Effect of Educational Program on Nursing and Nurse Interns' Performance Regarding Cardiopulmonary Resuscitation

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Original Research Article

Abstract: This study aimed to evaluate the effect of an educational program on nursing performance regarding advanced cardiopulmonary resuscitation. A Quasi-Experimental Study. The study conducted at the emergency department at Ain Shams University hospital and children hospital affiliated to Ain Shams University hospitals. A convenience sample included all available nurses (100), at the previously mentioned settings over a 6 months' period. Pre-designed sheet; it was concerned with their knowledge regarding advanced cardiopulmonary resuscitation. An observation checklist to assess nurses' practice regarding advanced cardiopulmonary resuscitation. Design, implement and evaluate the effect of the educational program regarding advanced cardiopulmonary resuscitation on nurses' performance. Most of the studied sample had an unsatisfactory knowledge and incompetent practices regarding advanced cardiopulmonary resuscitation pre-intervention, while their level was improved post-intervention regarding cardiopulmonary resuscitation. In the light of the current study it can be concluded that the educational program about advanced cardiopulmonary resuscitation improve the performance of the studied sample regarding advanced cardiopulmonary resuscitation. Moreover, significant improvement was observed in improving their practices post guidelines application of advanced cardiopulmonary resuscitation. Continuous training program should be carried out on a large number of nurses to improve their performance regarding advanced cardiopulmonary resuscitation.

Keywords: an educational program, cardiopulmonary resuscitation, nurses' performance, nurses' performance

INTRODUCTION

The Cardiopulmonary Resuscitation (CPR) is an essential skill for all healthcare professionals, especially nurses. It can be a lifesaver when applied by a competent and skilled person. 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, practice, required professional and good training nurses [1].

In contrast to adults, cardiac arrest in infants and children does not usually result from a primary cardiac cause. More often it is the terminal result of progressive respiratory failure or shock, also called an asphyxial arrest. Asphyxia begins with a variable period of systemic hypoxemlia, hypercapnea, and acidosis progresses to bradycardia and hypotension and culminates with cardiac arrest [2].

A high-performing team can exceed expectations in many instances, especially when all members of the team are aware of the goal and how best to achieve it. Team performance can be strained in a resuscitation because of its urgency, with multiple demands placed on responding team members. To have an effective team, roles of each team member must be defined and understood by all team members [3].

As mentioned by AHA, 2016, The American Heart Association uses the acronym of CAB compressions, airway, breathing to help people remember the order to perform the steps of CPR. The procedure for giving CPR to a child age 1 to 8 years old is essentially the same as that for an adult. The differences are as follows: If alone, perform five cycles of compressions and breaths on the child, this should take about two minutes, before calling ambulance or local emergency number, use only one hand to perform chest compressions, breathe more gently, and use the same compression-breath rate as is used for adults (30 compressions followed by two breaths). This is considering as one cycle.

Following the two breaths, immediately begin the next cycle of compressions and breaths, after five cycles (about two minutes) of CPR, if there is no response and an Automated External Defibrillator (AED) is available, apply it and follow the prompts. Use Paediatric pads, if available, for children ages 1 to 8 years old. If Paediatric pads aren't available, use adult pads. Do not use an AED for children younger than I year of age; only for children and adult administer one shock, then resume CPR, starting with chest compressions for two more minutes before administering a second shock [4].

Most cardiac arrests occur from lack of oxygen, such as from drowning or choking. If the causes of airway obstruction were known, perform first aid for choking. If the causes were unknown perform CPR. To begin, examine the situation. Stroke the baby and watch for a response, such as movement, but don't shake the baby. If there's no response, follow the CAB procedures below and time the call for help as follows: If only one rescuer and CPR is needed, perform CPR for two minutes, about five cycles, before calling ambulance or local emergency number, another person is available, have that person call for help immediately, while the health care provider attends to the baby [5].

There are many situations that need cardiopulmonary resuscitation such as; Paediatric respiratory failure develops when the rate of gas exchange between the atmosphere and the blood is unable to match the body's metabolic demands. Acute respiratory failure remains an important cause of morbidity and mortality in children. Cardiac arrests in children frequently result from respiratory failure [6].

SIGNIFICANCE OF THE PROBLEM
Many Cases admitted to the emergency department with cardiac arrest at least 2 cases per day in every emergency room (ER) in Egypt, some of those cases got the chance to survive, while others not. This may be due to false of intervention or errors in CPR techniques [7]. Nurses comprise the greatest group of health care providers and are the ones responsible for the quality of care provided to the patients, their perspectives on the effectiveness of their care are very important [8]. However, nurses possess a wide variety of holistic skills and there is evidence of nursing interventions that are proving to be valuable in CPR in ER settings. So, all Nursing staff is required to have a valid CPR card over the duration of their study. So, that nurses are required to take the Basel Life support (BLS) for Healthcare Providers course from [9]. In addition, they should be educated and updated about life support.

AIM OF THE STUDY
This study aimed to evaluate the effect of an educational program on nurses and nurse interns' performance regarding advanced cardiopulmonary resuscitation (CPR).

RESEARCH HYPOTHESIS
The nurses and nurse interns, who attend the educational program, will have an improvement in knowledge, and performance of advanced cardiopulmonary resuscitation.

SUBJECTS AND METHODS
Research design
A Quasi-Experimental study design with the pre-posttest intervention was used in this study.

Setting
The study conducted at Emergency Departments of Ain Shams University and Children Hospital affiliated to Ain Shams University Hospitals**.**

Subject
A convenience sample included all available staff nurses and the intern nurses and faculty students (100) from males and females 50 from Ain shams university hospital (20 males and 30 females) and (50 from Ain Shams children hospital (27 females and 23 males), who worked at the previously mentioned settings over a 6 months' period.

TOOLS OF DATA COLLECTION
Data were collected by using two tools:

Pre-designed questioner sheet
This tool is an Arabic interviewing sheet constructed by the researcher after reviewing related literature and content validated by experts. This tool was divided into two parts:

- **Part one:** Demographic characteristics of the studied sample include: age, ranking, residence, years of experiences and qualification.
- **Part two:** It concerned with nurses' knowledge regarding CPR, definition, indication, sequence, and assessment.

Scoring system
The questions about nurse's knowledge were given scores two marks to the complete correct answer, one mark to the incomplete correct answer and Zero to the incorrect answer.

According to nurses' answer, their knowledge was categorized into:
- Unsatisfactory knowledge $< 85\%$
- Satisfactory knowledge $\geq 85\%$.

An observation checklist adopted from *American Heart Association guidelines, 2016:* it was translated into Arabic language by the researchers. It was used to assess nurses' practice regarding advanced CPR (for pediatric and adult). (Pre/posttests).

Scoring system
The checklist about nurse's practice was given scores: one mark to the competent practice and Zero to the incompetent one.

According to nurses' practice, their practice was categorized into
- Incompetent practice $< 85\%$
- Competent practice $\geq 85\%$.

Operational design
The operational design consists of the preparatory phase, pilot study, fieldwork of the study.

The preparatory phase
It included reviewing of literature related to the cardiac & respiratory, and the theoretical knowledge about the CPR using books, articles, periodicals, and magazines to develop the study tools for data collection.

Content validity
Content validity was used for modified tools, AHA 2010 guidelines checklist, was translated by the researcher. Also, it was updated according to AHA, 2016, to tools content validity ascertained by jury expertise (7) from nursing and medical staff members.

Pilot study
The pilot study was applied to 10% of the studied sample who worked at the previously mentioned settings. The final form was achieved through re-arrangement and modification of the tools' item based on the findings of the pilot study. Some questions and items were omitted, added, or rephrased, and then the final form was developed. The nurses in the pilot study were excluded from the sample.

Fieldwork
Data collection for this study was carried out in the period from May 2016 until October 2016. The actual fieldwork was divided into four phases:

Assessment phase: *(one month)*
In this phase, the researchers were using the constructed tools to collect data about nurses' knowledge and performance related to CPR, in their workplace. The purpose of the study and its expectations were explained by the researchers to the studied nurses before starting interviewing and data collection. The pre-designed questionnaire was filled in by the nurses. Time needed to fill in the questionnaire depended on nurses' own knowledge, the average time ranged between 15-20 minutes. The observation checklist was filled in by the researchers, in nurses' workplace; during performing CPR the time needed to fill in the checklist was 20 minutes

Planning phase: *(one month)*

After determining objectives of the program, the training was designed by the researchers in Arabic language in the light of the literature review. It was revised, organized and the content was prepared according to nurses' educational needs. It included knowledge about initial assessment for the patient, methods of evaluation, the action for start step of CPR, indications of bag-mask ventilation (BMV), procedure facilitates, compression.

Implementation phase: *(two months)*

This phase consumed 8 weeks, three days per week, to implement the program. The researchers inspected the roster of nurses to identify the number of nurses in each shift. In the beginning, an introduction about the program was done, and then each nurse, in the shift, performed the procedures, whereas the researchers directed the nurse on how to perform appropriately and gave feedback immediately by pointing out any errors. Meanwhile, the researchers used group discussion with the studied nurses to cover the theoretical aspects about CPR. This process was repeated for each of the studied nurses several times until reaching competency. Different methods of teaching were used as group discussion, demonstration, and re-demonstration. Suitable media was used such as; real equipment (bag-mask, mannequin), posters and booklet.

Evaluation phase: *(one month)*

The same tools were used immediately post implementation of the program for all studied nurses as an indicator to determine the level of improvement during July 2016. Additionally, follow up by using the same tools of the evaluation was repeated after 3 months during October 2016.

Ethical Consideration: The ethical research considerations in this study included the following:
- The research approval obtains before the intervention.
- The researcher clears the aim of the study to all the study subjects.
- The researcher maintains anonymity and confidentiality of subjects.
- Subjects are allowed to choose to participate or not, and they have the right to withdraw from a study at any time without penalty.

Administrative design: To carry out the study, the necessary approval was obtained from the director of the mentioned studied settings, explaining the aim of the study to obtain the permission for data collection.

Statistical design: Statistical analysis was done using the Statistical Package for Social Sciences (SPSS), version 20. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, means and standard deviation for quantitative variables, qualitative variables were compared using chi-square test and quantitative variables.

RESULTS

Table-1: it was clear that 34.0% of the studied sample was in the age group of 25-30 years, with mean $\pm$ SD (21.4$\pm$2.8), in addition to 76% were from urban areas, and the majority of them (92.0%) did not attend CPR training in both hospitals.

Figure-1: shows that there was an improvement in the studied nurses' post-program intervention related CPR (definition, indication, sequence, and assessment), also the level of nurse during follow up was near to the results of the post intervention

Table-2: clarifies that there was a statistically significant difference between nurses' total knowledge related to advanced CPR throughout the intervention ($p<0.05$).

Table-3: illustrates high statistically significant differences between the age of the studied nurses and their knowledge regarding CPR at $p < 0.003$.

Table-4: illustrates high statistically significant differences between attended training course of the studied nurses and their knowledge regarding CPR at $p<0.0001$.

Figure-2: shows that there was an improvement in the studied nurses' post-program intervention related CPR practices (chest compression, mouth to mouth and assessment steps of CPR), also the level of nurse during follow up was nearly to the results of the post-intervention

Table-5: clarifies that there was a statistically significant difference between nurses total practice of advanced CPR throughout the intervention (p<0.05).

Table-6: illustrates statistically significant differences between the age of the studied nurses and their performance regarding CPR at p < 0. 05.

Table-7: illustrates statistically insignificant differences between the residence of the studied nurses and their performance regarding CPR at p >0. 05.

Table-8: illustrates high statistically significant differences between attending the training course of the studied nurses and their performance regarding CPR at p < 0. 0001.

Table-9: illustrates a positive correlation between total knowledge of the studied nurses and their total practice regarding CPR throughout the intervention at p< 0. 05.

Table-1: percentage distribution of the studied nurses according to their demographic characteristics (n=100)

Demographic characteristics	No	%
Age in years		
20<25	26	26.0
25<30	34	34.0
30<35	22	22.0
≥35	18	18.0
Mean ±SD	21.4±2.8	
Residence		
Urban	76	76.0
Rural	24	24.0
Attended training CPR		
Yes	8	8.0
No	92	92.0
Observe CPR process		
Yes	46	46.0
No	54	54.0

Nurses' knowledge related to definition, Importance, Technique and complication of CPR

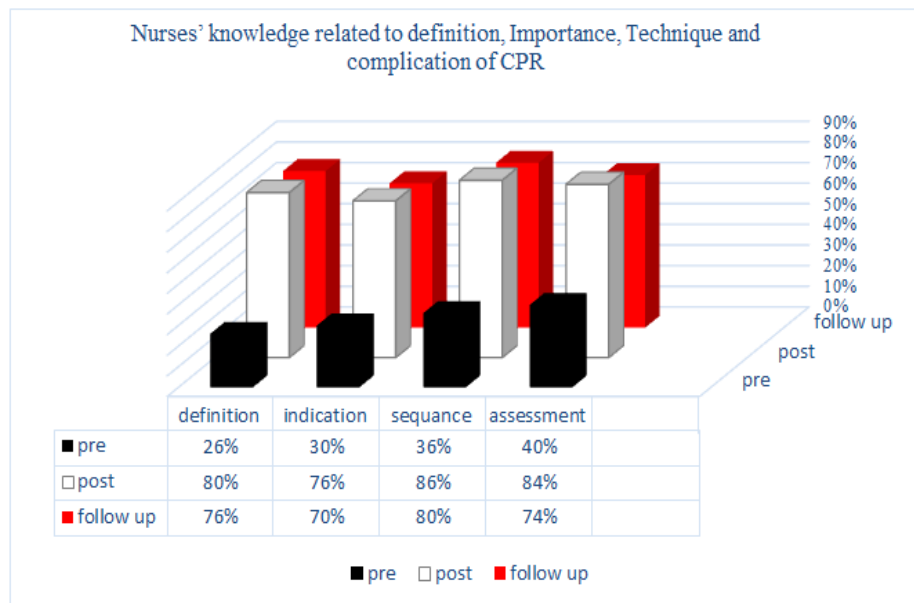|	definition	indication	sequance	assessment
■ pre	26%	30%	36%	40%
□ post	80%	76%	86%	84%
■ follow up	76%	70%	80%	74%

Fig-1: Distribution of nurses regarding their knowledge related to, CPR definition, Importance, Technique and complication of CPR (n=100)

Table-2: percentage distribution of nurses regarding their total knowledge related to CPR throughout the intervention (n=100).

Total Knowledge	Educational Program Group		X^2	P Value
	Satisfied	**Unsatisfied**		
	%	%		
Pre Program	36.0	64.0	0.17	0.67
Post Program	82.0	18.0	5.81	0.01**
Follow-up	78.0	22.0	7.35	0.01**
	28.67(0.0001)**			

*Statistically significant at p<0.05,** highly statistically significant at p<0.01*

Table (3): Relation between age of the studied nurses and their knowledge CPR (n=100).

Age \ knowledge	Educational Program Group		X^2	P Value
	Satisfied	**Unsatisfied**		
	%	%		
20<25	12.0	14.0		
25<30	17.0	17.0	19.47	0.003**
30<35	10.0	12.0		
≥35	10.0	8.0		

*Statistically significant at p<0.05,** highly statistically significant at p<0.01*

Table (4): Relation between attending training course of the studied nurses and their knowledge CPR (n=100)

Training courses \ knowledge	Educational Program Group		X^2	P Value
	Satisfied	**Unsatisfied**		
	%	%		
Yes	7.0	1.0	22.11	0.0001**
No	32.0	60.0		

*Statistically significant at p<0.05,** highly statistically significant at p<0.01*
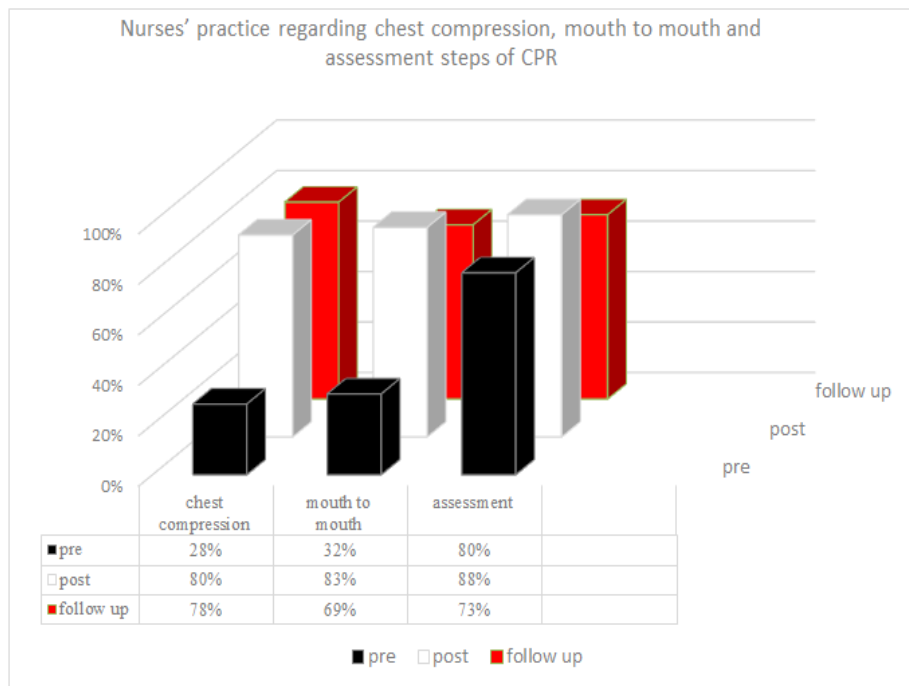

Fig-2: Distribution of nurses regarding their practice related to, chest compression, mouth to mouth and assessment steps of CPR (n=100)

Table-5: percentage distribution of nurses regarding their total practice of CPR throughout the intervention (n=100)

Total Practice	Educational Program Group		X^2	P Value
	Competent	Incompetent		
	%	%		
Pre Program	26.0	74.0	0.75	0.38
Post Program	80.0	20.0	4.71	0.03**
Follow-up	78.0	22.0	13.36	0.001**
	39.52(0.0001)**			

*Statistically significant at p<0.05,** highly statistically significant at p<0.01*

Table-6: Relation between age of the studied nurses and their practice CPR (n=100).

practice / Age	Competent %	Incompetent %		X^2	P Value
20<25	12.0	14.0			
25<30	16.0	18.0		10.49	0.02*
30<35	8.0	14.0			
≥35	7.0	11.0			

*Statistically significant at p<0.05,** highly statistically significant at p<0.01*

Table-7: Relation between residence of the studied nurses and their practice CPR (n=100).

| practice / Residence | Competent | | Incompetent | | X^2 | P Value |
	No	%	No	%		
Urban	21	21.0	55	55.0	0.13	0.71
Rural	8	8.0	16	16.0		

Table-8: Relation between attended training course of the studied nurses and their practice CPR (n=100).

| Training courses | Competent | | Incompetent | | X^2 | P Value |
	No	%	No	%		
Yes	5	5.0	3	3.0	18.74	0.0001**
No	36	36.0	56	56.0		

*Statistically significant at p<0.05,** highly statistically significant at p<0.01*

Table-9: Correlation between total knowledge of the studied nurses and their total practices regarding CPR (n=100).

| performance / Knowledge | Practices | | | | | |
| | Pre-Program | | Post Program | | Follow-up | |
	r	P	r	P	R	P
Educational Program Knowledge	0.31	0.06	0.96	0.001**	0.89	0.01**

*Statistically significant at p<0.05,** highly statistically significant at p<0.01*

DISCUSSION

Cardiopulmonary resuscitation (CPR) is an emergency procedure that combines chest compressions often with artificial ventilation in an effort to manually preserve intact brain function until further measures are taken to restore spontaneous blood circulation and breathing in a person who is in cardiac arrest. It is recommended in those who are unresponsive with no breathing or abnormal breathing. CPR involves chest compressions for adults between 5 cm (2.0 in) and 6 cm (2.4 in) deep and at a rate of at least 100 to 120 per minute. The rescuer may also provide artificial ventilation by either exhaling air into the subject's mouth or nose (mouth-to-mouth resuscitation) or use a device that pushes air into the subject's lungs (mechanical ventilation). Current recommendations place emphasis on early and high-quality chest compressions over artificial ventilation; a simplified CPR method involving chest compressions only is recommended for untrained rescuers. In children, however, only doing compressions may result in worse outcomes [10].

CPR alone is unlikely to restart the heart. Its main purpose is to restore partial flow of oxygenated blood to the brain and heart. The objective is to delay tissue death and to extend the brief window of opportunity for a successful resuscitation without permanent brain damage. Administration of an electric shock to the subject's heart, termed defibrillation, is usually needed in order to restore a viable. Defibrillation is effective only for certain heart rhythms, namely ventricular fibrillation or pulseless ventricular tachycardia, rather than asystole or pulseless electrical

activity. CPR may succeed in inducing a heart rhythm that may be shockable. In general, CPR is continued until the person has a return of spontaneous circulation (ROSC) or is declared dead [11]. So this study aimed to evaluate the effect of educational guidelines about pediatric and adult cardiopulmonary resuscitation on nursing performance at emergency departments.

As regards nurse's characteristics, the current study revealed that half of the study, one-third of them were in the age group of 20-25 years, Mean ±SD (21.4±2.8). Also, the majority of the studied sample were from urban areas, while almost all of them did not attend CPR training and more than half of both group did not observe CPR process. These study findings were in agreement with the study of Farrell, Kuruvilla and Eskra [12], who evaluated the effect of nontraditional teaching method on nurses performance regarding basic cardiopulmonary resuscitation, illustrated that nearly two quarters of nurses did not attend any CPR training courses, while nearly one quarter of the studied sample obtained one training course, while one fifth of them obtained two courses, or three training course, and the rest of them obtain 4 or 5 training courses in CPR. Additionally, this study was supported by the study of Damjan, *et al* [13], who study the Impact of additional module training on the level of basic life support knowledge of first-year student at the University of Maribor, mentioned that one-third of the studied sample has previous training courses regarding CPR.

This study finding clarified that there was a statistical significant difference between nurses' knowledge related to the definition, causes and signs of cardiac arrest throughout the intervention in both groups respectively (p<0.05). This study was in an accordance with the study of by similar study of Broomfiled [14] who study a quasi-experimental research to investigate the retention of basic cardiopulmonary resuscitation skills by qualified nurses following a course in professional development, mentioned that nurses have prerequisite level about CPR, but they have unsatisfactory knowledge regarding CPR pre-intervention. A similar finding was reported by Ahmed S *et al*., [15]. Their study demonstrates statistically significant improvement in nurses' knowledge scores after implementation of advanced cardiopulmonary resuscitation training program for maternity nurses.

The current study showed that there was a statistical significant difference between nurses' knowledge related to definition and sequence of CPR throughout the intervention (p<0.05). There was a statistical significant difference between nurse's knowledge related to the indication of CPR throughout the intervention (p<0.05), this study was supported by the study of Daigneau [16]; who study out-of-hospital pediatric cardiac arrest: an epidemiologic review and assessment of current knowledge. Mentioned that the educational program affects in improving the knowledge of the studied sample.

The current study illustrated that there was a statistically significant difference between nurses' knowledge related to initial assessment criteria, indication and sequence of CPR throughout the intervention (p<0.05). This study was in an agreement with the study of Samson *et al.*, [17]. Who study, outcomes of education in-hospital about ventricular fibrillation in children, mentioned that the initial assessment of CPR was improved by educational program intervention.

Basic care for the patient includes; the ABCs of resuscitation (airway patency, breathing, and circulation). The patient ought to be evaluated quickly, taking history and patient's physical examination should be performed as quickly as possible [18]. The result of the current study clarified that there was a statistically significant difference between nurses' knowledge related method to open airway in non-trauma victim & in trauma victim throughout the intervention (p<0.05). This study was in accordance with the study of Atkins *et al*., [10], who study epidemiology and outcomes from out-of-hospital cardiac arrest in children: the resuscitation outcomes, mentioned that knowledge about open airway in a traumatic and non-traumatic victim, was improved post educational program intervention.

The current study showed that there was a statistically significant difference between nurses' knowledge related to the initial assessment of breathing of arrested victim throughout the intervention (p<0.05). There was a statistically significant difference between nurses' knowledge related to breathing assessment during CPR throughout the intervention. This study was highly supported by the study of Madden [19], who study conventional and chest-compression-only cardiopulmonary resuscitation by bystanders for children who have out-of-hospital cardiac arrests: a prospective, nationwide, population-based cohort study, mentioned that the majority of the studied sample was improved by the educational program.

The current finding illustrated that there was a statistically significant difference between nurses' knowledge related to breathing ratio for the child throughout the intervention (p<0.05). This study was in agreement with similar study Lin [20], who study Pediatric out-of-hospital cardiac arrest in Korea: A nationwide population-based study mentioned that the studied sample improved by the educational program.

This study indicated that there was a statistically significant difference between nurses' knowledge related breathing ratio for infant throughout the intervention, this study was supported by the study of Parajulee & Selvaraj [2], who study a prospective investigation into the epidemiology of in-hospital pediatric cardiopulmonary resuscitation using the international style, mentioned that breathing calculation and measures improved by the training intervention program.

The current study finding presented that there was a statistically significant difference between nurses' knowledge related to pulse assessment throughout the intervention (p<0.05). This study was in an accordance with the study of Lee *et al.*, [21], who study the effect of a rapid response team on hospital-wide mortality and code rates outside the ICU in a Children's Hospital, mentioned that both education program

Concerning the finding of the current study, it was found that there was a statistical significant difference between nurses' knowledge related to assessment chest compression throughout the intervention respectively (p<0.05). This finding clarified that there was a statistical significant difference between nurses knowledge related to hand placement for chest compression throughout the intervention (p<0.05). These study findings were supported by the study of Devlin [22], who study reduction of hospital mortality and of preventable cardiac arrest and death on introduction of a pediatric medical emergency, mentioned that educational program improved the knowledge of the studied sample regarding chest compress.

The current study finding illustrated that there was a statistical significant difference between nurses' knowledge related to management of chest compression for the child and the infant throughout the intervention (p<0.05). These study findings were highly supported by the study of Branduck [23], who study implementation of a medical emergency team in a large pediatric teaching hospital prevents respiratory and cardiopulmonary arrests outside the intensive care unit, mentioned that education of the teamwork in the hospital was very markable effect as reported by their level knowledge score.

The current study finding clarified that there was a statistical significant difference between nurses' knowledge related to indication and precautions of AED throughout the intervention (p<0.05). This study was highly supported by the study of Hussain and Lyneham [24]; who study the transition from a traditional code team to a medical emergency team and categorization of cardiopulmonary arrests in a children's center, mentioned that educational program improves knowledge related to indication and precautions of AED.

The current findings illustrated that there was a statistical significant difference between nurses' knowledge related to management of choking throughout the intervention (p<0.05). This study was in an agreement with the study of Aboul-Hassan [25], who study quality of cardiopulmonary resuscitation during cardiac arrest, mentioned that choking very dangerous recorded evidence in the emergency so that the level of knowledge will be improved by the training about CPR.

The current findings of this study clarified that there was a statistical significant difference between nurses' knowledge related to contraindication and complication of CPR throughout the intervention (p<0.05). Also, there was a statistical significant difference between nurses' total knowledge related to CPR throughout the intervention (p<0.05). Also, there was highly statistical significant difference between pre, post and follow up program intervention related to total knowledge of studied nurses in cardiopulmonary resuscitation throughout the intervention which clear in table (2) the majority (82%) of studied nurses have satisfactory knowledge post program and declined to more than three quarter (78%) after six months at follow up with P Value<0.01. These study findings were highly supported by the study of Friedman *et al.,* [26], who study the effect of mattress deflection on CPR quality assessment for older children and adolescents. Resuscitation mentioned that there was a statistical significant difference between nurses' total knowledge related to CPR throughout the intervention

This study illustrated that there was a statistical significant difference between nurses' practices of initial assessment and activates emergency system throughout the intervention (p<0.05). This study was highly supported by the study of Parajulee and Selvaraj [2], who study Pre-hospital care and outcome of pediatric out-of-hospital cardiac arrest for the student, mentioned that skills of the studied sample were highly improved during application of the intervention the training program.

The current finding clarified that there was a statistical significant difference between nurses' practices of respiratory assessment, delivers birth and bag-mask ventilation throughout the intervention (p<0.05). This study was in an agreement with the study of Hauber *et al.*, [27], who study how frequently should basic cardiopulmonary resuscitation training be repeated to maintain adequate skills. Mentioned that nurse's practices were different in their level after implementation of training program.

The current study proceeded that there was a statistical significant difference between nurses' practices of circulation assessment and chest compression throughout the intervention (p<0.05). This study was in accordance with the study of Hamilton [28] who study nurses' knowledge and skill retention following cardiopulmonary resuscitation training.

It was clear from the current findings that there was statistical significant difference between nurses' practices of use the AED throughout the intervention (p<0.05). This study was in accordance with the study of Nagashima *et al.*, [29], who study investigation of nurses' knowledge and experience in cardiopulmonary resuscitation, mentioned that nurses' practices of use the AED throughout the intervention was improved.

The current findings indicated that there was statistical significant difference between nurses total practice of CPR throughout the intervention (p<0.05). This study was highly supported by the study of Timsit, *et al* [30], who study evaluation of a continuous training program at Bichat hospital for in-hospital cardiac arrest resuscitation mentioned that there was a statistical significant difference between pre and post educational program regarding total knowledge and practice of CPR. This finding is in accordance with Ahmed S *et al.*, [15] who found statistically significant improvement in nurses' practice scores. Moreover, the post-test score reported high score (92.9%) in the CPR practice technique.

CONCLUSION

In the light of the current study, it can be concluded that the educational program improves the knowledge and practices of the nursing staff regarding advanced CPR at the Emergency Department.

RECOMMENDATIONS
In the light of the study findings, the following recommendations are suggested:

- Frequent training courses should be provided for nurses to update their knowledge & practice regarding basic CPR for adult and pediatric.

- In-service education departments should make continuous training courses for the nurses about the new intervention related to knowledge & practice of basic CPR.

- There must be a periodical evaluation of nurse's practice regarding CPR in all departments of medical-surgical and pediatric critical care areas.

- Training refreshing courses about CPR is important to increase the retention of CPR knowledge for the nurses.

- Further researches should be conducted to investigate a new teaching method for improving nurses' knowledge and practice regarding CPR.

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