbalize that scene as safe" after educational training.

Toubasi et al<sup>(22)</sup> found that nurses had better scores after the BLS training program regarding check for responsiveness and pulse and there was a statistically significant difference which suggested the effectiveness of the BLS simulation program in improving the skills. This goes in line with the present study as all of the studied nurses had done checking for responsiveness and locating pulse for infant and children after implementation of the training program.

Concerning nursing performance of recovery position, the present study revealed that, there was a significant improvement of nurses' practice regarding recovery position throughout the three phases of the program. This might be due to the success of the program and may be attributed to the fact that the procedure was practiced under supervision and guidance of the researcher.

Xanthus et al<sup>(24)</sup> reported that airway management is an essential skill for both physicians and nurses who may be confronted with a critically ill patient, because in the emergency department the airway is not exclusively managed by medical personnel. Several studies have shown that other healthcare professionals are not any less efficient in securing the airway.

The results of the present study showed that all of the studied nurses had poor practice regarding opening the airway by using head tilt, chin lift and jaw thrust maneuvers before implementation of the program and their performance improved after implementation, while at follow up phase their performance about jaw thrust maneuver was declined. This might be due to that this technique was not routinely done as head tilt and the researcher used traditional manikin

which had no ability to perform this technique but used other teaching methods as videotape.

These findings were in agreement with the result of Kenny et al<sup>(25)</sup> who conducted a study to assess, whether family member presence had an impact on students' ability to perform basic life support tasks in keeping with their training stage in a United Kingdom University nursing department, and found that the basic tasks of calling for help, opening airway and checking for breathing were completed most successfully by groups who either had no family member present or a quiet family member present.

Also Boada et al<sup>(26)</sup> conducted a study to describe LISSA (a serious game designed to complement CPR teaching and also to refresh CPR skills in an enjoyable way) and its evaluation in a population composed of 109 nursing undergraduate students enrolled in the Nursing degree of Girona University, Spain, which supported these results and found that more than two third of students; that used LISSA; performed open airway correctly. Husebø et al (2012) found that opening the airways was the most poorly performed part of the D-CPR. This result was in accordance with the present study as all of studied nurses had poor practice regarding to opening the airway before implementation of the program.

After implementation of the educational training program, nearly all of the studied nurses were able to give mouth breathing. This goes in line with Alshonee et al<sup>(14)</sup> who found that the majority of the studied nurses were giving two breaths correctly after educational training. This may be related to emphasize the importance of training and reinforcing correct technique which had been done.

Ortega et al<sup>(27)</sup> mentioned that bag valve mask ventilation was an essential element of emergency airway management. Rescuers usually accomplish mask sealing against the

face with 1-handed or 2-handed techniques, with the thumb and index finger wrapped in a "C" shape around the mask apex and the remaining fingers lifting the jaw. This was done by all of the studied nurses after implementation of the program. This result might be due to that the program had an effect in improving the nurses' practice and the researcher assesses nurses' bag valve mask ventilation technique by direct observation.

In a study exploring the retention of basic life support knowledge, self-efficacy and chest compression performance among Thai nursing students at a University in Thailand, Partiprajak and Thongpo<sup>(28)</sup> found that overall the chest compression performance of the participants at posttest was better compared to the pretest. This was in agreement with the result of the present study as there was a significant improvement regarding to chest compression after implementation than before. Similarly, Alshonee et al<sup>(14)</sup> found that most of the studied nurses delivered chest compression correctly after the training.

This result was also supported by Johnson et al<sup>(29)</sup> who conducted a study to investigate the use of an automated training manikin that provides immediate feedback about the various aspects of CPR, including chest compression rate and depth and ventilation rate and volume within a hospital-based CPR recertification program for its medical staff. It was found that an overall

improvement in the quality of both measured components cardiac and chest compressions. In the same context, Pozner et al<sup>(30)</sup> assessed the effect of a handheld feedback device on the measured and perceived quality of chest compression and rescuer physiologic response. It was found that the study demonstrated significant improvements in chest compression quality performed by hospital nurses with the use of an accelerometer-based audiovisual CPR feedback device in a simulated setting.

### **Conclusion**

Based upon the findings of the present study, it was concluded that educational training program to nurses had improved their knowledge and practice regarding cardiopulmonary resuscitation, as there was a statistical difference throughout the three phases of the study.

### **Recommendations:**

Based on findings, the study recommended:

1. Continuous formal training program about CPR will help nurses to update their knowledge and improve their practice.
2. Brief bedside booster CPR training, improves CPR skill retention.
3. The head nurse should provide adequate guidance, supervision and regular feedback to improve nurses' performance

**Table (1):** Characteristics of the studied nurses **No=103**

<b>Characteristics</b>	<b>No (=103)</b>	<b>%</b>
<b>Age/ years</b>		
<30	49	47.6
30-40	29	28.1
>40	25	24.3
	Mean± SD	32.41±9.4
<b>Sex</b>		
▪ Female	103	100.0
<b>Education</b>		
▪ Nursing diploma	49	47.5
▪ Nursing technician institute	36	35.0
▪ Bachelor of nursing	18	17.5
<b>Years of experience</b>		
▪ Less than 5 years	37	35.9
▪ 5-10 years	11	10.7
▪ More than 10 years	55	53.4
	Mean ±SD	11.7±4.8
	Range	(3-15)
<b>Marital status</b>		
▪ Single	13	12.6
▪ Married	89	86.4
▪ Widowed	1	1.0
<b>Department</b>		
▪ NICU	46	44.7
▪ PICU	38	36.9
▪ Emergency department	19	18.4

**Table (2):** The studied nurses' previous training program .No=103

Characteristics	No	%
<b>Have you received any courses or programs for cardiopulmonary resuscitation</b>		
▪ Yes	89	86.4
▪ No	14	13.6
<b>If the answer is "yes", how many times have you been trained on CPR (n= 89)</b>		
▪ No one	0	0.0
▪ One	56	62.9
▪ Two	20	22.5
▪ More than two	13	14.6
<b>Have you done CPR before</b>		
▪ Yes	72	69.9
▪ No	31	30.1
<b>If answer no what are the reasons (n= 31)</b>		
▪ Personal causes	7	22.6
▪ Lack of experience	16	51.6
▪ Didn't met case before	5	16.1
▪ Administrative causes	2	6.5
▪ Doctor do not call her	1	3.2
<b>Have you hesitated to do cardiopulmonary resuscitation before</b>		
▪ Yes	36	35.0
▪ No	67	65.0
<b>If the answer yes what are the reasons<sup>\$</sup></b>		
▪ Lack of efficiency	20	55.5
▪ Lack of self confidence	11	30.5
▪ Fear of infection	1	2.7
▪ Fear of hurting the child	19	52.7
<b>Do you think that CPR training is important for nursing staff</b>		
▪ Yes	102	99.0
▪ No	1	1.0
<b>\$ More than one answer</b>		

**Table (3):** The impact of an educational training program on the studied nurses' practice regarding cardiopulmonary resuscitation **No=103**

Activities		Mean	Std. Deviation	Minimum	Maximum	F/ Kruskal walis	P
Verify the scene is safe for you and the child	Pre	2.7670	.64480	1.00	3.00	467.570	.000**
	Post	1.0388	.27732	1.00	3.00		
	Follow	1.0777	.38829	1.00	3.00		
Check for responsiveness:	Pre	1.9709	.98475	1.00	3.00	94.376	.000**
	Post	1.0000	.00000	1.00	1.00		
	Follow	1.0194	.19707	1.00	3.00		
For infant: tap the heel of the infant's foot and shout are you ok?	Pre	2.4951	.86176	1.00	3.00	290.868	.000**
	Post	1.0000	.00000	1.00	1.00		
	Follow	1.0194	.19707	1.00	3.00		
For child: tap the child's shoulder gently and shout are you ok?	Pre	2.0583	.98842	1.00	3.00	111.510	.000**
	Post	1.0000	.00000	1.00	1.00		
	Follow	1.0194	.19707	1.00	3.00		
If the child is not responsive, shout for nearby help. Activate the emergency response system via mobile device	Pre	1.9223	.99695	1.00	3.00	83.095	.000**
	Post	1.0000	.00000	1.00	1.00		
	Follow	1.0194	.19707	1.00	3.00		
Assess for breathing and pulse at the same time. This should take no more than 10 seconds.	Pre	1.8058	1.77708	.00	6.00	1507.159	.000**
	Post	12.0000	.00000	12.00	12.00		
	Follow	11.2816	1.86515	2.00	12.00		
I- If the child is breathing normally and a pulse is present.	Pre	.0777	.45781	.00	4.00	1357.398	.000**
	Post	23.5534	1.14385	20.00	24.00		
	Follow	20.1359	5.92444	.00	24.00		
Place the patient on the recovery position	Pre	1.7670	1.26958	.00	4.00	545.248	.000**
	Post	9.3398	1.38304	4.00	10.00		
	Follow	7.5437	2.31270	.00	10.00		
If the child is not breathing normally but a pulse is present.							
• Provide rescue breathing							
Opening the airway Head tilt- chin lift	Pre	1.7282	1.59776	.00	6.00	638.908	.000**
	Post	6.0000	.00000	6.00	6.00		
	Follow	5.9417	.59120	.00	6.00		
Jaw thrust maneuver	Pre	.0000	.00000	.00	.00	775.318	.000**
	Post	5.8252	.92277	.00	6.00		
	Follow	4.6019	1.70547	.00	6.00		
mouth breathing for infant and children	Pre	3.4175	1.99275	.00	8.00	3907.658	.000**
	Post	21.9903	.09853	21.00	22.00		
	Follow	20.8252	2.13939	14.00	22.00		
bag mask ventilation	Pre	2.2913	1.1257	.00	5.00	1764.358	.000**

technique		3					
	Post	7.9903	.09853	7.00	8.00		
	Follow	7.5534	.69632	4.00	8.00		
Pocket mask ventilation technique	Pre	2.1165	2.0354	.00	8.00	823.608	.000**
		7					
	Post	11.5728	1.1341	6.00	12.00		
		6					
	Follow	10.0388	2.0576	4.00	12.00		
		1					
III- If the child is not breathing normally or is only gasping and has no pulse. Performing High Quality CPR (CAB)	Pre	.4175	.79858	.00	3.00	684.733	.000**
	Post	9.1262	1.9029	2.00	10.00		
		4					
	Follow	7.8932	2.4006	.00	10.00		
		2					
Infant (1 rescuer) 2 finger technique	Pre	1.9903	1.7121	.00	7.00	1481.254	.000**
		0					
	Post	15.8544	.71958	11.00	16.00		
	Follow	12.7379	2.7545	6.00	16.00		
		4					
Infant 2 thumb encircling hands technique (2 rescuers)	Pre	1.9126	1.5724	.00	6.00	1580.891	.000**
		8					
	Post	13.5825	.79858	12.00	14.00		
	Follow	11.8155	2.1500	5.00	14.00		
		0					
Chest compression for child	Pre	3.3495	1.9235	.00	7.00	1234.608	.000**
		8					
	Post	17.3398	1.2722	13.00	18.00		
	Follow	14.9126	2.9442	6.00	18.00		
		8					

(\*\*) P value is statistically Significant at <0.01

Table (4): Total nurses practice score

practice	Pre		Post		Follow		P
	N	%	N	%	N	%	
Poor	103	100.0	0	0.0	0	0.0	
Fair	0	0.0	0	0.0	14	13.6%	0.00**
Good	0	0.0	103	100.0	89	86.4%	

(\*\*) P value is statistically Significant at <0.01

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