

## Effect of High-Fidelity Simulation Training on Pediatric Nursing Student's Knowledge, Practice and Attitude Regarding Cardiopulmonary Resuscitation

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### Abstract

High-fidelity simulation is a learning method consisting on reproduction of medical scenarios through the use of a computerized manikin that can be programmed to recreate clinical conditions and to react to learners' actions in a controlled and safe setting. **Aim of the study:** The aim of the study is to assess effect of high-fidelity simulation training on pediatric nursing student's knowledge, practice and attitude regarding cardiopulmonary resuscitation. **Design:** A quasi-experimental research design was used to conduct the study. **Settings:** This study was carried out in clinical pediatric laboratory skills for third year student's and teaching hall of Faculty of Nursing / Benha University. **Sample:** A systematic random sample of 100 pediatric nursing students from pediatric nursing department, third year. **Tools of data collection:** three tools were used: tool (1) A structured interviewing questionnaire that was constructed by the researcher including two parts and tool (2) observational check list sheet and tool (3) attitude of pediatric nursing student's regarding cardiopulmonary resuscitation. **Results:** The results showed that, there was a highly statistical significant difference in the studied student's total knowledge, attitude and practice scores in favor of post training. **Conclusion:** The study concluded that, our study finding add more support in favor of high-fidelity simulation evidence by an obvious improvement of studied students' knowledge, practice and attitude scores after training. **Recommendations:** The study recommended that nursing education programs should adopt high fidelity simulation in undergraduate education.

**Key words:** Cold High fidelity simulation, cardiopulmonary resuscitation, knowledge, attitudes, practice, nursing students.

breathing and airway management(*Al Hadid& Suleiman, 2012*).

### Introduction

Cardiopulmonary resuscitation (CPR) is an essential skill for all health care professionals especially nurses. It can be a life-saver when applied by a competent and skilled person during resuscitation. CPR is defined as coordinated integration of chest compression-induced circulation, rescue

The quick start of CPR and defibrillation during the first (3-5) minutes after CA with quick start of advanced life support can increase more than 50% of survival rate. For every one minute delay in defibrillation the survival rate of cardiac arrest reduced by 7-10 percent. Survival rate remain low due to in effective administration

of CPR, so survival rate for cardiac arrest child receiving high quality CPR has been increased. Moreover, prompt CPR has important impact on improving outcome. The quality of CPR is poor in clinical setting due to lack of resuscitation skills of nurses and doctors that lead to poor outcome of arrest child(Alshonee, 2014).

Approximately (98.9%) of nursing students work in clinical areas after graduation and they may be the first responder in the event of cardiac arrest, therefore CPR training is necessary for nursing students to help them acquire the necessary skills and knowledge to respond rapidly and accurately to arrested children. According to previous research findings, factors that inhibit CPR performance include lack of knowledge and self-confidence due to lacking of continuous training about CPR. Also, there is a close relation between self-efficacy and attitude when performing CPR, because self-efficacy having the biggest influence on attitude formation that helps in the ability to perform CPR(Park, 2016).

Respiratory distress and failure are the most common causes of cardiac arrest in children. Any condition that compromises oxygenation and ventilation may lead to respiratory failure. These include respiratory or extra-pulmonary infections, upper or lower airway obstruction, tension pneumothorax, pulmonary edema, disorders of the chest wall, central neurologic system (CNS) dysfunction, metabolic disorder, endocrine disorder and hematologic disorder. Primary pediatric cardiac arrest is most commonly associated with conditions such as viral myocarditis, pericarditis, dysrhythmias, and congenital heart disease(Pacheco & Leetch, 2015).

Simulation-based clinical education is a useful pedagogical approach that provides nursing students with opportunities to practice their clinical and decision-making skills through real-life situational experiences without compromising the pediatric patient's

well-being. The advantages of simulation-based educational interventions include: help nursing staff to develop effective technical skills, practice rare emergency situations such as CPR and the ability to provide immediate feedback. Simulation can be ranged from low-fidelity simulation (LFS) to high-fidelity simulation (HFS). Various simulation methods can be used according to specific learning outcomes and educational levels. (Kim et al., 2016).

High-fidelity simulation is described as an approach to experiential learning using manikins with the actual physiological and pharmacological response. Nursing students can make, detect and correct errors in pediatric patient care without negative consequences. HFS is considered as a novel supplemental teaching – learning strategy to enhance transfer of nursing student's confidence and competence from classroom to clinical nursing environment. Difficulty in finding safe clinical nursing environment for nursing student to provide clinical experience for them during the time of nursing education and training can be one of the causes of using simulation (Gamal el-deen et al., 2015).

### **Significance of the study**

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Cardiopulmonary resuscitation initiated within minutes of the onset of arrest has been shown to improve survival rates and improve neurologic outcomes. Targeted education and training regarding treatment of cardiac arrest has significantly increased cardiac arrest survival rates (Bon & Bechtel, 2015).

More over; simulation considers an effective tool to teach resuscitation skills. There is a growing body of literature supporting that higher fidelity training methods and scenarios achieve superior training targets for nursing student. Recent studies confirmed that simulation-based education result in higher quality of care provided during an actual resuscitation events (Sutton et al., 2012). So, this study aim to improve operational performance of

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pediatric nursing students on manikins to improve their operational performance in real life during rare-occurring, stressful situations, such as cardiac arrests

### Aim of the study

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This study aimed to assess effect of high-fidelity simulation training on pediatric nursing student's knowledge, practice and attitude regarding cardiopulmonary resuscitation.

### Research hypothesis

High-fidelity simulation training will improve pediatric nursing students' knowledge, practice and attitude regarding cardiopulmonary resuscitation.

### Subjects and method

#### Research Design

A quasi experimental design was used in the current study.

#### Setting

The study was conducted at clinical pediatric laboratory skills for third year students and teaching hall of faculty of nursing / Benha University.

#### Sample

Systematic random sample of 100 pediatric nursing students (pre-test and post-test) from pediatric nursing department, third year.

#### Tools of data collection

**Tool (1):** A structured interviewing questionnaire:

It was developed by the researcher in an Arabic language after reviewing the related

literatures and under supervision of supervisors, it included two parts:

#### Part I:

Concerned with personal characteristics of the studied student's (age, sex, previous CPR training with high fidelity simulation, ability to implement what learned in CPR training during practical training in hospital, causes of inability to implement what learned in CPR training during practical training in hospital). It includes 5 questions.

#### Part II:

Was adapted from *Almesned et al., (2014)* and modified by the researcher to suit the study. It was used to assess pediatric nursing student's knowledge regarding CPR (pre-test and post- test). **First section** was included pediatric nursing student's knowledge about arrest and resuscitation (definition of cardiac arrest , pulmonary arrest , causes, symptoms, alarming signs, prevention, correct depth of chest compression for children, correct chest compression: ventilation ratio for a neonate , nursing action .....etc.). **Second section** was included knowledge about oxygen therapy (method of oxygen administration, concentration of oxygen, complication.....etc.). **Third section** was included knowledge about suction process e.g. (time of suction, precaution, nursing care .....etc.). All parts of this tool include 29 questions.

#### Scoring system of the knowledge

The studied students answers were compared with the model key answer, where 2 scores was given for complete correct answer, 1 score was given for incomplete correct answer and 0 score for wrong answer and unknown answer. According to the student's responses, their total level of knowledge was categorized as the following:

- Poor level (less than 50%) (Less than 29 points)

- Average level (50% to less than 75%) (From 29 point to less than 43 point)

- Good level (75% to 100%) (From 43 point to 58 point).

### **Tool (2): Observational check list**

Was adapted from *American Heart Association, (2011)* and modified by the researcher to suit the study (assessment of unconscious child, chest compression steps, opening airway, breathing and defibrillations) and practical examination (Sim - Baby) mannequin simulator was used to assess pediatric nursing student's practical skills of cardiopulmonary resuscitation (pre-test and post- test). It includes 28 steps.

### **Scoring system of the practice**

The studied student's practices were compared with the observational check list where 2 scores were given for each step done correctly, 1 score for step done incorrectly and 0 score for step not done. According to the student's responses, their total level of practice was categorized as the following:

- Unsatisfactory (less than 80%) (44 point or less)

- Satisfactory (more than 80%) (More than 44 point)

### **Tool (3): Attitude of pediatric nursing student regarding cardiopulmonary resuscitation:**

Was adapted from *Källestedt et al, (2012)*. It was used to assess pediatric nursing student's attitude toward cardiopulmonary resuscitation (pre-test and post-test).It included 11 statements.

### **Scoring system of the attitude**

The students' attitudes were classified into agree (2), neutral (1) and disagree (0). The total scores of attitude were divided into two levels as the following:

- Negative attitudes (< 80%) (17 point or less)

- Positive attitudes (80 % ≤ 100%) (More than 17 point)

### **Tools validity and reliability**

The data collection tools were revised by a panel of three experts in the field of pediatric nursing to test face and content validity. Modifications of the study tools were done according to the panel judgment on clarity of sentences, appropriateness of content and sequence of items.

Regarding reliability, internal consistency reliability of all items of the tools were assessed using coefficient alpha. It was 0.94 for a structured interviewing questionnaire part 2 to assess pediatric nursing student's knowledge regarding cardiopulmonary resuscitation, 0.83 for students observational check list sheet, 0.75 for tool (3) to assess attitude of pediatric nursing student's regarding cardiopulmonary resuscitation.

### **Pilot study**

A pilot study was carried out on 10 % of the total sample size (10 pediatric nursing students) over a period of two weeks to test the validity and applicability of the study tools and to estimate the time needed to fill the questionnaire. No modifications of the tools were done according to the results of the pilot study. Participants involved in the pilot study were included from the study sample.

**Data collection procedure:**

Permission from faculty of nursing, Benha University was obtained in order to take their approval for conducting the study.

The actual field work was carried out over a period of three months (from 15 February 2016 to 15 May 2016). The purpose of the study was explained by the researcher to all students included in the study. The researcher interviewed the students in the academic year (2015–2016). Initial assessment of student's knowledge and attitude regarding pediatric cardio pulmonary resuscitation was carried out prior to training sessions using tool 1 and 3. The training started by teaching the theoretical part about pediatric CPR for all students. Theoretical part conducted in the 3rd year pediatric nursing students' department class room and took 2 hours but regarding implementation the practical part conducted in the affiliated laboratory to this department

Practical part: started by setting objective of simulation – based training, preparation of the content which covered the reason behind the application of the sessions, the simulation – based training module (Sim Baby) mannequin simulator was used, Sim baby is a wireless life size infant manikin that can talk with pre-recorded sounds and speech, breathe with normal and abnormal breath sounds and produce heart sounds, palpable pulses and unilateral/ bilateral chest movements. It is connected to a monitor who displays parameters such as oxygen saturation, ECG trace, pulse rate and blood pressure. It was programmed to display up signs of cardiac and pulmonary arrest. Sim - baby was set up on a standard hospital bed equipped with monitors, simulated oxygen supply and other supplies found in the clinical pediatric skills lab such as a training automatic external defibrillator, oxygen, emergency medications, an oropharyngeal airway and a bag-mask manual ventilator.

Demonstration and re demonstration was conducted in 2 session for each group in the clinical pediatric laboratory skills, 2 session per day/ approximately 2 to 3 day per week for 20 days, the time of each session about 45- 50 minutes, the time depending upon understanding and responses of the students. Students divided into groups (the group consist of 5 students) to facilitate their training on the Sim Baby according to the stated scenario. Each student takes about 15- 20 minutes. Each student was allowed to perform the steps of pediatric cardio pulmonary resuscitation on (Sim Baby) mannequin simulator in the faculty clinical pediatric laboratory skills under the supervision of researcher. This was repeated until the student mastered these skills. The evaluation phase took one month, during this period the researcher observed the students' practice for pediatric CPR through the observational check list and assessed their knowledge and attitude through nursing students' self-administered questionnaire sheet.

**Ethical considerations**

The researcher explained the aim of the study to students and they were informed that the study is harmless. The researcher secured that all the gathered data are confidential and are used for the research purpose only. The students were informed that they are optionally allowed either to participate or not in the study and they have the right to withdraw at any time. An oral consent was taken from the students

**Statistical analysis**

The collected data were organized, tabulated and analyzed using electronic computer and statistical package for social sciences (SPSS) version 20. Descriptive statistics were calculated for the data in the form of: Mean and standard deviation for quantitative data, and frequency and distribution for qualitative data. Also in analytical statistics, inter-group comparison

of categorical data was performed by using chi square test (X2-value). Also, Pearson correlation coefficient test was used. P value <0.05 was considered statistically significant

(\*) while >0.05 statistically insignificant and P value <0.001 was considered highly significant (\*\*) in all analyses.

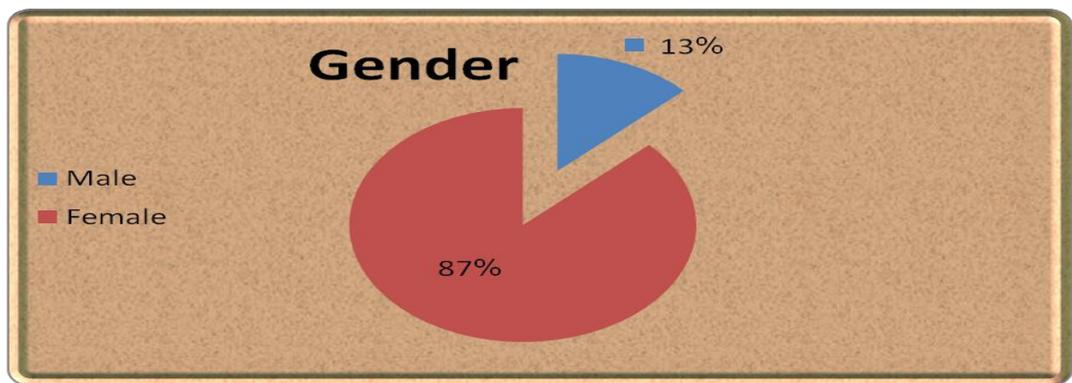
**Results**

**Table (1): Distribution of the studied students according to their personal characteristics (N=100).**

Items	No.	%
<b>Age of students</b>	99	
- 20 >22	1	<b>99.0</b>
- 22 ≤ 24		1.0
<b>B± SD</b>		<b>2.01 ± .10</b>
<b>Previous CPR training with high fidelity simulation</b>		
- Yes	14	14.0
- No	86	<b>86.0</b>
<b>Ability to implement what learned in CPR training during practical training in hospital</b>		
- Yes	2	2.0
- No	98	<b>98.0</b>

Table (1): shows that the majority (99.0%) of the studied students are ranged between 20-22 years old. In relation to previous CPR training with high fidelity simulation, it is found that, more than three quarters (86.0%) of the students are haven't previous training. The table also illustrates that the majority (98.0%) of the students are not having the ability to implement what learned in CPR training during practical training in hospital.

**Fig. (1): Distribution of the studied students according to gender.**



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It is clear from this figure that more than three quarters (87%) of the studied students are female while less than one quarter (13%) of them are male.

**Table (2) Total knowledge, attitude and practice scores of studied students regarding CPR through the training phases (No 100).**

Topic	Pre-training implementation		post training implementation		Chi square test	P value
	No.	%	No.	%		
<b>Total knowledge score</b>						
-Poor	59	<b>59.0</b>	0	0.0	146.8	.001
-Average	39	39.0	16	16.0		
-Good	2	2.0	84	<b>84.0</b>		
<b>B± SD</b>	<b>20.56± 2.9</b>		<b>35.61± 5.18</b>			
<b>Total attitude score</b>						
- Negative	98	<b>98.0</b>	20	20.0	142.8	.001
- Positive	2	2.0	80	<b>80.0</b>		
<b>B± SD</b>	<b>2.76± 1.10.</b>		<b>8.21± 2.53</b>			
Topic	Pre-training implementation		post training implementation		Chi square test	P value
	No.	%	No.	%		
<b>Total practice score</b>						
-Unsatisfactory	100	<b>100</b>	12	12.0	154.7.	.001
-Satisfactory	0	0.0	88	<b>88.0</b>		
<b>B± SD</b>	<b>18.06± 4.84</b>		<b>41.91± 4.92</b>			

Table (2): Showed that there was a highly statistical significant difference (P value <0.001) in the studied student's total knowledge, attitude and practice score in favor of post training.

**Table (3):Correlation between student's total knowledge, practice and attitude after training implementation.**

Items	Pearson correlation coefficient					
	Knowledge score		Practice score		Attitude score	
	Pearson	Sig	Pearson	Sig	Pearson	Sig
<b>Knowledge score</b>	1	-	.879**	< .001	.940**	< .001
<b>Practice score</b>	.879**	< .001	1	-	.938**	< .001
<b>Attitude score</b>	.940**	< .001	.938**	< .001	1	-

\*\* Correlation is significant at the 0.01 level (2- tailed).

**Table (3):** Revealed that there is positive correlation between students total knowledge, practice and attitude (p value < .001) after training implementation.

## Discussion

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Regarding characteristics of the studied students, the current study showed that, the majority of their age ranged from 20-22 years and about 1% of them are about 22- 24 years or more. This may be due to age of the studied students in nursing college are in the third band of the same age group almost. These results agreed with the findings of the study done by *Aqel& Ahmad, (2014)*, entitled “high-fidelity simulation effects on CPR knowledge, skills acquisition and retention in nursing students”, who reported that, the age of the studied students ranged from 18-28 years.

Concerning gender of the studied students, the current study revealed that, more than three quarter of them were females while less than one quadrant was male. This may be attributed to the increase of numbers of females who studied in faculty of nursing than males. These results were consistent with the findings of the study done by *Stayt et al., (2015)*, entitled “recognizing and managing a deteriorating patient: a randomized controlled trial investigating the effectiveness of clinical simulation in improving clinical performance in undergraduate nursing students”, who found that more than three quarter of the studied students were females while less than one quadrant was male.

According to the previous CPR training with high fidelity simulation, the present study reflected that, more than three quarter of the studied students are haven't previous simulation training. This is may be due to lack of training using high fidelity simulation methods due to lack of time as well as the lack of training for faculty members and high cost. These findings were supported by the results of the study done by *Burns et al., (2010)*, entitled “high-fidelity simulation in teaching problem solving to 1st-year nursing students”, who revealed that, about one-third of the studied nurses had a simulation

experience of one or two times, while more than half had no simulation experience.

The current study illustrated that, more than half of the studied students have poor level of knowledge during the pre-training phase while the majority of them have good level of knowledge in post training phase. Also, there was a highly statistical significant difference in the studied student's total knowledge in favor of post training with high fidelity simulation. This might be related to the using of Sim - Baby as a teaching method was improved restoring and gasping the knowledge for nursing students. These findings were supported by the results of the study done by *Tivener&Gloe,(2015)*, entitled “the effect of high-fidelity cardiopulmonary resuscitation (CPR) simulation on athletic training student knowledge, confidence, emotions and experiences”, who revealed that, a significant improvement in athletic training students' knowledge acquisition in the post test.

The current study found that, the majority of the studied students have unsatisfactory level of practice in the pre-training while; the majority of them have satisfactory level of practice in favor of post training. There was a highly statistical significant difference in the studied student's total practice in favor of post training. These findings were supported by the results of the study done by *Pfitzinger& Heather, (2015)*, entitled “improving attitudes and perceived competence in caring for dying patients: an end of life simulation” who revealed that, there is significant improvement of practice level of the studied participant after the simulation training.

Additionally, the present study showed that, the majority of the studied students have negative attitude in the pre-training while; more than three quarters of them have positive attitude in the post training. Also, there was a highly statistical significant difference in the studied student's total attitude, in favor of post training. These

findings were supported by the results of the study done by *Burns et al., (2010)*, who revealed that, all students showed a significant positive difference for multiple attitudinal items after training.

Also, these findings were supported by the results of the study done by *Dame & Hoebcke, (2016)*, entitled “effects of a simulation exercise on nursing students' end-of-life care attitudes”, who revealed that, participation in an end-of-life care simulation resulted in more positive student’s attitudes toward caring for dying patients after training.

The current study revealed that there are positive correlations between student’s total knowledge, practice and attitude after training implementation. These results agreed with the findings of the study done by *Pinar et al., (2015)*, entitled “the effects of high fidelity simulation on nursing students’ perceptions and self-efficacy of obstetric skills”, who reported that, there is a positive correlation between participants’ perceptions and self-efficacy regarding obstetric skills post training.

Moreover; these results agreed with the findings of the study done by *Gamal el-deen et al., (2015)*, entitled “impact of using simulation based learning on nursing students performance, self – efficacy, satisfaction and confidence during pediatric injection administration”, who reported that, there was statistically significant difference in students total knowledge and performance after simulation based learning (SBL). The majority of student's answers were correct after SBL. All students were satisfied with SBL, most of students were confident and had increased self – efficacy after SBL.

## **Conclusion**

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Based on the results of the present study, it was concluded that our study finding add more support in favor of high-fidelity simulation evidence by an obvious

improvement in pediatric nursing students' knowledge, practice and attitude scores regarding cardiopulmonary resuscitation after high-fidelity simulation training.

## **Recommendations**

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-Nursing education programs should adopt high fidelity simulation in undergraduate education and should support the introduction of simulation – based learning as an important step in nursing curriculum development to enhance students' acquisition of knowledge with better performance

-This study should be replicated with more students and at several universities to determine measurable outcome of high fidelity simulation and to generate larger statistical power with a diverse group of nursing students.

-Research studies need to be conducted to see if high fidelity simulation has an impact on transfere of learning to the clinical environment and to fully understand the role of high fidelity simulation in nursing education.

- Continuous training program for faculty staff members about using of high fidelity simulation in training nursing students.

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