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RESEARCH ARTICLE

EFFECT OF EDUCATIONAL TRAINING ABOUT CARDIOPULMONARY RESUSCITATION ON
PEDIATRIC NURSES' PRACTICE

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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.

The aim of this study was 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.

Materials and Methods: a quasi-experimental research design was used. All nurses who work in the Pediatric Intensive Care Unit and Emergency Department in El- Mobarra hospital were included in this study (60 nurses). Structure interview sheet was used to assess nurse's knowledge before and immediately after the educational training program about CPR. Practical test sheet was used to assess nurses' practice before and immediately after the educational training program about CPR.

The Results of the study revealed that before educational training program the total scores of nurse's knowledge were good, fair and poor with percentage 15 %, 6.7% and 78.3% respectively. Whereas, after educational training the total score of knowledge for all studied nurses (100%) was good. All nurses' practice (100%) was poor before educational training. While after educational training 60%, 33.3% and 6.7 of nurses' practice were good, fair and poor respectively.

Conclusion: The mean knowledge scores of nurses increased immediately after implementation of the program with a significant statistical difference. As well, the mean practice scores of the study group subjects were higher immediately after the implementation of the program with a high significant statistical difference. In addition, a positive correlation was found between knowledge and practice scores of the study subjects. Continuous In-service training programs for updating the knowledge and practice of nurses working with cardiac arrest pediatric patients about CPR was recommended.

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INTRODUCTION

The magnitude of cardiopulmonary resuscitation CPR is as a part of the emergency cardiac care system designed to save lives. Many deaths can be prevented by prompt recognition of cardiopulmonary arrest and notification of the Emergency Medical System (EMS) followed by early CPR (Beck and Squire 2010). Studies by (Gallagher *et al.*, 2005) indicate that early and effective cardiopulmonary resuscitation (CPR) improves the chances of survival in cardiac arrest victims (Gallagher *et al.*, 2005). Undoubtedly, cardiac arrest is one of the most high risk situations which require urgent, immediate and deliberate action to survive and prevent the complications

of the body vital systems. These actions and measurements are implemented based on some specific protocols and its prerequisites are acquisition of the background knowledge, skill and experience by the resuscitator. Therefore, management, standardization and education of CPR process would be of high importance (Nikravan 2010). The aim of CPR is to ensure that body functions are maintained so that the brain and other vital organs receive a sufficient supply of oxygen and nutrients to maintain their functions and that the waste products of metabolism are removed (Sadeghi 2003). Cardiac arrest (CA) in-hospital occurs in 2-6% of the patients admitted to a pediatric intensive care unit. As expected, a majority (71-88%) of the patients with in-hospital CA have chronic pre-existent conditions, most commonly pulmonary, cardiac, gastrointestinal, neurological and oncology disorders (WHO 2009; American Heart Organization 2006). Etiology of CA

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remains similar to that of the out-of-hospital population, asphyxia being most common, followed closely by circulatory shock (Rakic *et al.*, 2005; Lee 2005). Sudden cardiac arrest is associated with a high rate of morbidity, accounting for over 300,000 deaths annually. It is estimated that the morbidity rate in Egypt as result of cardiovascular diseases (5.6%) and by 2015 over million people will suffer serious cardiac arrest in Egypt. It has been documented that 33 % to 40 % of cardiac arrests in developed countries occur in the hospital setting, and of the arrests that occur in the hospital setting more than 60% are first recognized by nurses (WHO, 2009) (WHO 2009). According to the American Heart Association in 2006, the quick start of CPR and defibrillation during 3-5 minutes after the CA along with quick start of advanced supports of life maintenance can increase more than 50% the survival rate and long-term outcomes in the patients with CA and primary ventricular fibrillation. For every one minute delay in defibrillation, the survival rate of the patients would reduce by 7-10 percent (American Heart Organization 2006)

CPR technique differs for infants, children, and adolescents. The American Heart Association that provide CPR training and guidelines, distinguish infants, children, and adolescents for the purposes of CPR as follows; infant includes neonates (those in the first 28 days of life) and extends to the age of one year, child; includes toddlers aged one year to children aged eight years and Adult; includes children aged eight years and older (9). CPR Sequence changed from A-B-C to C-A-B. Initiate chest compressions before ventilations to reduce delay to CPR, sequence begin with skill that everyone can perform, emphasize primary importance of chest compressions for professional rescuers, Chest compressions can be started immediately (no equipment needed). Opening airway, providing ventilation may significantly delay other actions. Healthcare provider: perform compressions and ventilations at rate of 30:2 for all pediatric arrest, compressions and ventilations still recommended (10) 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 (CPR) (11). So, cardiopulmonary resuscitation training is mandatory for nursing staff and is important as nurses often discover the victims of in-hospital cardiac arrest (12, 13). Moreover; nurses are an integral part of the healthcare system and are perceived to be knowledgeable in providing institutional care to the patients. Many times, nurses take care of the patients when the doctor is not present in the ward and also in the community settings, the nurses have to play a major role in the emergency thus, CPR becomes a fundamental requirement of any nurse (14).

There is universal evidence to suggest that CPR knowledge is poorly recalled by nurses (15). Acquisition and retention of CPR knowledge and skills are vital in ensuring that nurses can respond quickly and effectively to patients in cardiopulmonary arrest (16). Education is a way of dealing with both the actual and perceived complexities of CPR. Furthermore, various international organizations on resuscitation have emphasized the importance of education on providing high quality CPR and thus improving survival from cardiac arrest (Hamilton 2005; Madden 2006) 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 (11).

AIM OF THE STUDY: The aim of the present study was to

Determine the effect of educational training of cardiopulmonary resuscitation on nurses' practice regarding cardiopulmonary resuscitation in pediatric intensive care unit and emergency department.

MATERIALS AND METHODS

Research design

A quasi-experimental design was used in the present study.

Setting

The study was conducted at Pediatric Intensive Care Unit and Emergency Department in El-Mobarra Hospital affiliated to the Health Insurance at Tanta City.

Subject

All nurses working in the previously mentioned settings (60 nurses) were distributed as the following:

- 40 nurses were from Pediatric Intensive Care Unit.
- 20 nurses were from Emergency Department.

Tools of the study

Three tools were used to collect the required data as follows:

Tool : - "A structure interview sheet"

It was developed by the researcher after a review of the literature to assess nurses' knowledge in relation to cardiopulmonary resuscitation. It comprises from two parts:

Part one: Biosocial data of nurses which includes

Age, educational level, years of experience inside and outside Pediatric Unit, marital status, and attendance to any workshop or congress about CPR.

Part two: knowledge related to cardiopulmonary resuscitation which includes two parts

Part A: it consists of 16 questions in the form of multiple-choice questions to assess nurses' knowledge about cardiopulmonary resuscitation. It includes:-

- I- Identification of the consciousness level.
- II- Correct position to keep open airways.
- III-Necessity to examine respiration of unconscious child.
- IV-Method of examination of respiration.
- V-Positioning of child in case of proper respiration.
- VI-Number of rescue breaths needed in every cycles of CPR.

VII-Necessity to examine pulse.

VIII-The artery used to examine pulse.

IX- Evaluation of pulse during CPR.

X- Actions to be done in the presence of pulse but no respiration.

XI-Actions that must be taken in the absence of pulse and respiration.

XII-Number of cycles of CPR.

XIII-Number of chest compression.

XIV-Proper hand placement in chest compression.

XV-Space of displacement of sternum.

XVI- Complications of CPR.

Scoring system for nurses' knowledge regarding CPR in part A

The total score was 16 and every item was evaluated where:

Correct answer was scored (1)

Incorrect answer was scored (0)

Part B: it consists of six questions in the form of open question to assess nurses' knowledge about cardiopulmonary resuscitation It includes

- Objectives of the cardiopulmonary resuscitation.
- Definition of cardiopulmonary resuscitation.
- Causes of cardiac arrest in childhood.
- Early signs and symptoms of cardiac arrest.
- Nursing intervention for cardiac arrest.
- Stopping of CPR technique.

Scoring system for nurses' knowledge regarding CPR in part B

The total score was 12 and every item was evaluated where:

- Correct and complete answer was scored (2)
- Incomplete correct answer was scored (1)
- Incorrect answer scored (0)

The total score of nurses' knowledge was calculated and classified as follows

- 70 % and more was considered good.
- 60-69 % was considered fair.
- Less than 60 % was considered poor.

Tool (II): "Nurses CPR performance checklist"

It was formulated to assess nurses' practice during cardiopulmonary resuscitation. It was adapted by the researcher according to American Heart Association, Program basic life support for pediatric (2011). The researcher modified the score system of the tool from done or not done to done correct , incomplete correct and not done. The nursing practice observational checklist comprised of 12 steps. It includes the following:-

- Safe position.
- Child responsiveness.

- Position to keep airway open
- Shout for help.
- Check respiration for up to 10 seconds.
- Check carotid pulse.
- Call for team.
- 30 chest compressions at correct hand position, correct rate and adequate depth.
- 2 breaths at visible chest recoil.
- Delivers first cycle of compressions at correct rate.
- Delivers second cycle of compressions at correct hand position.
- Delivers third cycle of compressions of adequate depth with full chest recoil.

Scoring system for nurses' practice

The total score for all steps were 24 and every item was evaluated as follows;

Correct and complete done was scored (2)

Incomplete correct done was scored (1)

Not done was scored (0)

The total score of nurses' practice was calculated and classified as follow

- 70 % and more was considered good.
- 60-69 % was considered fair.
- Less than 60 % was considered poor

METHODS

1. An official permission to conduct the study was obtained from the responsible authorities (Health Insurance El-Mobara Hospital in Tanta city)
2. The tools of the study were developed after review of literature containing the knowledge and skills related to CPR procedure.
3. Study tools were introduced to nine juries expert in the field of pediatric nursing before conducting the study to test the validity and clarity of the tools.
4. The researcher was trained on delivering or making CPR procedure by specialist in this field.
5. Ethical and legal consideration as informal consent for participation in the study was obtained, nature of the study was not to cause any harm and/or pain for the entire sample and confidentiality and privacy was taken into consideration regarding the data collection.
6. Pilot study was conducted on six pediatric nurses working in Pediatric Intensive Care Unit to test the tools for its clarity and reliability and time needed for completion of the tools.
7. All nurses in pediatric intensive care unit and emergency department were interviewed individually during break time in different shifts.
8. Tool I and II were used two times, before and immediate after implementation of educational training program related to CPR.
9. Nurses' knowledge and practice were assessed using tool I and tool II at the beginning and prior to implementation of the educational training program; the tool I was given to

- all nurses included in the study to assess their CPR knowledge and the studied nurse were observed during practice to assess their practice about CPR using tool II.
10. The structure interview sheet was completed within 15:20 minutes for each nurse (tool I) and practical test sheet was completed within 5:10minutes for each nurse (tool II)
 11. Based on the data collected from studied nurses before implementation of educational training program the researcher assessed the needs of the studied nurses and reviewed the related literature and then the educational training program was developed in order to provide the nurses with knowledge and practice regarding CPR.
 12. The educational training program consisted of three parts:

The first session

For theoretical contents, a teaching session was conducted. It was given to all nurses in the study 10 groups, one group every day, 6 nurses each, the educational session was given for duration of 30 minutes using lecture, data show, discussion, video tapes, and handout which given to all nurses included in the study. The handout related to CPR was written in Arabic language to be easily understood by all nurses.

The second session

For practical contents, each nurse’s performance as regards the pre determined procedure was evaluated before provision of any information (pretest) utilizing the formulated checklists (second tool). Then subjects were divided into the small groups (6) nurses in each group. Demonstrations by the researcher and redemonstraion by nurses were carried on feedback Manikins (Junior Anne Manikin) each nurse demonstrate and re-demonstrate the steps individually until she correctly and completely performed the steps. For duration of one hours.

The third session

The researcher continued to assure understanding and clear any misconception or misunderstanding and reinforce the gained information, answer any raised questions, revision of the content of the program and gave feedback. The session within 30 minutes. Communication channel was kept open between the researcher and the nurses. The evaluation of the educational training program was carried out immediately after the application of the training program using tool I and II. The training program was achieved in the conferences' place in EL Mobrra hospital. Teaching methods were lectures, small group discussion, and problem solving situations. Teaching aids were utilized, algorism posters about basic life support, videotapes, handouts, data show, and pen & paper test. The setting was equipped and prepared to be used.

Statistical analysis

The collected data were organized, tabulated and statistically analyzed using SPSS version 19 (Statistical Package for Social Studies). For each variable the number and percentage distribution were calculated before and immediately after educational training .The difference in observations before and immediately after educational training was tested suing

Wilcoxon signed rank test (Z). The total score of knowledge and practice were calculated by summation of the score of each question. The total percentage was calculated by dividing the sum of questions on total maximum scores multiplied by 100. The mean and standard deviation were calculated for the total score percentage. The mean values of total scores percentage were compared in relation to other variables options by students' t test if comparing between two groups and analysis of variance if comparing between more than two groups. The level of significance was adopted at $p < 0.05\%$.

RESULTS

Table (I) shows the sociodemographic characteristics of the studied nurses. It was found that, 31.7% of the nurses their age from 20 < 25 years and 36.7 % of them from 25 < 30 years old While the minority of the nurses (15.0 %) are more than 35 years old. Regarding their educational level, two thirds (60 %) of nurses graduated from secondary nursing school while those who have completed university nursing education and technical institute of nursing are 25 & 15 % respectively. Moreover, the table shows also that, 43.3 % of the nurses have more than 10 years of experience, and 30 % of them have 5 < 10 years of experience.

Table II. Sociodemographic Characteristics of the Studied Nurses

Characteristics	No.(=60)	%
Age in years:		
▪ 20 -	19	31.7
▪ 25 -	22	36.7
▪ 30-	10	16.6
▪ 35+	9	15.0
Total	60	%100
Mean ± SD	27.61±8.57	
Marital status:		
▪ Married	49	81.7
▪ Single	10	16.6
▪ Divorced	1	1.7
Education		
▪ Bachelor degree	15	25.0
▪ Technical institute	9	15.0
▪ Secondary school	36	60.0
Years of experience:		
▪ 5-	16	26.7
▪ 10-	18	30.0
▪ 10+	26	43.3
Mean ± SD	28.1 ± 6.12.79	
Previous training on CPR		
▪ No	24	40.0
▪ Yes	36	60.0

Whereas about one quarter (26.7%) of them have less than 5 years of experience. In relation to their previous training on CPR, the table reveals that, about two thirds (60 %) of them have previous training on CPR. Table (II) illustrates percentage distribution of nurses' knowledge about CPR before and after educational training. The answers of 78.3 % and 100 % of nurses about identification of the level of consciousness were correct before and after the educational training respectively.

Table II. Percentage Distribution of Nurses' Knowledge about CPR before and Immediately after the Educational Training

Items of general knowledge	Before educational training n=60				Immediately after educational Training n= 60				z	p
	Correct answer		In correct answer		Correct answer		In correct answer			
	No.	%	No.	%	No.	%	No.	%		
▪ Identification of level of consciousness	47	78.3	13	21.7	60	100.0	0	0	3.606	0.001*
▪ Correct position to keep open airway	32	53.3	28	46.7	59	98.3	1	1.7	5.196	0.001*
▪ Necessity to examine respiration of unconscious child	57	95.0	3	5.0	59	98.3	1	1.7	1.000	0.317
▪ Method of examination of respiration	50	83.3	10	16.7	60	100.0	0	0	3.162	0.002*
▪ Positioning of child in case of proper respiration	17	28.3	43	71.7	60	100.0	0	0	6.557	0.001*
▪ Number of air puffs to resuscitate respiration	40	66.7	20	33.3	60	100.0	0	0	4.472	0.001*
▪ Necessity to examine pulse	52	86.7	8	13.3	60	100.0	0	0	2.828	0.005*
▪ The artery used to examine pulse	29	48.3	31	51.7	60	100	0	0	5.477	0.001*
▪ Time needed to evaluate the pulse during CPR	14	23.4	46	76.6	54	90	6	10	6.030	0.001*
▪ Actions to be done in presence of pulse but no respiration	17	28.3	43	71.7	52	87	8	13.3	5.604	0.001*
▪ Actions to be done in absence of pulse and respiration	41	68.3	19	31.7	56	93.3	4	6.7	3.273	0.001*
▪ When starting CPR what is the number of cycles of CPR	12	20.0	48	80	60	100	0	0	6.928	0.001*
▪ Number of chest compression to artificial breathing	21	35.0	39	65	60	100	0	0	6.245	0.001*
▪ Proper place of hand during chest pressure	10	16.7	50	83.3	47	78.3	13	21.7	6.083	0.001*
▪ Space of displacement of sternum	6	10.0	54	90	56	93.3	4	6.7	7.147	0.001*
▪ Complications of CPR	16	26.7	44	73.3	58	96.7	2	3.3	6.557	0.001*
• Objectives of CPR	29	48.3	31	51.7	8	13.3	52	86.7	6.659	0.001*
• Definition of CPR	41	68.3	19	31.7	9	15.0	51	85.0	6.855	0.001*
• Causes of circulation and respiration failure	32	53.3	28	46.7	14	23.3	46	76.7	6.604	0.001*
• Signs of cardiac arrest	27	45.0	33	55.0	7	11.7	53	88.3	6.730	0.001*
• Steps of CPR for child 1-8 years	30	50.0	30	50.0	26	43.3	34	56.7	6.472	0.001*
• When to stop CPR	36	60.0	24	40.0	13	21.7	47	78.3	6.718	0.001*

Table III. Percentage Distribution of Nurses' Practice about CPR before and Immediately after the Educational Training

Items of practice	Before educational training n=60						Immediately after educational training n= 60						Z	P
	Not done		Done incorrectly		Done correct		Not done		Done incorrectly		Done correct			
	No	%	No	%	No	%	No	%	No	%	No	%		
• Verbalize that scene is safe	47	78.3	11	18.4	2	3.3	4	6.7	8	13.3	48	80.0	6.41	0.001*
• Check for response tap and shout	37	61.7	18	30.0	5	8.3	1	1.7	6	10.0	53	88.3	6.46	0.001*
• Yell for help	52	86.7	7	11.6	1	1.7	25	41.7	6	10.0	29	48.3	5.18	0.001*
• Check for no breathing for only gasping	45	75.0	15	25.0	0	0.0	1	1.7	18	30.0	41	68.3	6.71	0.001*
• Locate hands placement for compression	28	46.7	32	53.3	0	0.0	0	0.0	29	48.3	31	51.7	6.30	0.001*
• Deliver first set of compression	25	41.7	34	56.6	1	1.7	0	0.0	20	33.3	40	66.7	6.66	0.001*
• Gives two breaths	29	48.3	28	46.7	3	5.0	0	0.0	16	26.7	44	73.3	6.53	0.001*
• Deliver second set of compression	48	80.0	11	18.3	1	1.7	1	1.7	2	3.3	57	95.0	7.04	0.001*
• Give two breathes	48	80.0	8	13.3	4	6.7	1	1.7	5	8.3	54	90.0	6.83	0.001*
• Leave to phone and get an AED	59	98.3	1	1.7	0	0.0	14	23.3	22	36.7	24	40.0	6.02	0.001*
• Deliver third set of compression	55	91.6	4	6.7	1	1.7	0	0.0	1	1.7	59	98.3	7.40	0.001*
• Give two breathes	55	91.6	4	6.7	1	1.7	0	0.0	0	0.0	60	100.0	7.45	0.001*

As regard the correct position of the child to keep air way open, 46.7 % of nurses' answers were incorrect before educational training while the answers of the majority of them (98.3 %) were correct after educational training. Moreover, 95.0 % and 98.3 % of nurses' answers regarding the necessity to examine respiration of unconscious child were correct before and after of educational training respectively. There were statistical significant difference ($p < 0.05$). The table also reveals that, the answers of 16.7 %, 71.7 %, 33.3 % and 13.3 % of nurses were incorrect about methods of examination of respiration, positioning of the child in case of proper respiration, necessity to examine pulse and the artery used to examine pulse before educational training respectively. While the answers of all of them (100%) were correct after educational training. Farther more, 76.6 %, 71.7 % and 31.7 %

of nurses were answered incorrectly about the time needed to evaluate the pulse during CPR, action to be done in presence of pulse but no respiration and action in absence of pulse and respiration before educational training respectively. Where as after educational training the answers of the majority of them (90 %, 87 % and 93.3 %) were correct after training respectively. There were statistical significant difference ($p < 0.05$). The table presents that, 80% and 65% of nurses were answered incorrectly in their knowledge about number of cycles of CPR and number of chest compression before the educational training respectively. While after the educational training the answers of all of them (100%) were correct in those questions. As regard proper hand place during chest pressure, space of displacement of sternum and complication of CPR 83.3 %, 90% and 73.3 of nurses were answered

incorrectly before educational training respectively. While the answers of 78.3%, 93.3% and 96.7% of them were correct after educational training. There were statistical significant differences ($p < 0.05$)

As regards the objectives of CPR the answers of nearly half of them (48.3%) were incorrect before educational training. While most (86.7%) of nurses answers were correct after educational training. Moreover, the answers of more than two thirds of the studied nurses (68.3%) were incorrect regarding the definition of CPR before educational training while after educational training the answers of (85.0%) were correct. There were statistical significant difference ($p < 0.05$). The table also reveals that, slightly more than half of nurses (53.3%) answers were incorrect regarding reasons of respiratory and circulatory failure before educational training while the answers of three quarters of them (76.7%) were correct after educational training. Further more, the answers of 45.0%, 50% and 60% of nurses about signs of cardiac arrest, steps of CPR and when to stop CPR were incorrect before educational training respectively compared with 88.3%, 56.7%, and 78.3% of answers were correct after educational training. There were statistical significant differences ($p < 0.05$).

Table (III) illustrates percentage distribution of nurses' practice about CPR before and after educational training. It is clear that, 78.3% of nurses didn't verbalize that scene as safe before educational training while 80.0 % of them done this practice correctly after educational training. As regard checking for response tap and shout, yells for help 61.7% and 86.7% of nurses didn't do those practices before educational training. Where as, 88.3% and 48.3% of them were done correctly after educational training respectively. Moreover, three quarter (75.0 %) of nurses didn't check for breathing before educational training while 68.3% of them were done this practice correctly after educational training. There were statistical significant difference ($p < 0.05$). The table also reveals that, 46.7 % of them didn't locate the hands correctly during chest compression compared with 51.7 % of nurses were done this practice correctly after educational training. In addition, it was found that 41.7 % and 48.3% of nurses didn't deliver first set of chest compression and giving two breaths correctly where as, 66.7% and 73.3% of them were done those practices correctly after educational training respectively. Further more, 80.0% of nurses didn't deliver second set of chest compression and giving two breaths correctly before educational training. While 95.0% and 90.0% of nurses were done those practices correctly after educational training respectively. There were statistical significant difference ($p < 0.05$). Further more, the majority of nurses (98.3%) didn't leave to phone and get AED correctly before educational training. While after educational training 40.0% of them were done this practice correctly after educational training. The table also reveals that, 91.6% of nurses were not deliver third set of compression and Gives two breaths correctly before educational training compared with 98.3% and 100.0 % of them were done those practices correctly after educational training respectively. There were statistical significant difference ($p < 0.05$).

Figures (1, 2) present the total score for the nurses' knowledge and practice about CPR before and after educational training. It

was observed that, before the educational training the total scores of nurses' knowledge were good, fair and poor with percentage 15 %, 6.7% and 78.3% respectively. Whereas, after educational training the total score of knowledge for all nurses (100%) were good. As regarding the total practice score 100% of nurses' performances were poor before educational training. While after educational training 60%, 33.3% and 6.7 of nurses' performance were good, fair and poor respectively. There were a statistical significant differences where p values < 0.005 .

DISCUSSION

Nurses are important members of the healthcare team. They play a vital role in the institutional care of the patients, including the ones who undergo emergency and intensive care. Nurses have great role in cardiopulmonary resuscitation. They are frequently the first line of defense in the management of cardiac emergencies (Sadeghi 2003). Acquisition and retention of CPR knowledge and skills are vital in ensuring that nurses can respond quickly and effectively to patients in cardiopulmonary arrest (Chamberlain 2003). Various international organizations on resuscitation have emphasized the importance of education on providing high quality CPR and thus improving survival from cardiac arrest (Hemming *et al.*, 2003; Smith and Hatchett 2009).

An obvious improvement in nurse's knowledge and practice scores were documented with highly significant statistically differences. This improvement might be related to the fact that majority of them are young, secondary school nurse, slightly less than one half of them had more than 10 years of experience and about two thirds of them receiving previous training about CPR (Table, II). This finding is supported by Hamed (159) (2009) who studied "Nurse's performance during cardiopulmonary resuscitation in intensive care unit and cardiac care unit at Benha University Hospital", master thesis, Benha university. Revealed that the majority of the study sample was female, with age ranged from 20-30 years, and they had general diploma in nursing with average years of experience of 12 years. Concluded that the nurse's practice scores of the nurses at the ICU & CCU post program improved significantly especially in the immediate post test. Also the result of the present study is in an agreement with Mahrous, (160) (2003) who stated that, more than half of the nurses had a diploma degree with age from 20- 29 years and less than one quarter of nurses did not receive a training course. This result is also in an accordance with Nagashema *et al.* (161) (2012) who stated that the majority of the nurses were much interested in CPR and most of them had received education and training in CPR as students or after the graduation.

The current study figured out that, there was a significant improvement in nursing staff knowledge after the application of the training program about CPR. This result is in an accordance with a study conducted by Suchitra and Lakshmi (162), who reported that education has a positive impact on retention of knowledge, attitude and practice in all categories of staff. Also, this result can be explained in the light of Mallik *et al.* (163) who stated that the education programs always keep nurses familiar with recent advances in their area of specialty and maintain their speed and efficiency in carrying

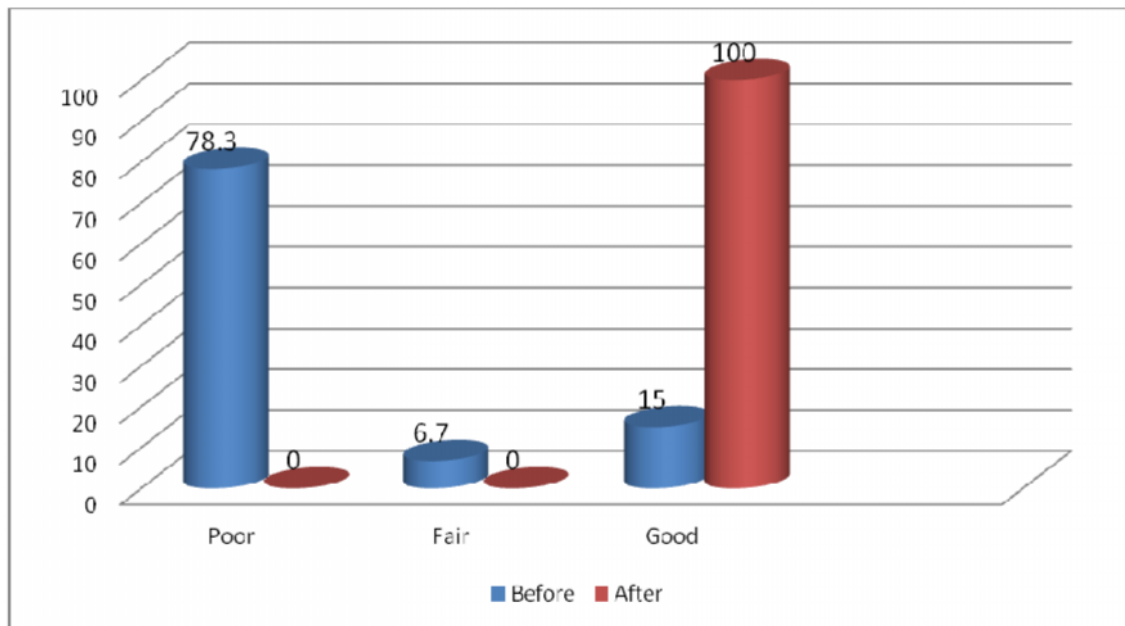


Figure 1. Distribution of the studied nurses by level of total score of knowledge before and immediately after the educational training

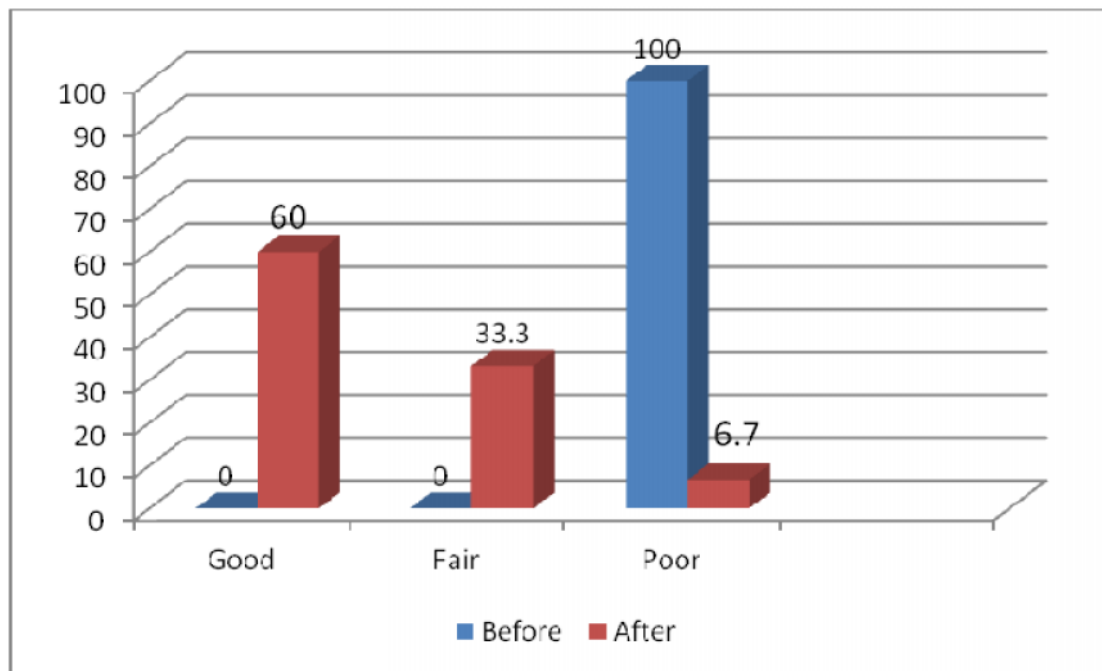


Figure 2. Distribution of the studied nurses by level of total score of practice before and immediately after the educational training

out their respective activities so the quality of care will be improved. It was found throughout the study that, more than three quarters of nurses had poor score in relation to their overall knowledge about CPR before the training program (Table, IX). This may be attributed to the lack of in-service training programs and absence of related literature which help nurses get the required knowledge whenever they need. Furthermore, there was no motivation for the nurses to improve their performance. While, immediately after the educational training, all nurses were good in their overall knowledge. This improvement might be related to the fact that majority of nurses are young, liable to learn and acquire knowledge

through the training program and about two thirds of them receiving previous training about CPR

The results of this study at the same line with the findings of Madden (2006) (18) and Broomfield (2007), (16) they suggest that a properly designed training program can exert a beneficial effect on the CPR preparedness of registered nurses. A study undertaken by Elif and Zeynep in Turkey (2003) (167), confirmed that training helps nurses to refresh and retain their theoretical knowledge of basic life support. Effective resuscitation involves effective technique (breaths and compressions) and the early use of defibrillation (127,182). The findings of the present study showed that, all nurses were

poor in all performance items in relation to their skills about CPR before educational training. This may be attributed to lack of continuous education and training about CPR. Whereas, after educational training about three quarter of nurses performance were good. This may be related to the organized and effective program sessions about 81 CPR and each nurse performed procedure manual on manikin at least three series of complete CPR. These interpretations were in line with Madden (183) (2006), Broomfield (16) (1996), Handly (184) (2003), and Mekinen, (185) (2010): they demonstrated that a positive training effect and a significant acquisition in psychomotor skills illustrated that overall level of performance was significantly improved after program implementation The Resuscitation Council of the UK (199) (2005) and the National Patient Safety

Agency of the UK (200) (2008) both insist that all health care practitioners should possess a thorough knowledge of the latest evidence based on resuscitation guidelines from attending in-service education courses because this enables them to respond appropriately and effectively in emergency situations. The current study found Nurses' knowledge and practices were improved significantly after educational training program. This Knowledge and practice were improved parallelly. This reflects the importance of integration between theory and practice providing an optimum learning and facilitates the acquisition of the clinical skills of nursing. This agrees with Christoffer (201) (2007) in his study "Aquasi- experimental study to assess the effectiveness of structured teaching program on knowledge and skill of cardiopulmonary resuscitation among staff nurses working in selected hospitals" Rajiv Gandhi University, Master thesis, Concluded that the program was very effective in increase the knowledge and skills of staff nurses.

Recommendations

- CPR educational program should be included in all nursing schools and curriculums.
- Raising awareness in PICU about importance of educational training program about CPR among all nurses.
- Continuous in-service training programs for updating the knowledge and practice of nurses working in PICU.
- A periodic evaluation of nurses' knowledge and skills regarding CPR at intensive care unit and emergency department must be carried out.
- Nurses motivation to encourage them to updating their knowledge and practice about CPR

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