Effect of Boost Simulated Session on CPR Competency among Nursing Students: A Pilot Study

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Abstract

Effective cardiopulmonary resuscitation effort can lead to saving lives. This skill is especially important to nursing practice. The aim of this quasi-experimental, control group, pilot study was to measure the effect of boost training session supported by simulation on the retention of CPR knowledge and skills in 40 nursing students. Participants attended a pretest, 3-hour workshop CPR then completed posttest I. The experimental group attended simulation-supported boost training at week six. Findings indicated that the experimental group achieved significant improvement in CPR procedure compared with the control group in posttest II. Boost training sessions using simulation facilitate learning CPR knowledge and skills. This teaching strategy may apply on other competencies requiring both psychomotor and cognitive engagement.

Keywords: Cardiopulmonary resuscitation, boost session, simulation, nursing students.

1. Introduction

Cardiopulmonary resuscitation (CPR) is an essential skill for all health care professionals, especially nurses. It can be a lifesaver when applied by a competent and skilled person during resuscitation (Canlas 2009). CPR procedure is a coordinated integration of chest compression-induced circulation, rescue breathing and airway management whereby priorities are determined by evidence from literature and practice (AHA 2010). The two levels of CPR are basic and advanced cardiac life support (BLS and ACLS). In the present study CPR refers only to the BLS only. During their study, health care and nursing students are instructed to carry out CPR effectively. They are trained by educators who are usually licensed and well-experienced on performing CPR. This is usually followed by updates for the resuscitation knowledge and skills in different settings while studying, such as the simulation lab (Spunt, Foster & Adams 2004). This practice of training is carried out in many countries around the world, including Jordan. However, Jordanian nursing students usually lack the opportunity to practice CPR skills either in clinical settings or in laboratories designed for this purpose. Therefore, their CPR competency remains untested, and they may even fail to perform well when needed (Hamilton 2005).

Adequacy of CPR knowledge and skills can be gained from two sources. First, it is the nursing graduates' professional responsibility to assume control and update their skills. Second, it is the responsibility of the nurse educator to ensure CPR adequacy among students while studying. Literature, however, indicated that nursing students, who attended CPR training, might not retrain, update or retest their skills frequently (Hoadley 2009). Thus, they remain under limited supervision to ensure that they have the ability to perform CPR well when needed.

Numerous studies reported limited knowledge of nursing students trained on CPR (Hoadley 2009; Morrison & Catanzaro 2010). Consequently, the achievement of the required levels is not met. The process of improving students' CPR knowledge and skills may be achieved through the adoption new methods or strategies of training. The present study suggests using boost training session as a strategy to improve students' retention on both CPR knowledge and CPR skills.

So, the purpose of this quasi-experimental, time series, control group, pilot study was to measure the impact of simulation-supported boost session during the academic semester on nursing students compared with the conventional approach of teaching CPR.

2. Cardiopulmonary resuscitation skill and knowledge retention

CPR knowledge and skills have improved tremendously for the last three decades (Hamilton 2005). Many guidelines have been issued by different associations worldwide; the most adopted ones are those of the American Heart Association (AHA) (Canlas 2009). Within these guidelines, emphasis has been put on early access, followed by an ABC (airway management-rescue breath-chest compression for circulation) management of the victim. The latest version of the guidelines issued in 2010 has re-organized the sequence into compression-airway management- rescue breathing (CAB) (AHA 2010). CPR is performed infrequently by nursing students, and when it is performed, the quality may be less achieving and sometimes discouraging (Ackermann 2009). Its skills and knowledge are usually lost within weeks of training (Hamilton 2005). The remaining knowledge and skills are inadequate to perform CPR effectively (Billing & Kowalski 2009). Therefore, there is a need for planned process that improves the retention rates of knowledge and skills among students.

Among the issues of inadequacy are insufficient compression force, inadequate rate and interruptions of chest compressions, all of which are crucial elements in performing CPR effectively (Hamilton 2005; Wang *et al*. 2010). CPR is a complex psychomotor technique that is difficult to teach, learn, remember and perform. So, other assisting devices have been used to promote mastering CPR, including the use video-taped material and simulation.

Although difficult even under the best set of circumstances, the use of simulation and video-based learning can improve student performance of CPR (Ackermann 2009). More opportunity to master it can then be provided in order to achieve better outcome over time. A significant effort to educate nursing students on CPR is warranted. Yet the best experiential learning opportunities have to be explored, including the presence of boost session during the semester.

3. The use of simulation to teach cardiopulmonary resuscitation

The use of simulation in education has been reported in the literature earlier than 1970 (Dreifuerst 2009). The use of this technology has then been indicated as a useful component in teaching of health sciences, including nursing (Paige *et al*. 2009; Harder 2010). Simulation is an innovative learning method. It is a form of learning experience where the students are active participants in the process of decision making. Simulation provides the learners with realistic training accompanied with sensory input to improve learning and decision making (Morrison and Catanzaro 2010; Parker & Myrick 2010).

The roles of educators and students are clearly identified in simulation. Students are expected to participate actively in solving real-life situations while noticing the ambiguity that may surround such situations. Students then use previous knowledge and experience in building their responses, which lead to solving the situation (Cato *et al*. 2009). Additionally, they learn to control their affective attributes gradually and strength their decisions in real situations (Dreifuerst 2009). Students often enjoy autonomy in simulation more than that expected in clinical training (Miller *et al*. 2010), which may enhance self confidence (Gordon & Buckley 2009). Nurse educators, on the other hand, facilitate, direct, and nurture decision-making and critical thinking skills (Jeffries *et al*. 2009). Accordingly, their role has changed from the traditional didactic role to become partners within the learning-teaching didactic, instead of being merely the source of information as in the traditional model of teaching (Leighton 2010).

Simulation use in teaching CPR skills has been emphasized in literature (Ackerman 2009; Billing & Kowalski 2009; Gordon & Buckley 2009). According to Hamilton (2005) simulation yields better outcomes compared with the traditional methods of teaching.

Ackermann (2009) and Gordon (2009) also recommended combining simulation, training, and boost training sessions after a period of time to improve student retention of knowledge and skills; the present study tested the application of these recommendations to nursing students in Jordan compared with a control group that did not receive elements of this training.

4. Methods

4.1 Sample

Participants were fourth-year students from one university nursing program. Following the university IRB approval, study purpose and procedure were explained to candidates. Participation was voluntary and shall any of the candidates choose not to participate, no burden will be placed on them. The number of students who accepted to participate in the study was 40. Data were collected during spring semester of the academic year 2010-2011.

4.2 Procedure

The teaching method was a 3-hour workshop conducted only by the principal researcher, who is an AHA licensed professional to train CPR. It combined the standard CPR guidelines for adults and a low-fidelity simulation experience using cardiopulmonary arrest scenarios. Knowledge and skills acquisition tests were applied at three points: pretest, posttest I (directly after the workshop), and posttest II towards the end of week 13. All participants had been trained on CPR within the past 18 months as part of their training within the program.

The timing of the initial workshop was at week 1, boost session by the end of week 6, and the administration of posttest II at week 13 toward the end of the semester. The academic semester is 14 weeks in length. After deducting one week for the final theory exams, 13 week were left for the researchers to conduct the study. During the boost session students watched the initial workshop which was conducted early in this study on a video-tape. They also have the opportunity to practice on the low-fidelity simulator that was provided during the initial workshop supported with similar cardiopulmonary arrest scenarios.

Students attended a standard 25 multiple- choice question-pretest representing situations requiring clinical decisions based on CPR knowledge. These situations are AHA approved for BLS licensing workshops around the world. Students were given 1point for each correct response on these situations with a range of 0-25. Figure 1 illustrates an example of the knowledge test questions. Students also had skill test, which was rated based on a checklist representing the performance guidelines set by the AHA using low-fidelity human simulation (Figure 2). They attended the 3-hour workshop and were given adequate time to practice and master each skill. When students expressed that they were ready for posttest I, the knowledge part was administered first. This test included similar situations presented earlier in the pretest, but in different order. The skill test was applied next.

The tests for CPR skills were completed by the researchers, who observed the students individually. All students were evaluated on the same mock code situation for the skill test. The possible range of scores for each test was 0 to 25. Each student received 1 point for each of skills they performed correctly and in correct order; no points were granted for not performing the skill, performing in the incorrect order, or performing incorrectly.

Participants were then divided using simple randomization technique into experimental and control group. The experimental group attended a boost session and practiced on the simulator by the end of the sixth week from the initial workshop, while the control group did not. Both groups then completed posttest II by the end of week 13.

5. Study limitations

This pilot study was limited by three factors. First, it was limited to only one nursing program, and the sample was also limited in number. And thus representation and generalization of the results can hardly be assumed. The second factor is that the exact impact of simulation could not be determine as both groups, experimental and control, received training on the same simulator during the initial training workshop. Thirdly, the sample was made of a single program. So, it cannot represent variations that usually exist among students, including different nursing programs, nursing degrees and educational background (high school streams and previous nursing education and training).

6. Results

A total of 40 fourth year nursing students participated in this study. The age of the participants ranged between 21 and 26 year-old, 65% (n=26) of them were 21year-old (Table 1). Half of the participants were female (n= 20), and only 30% (n=12) reported previous exposure to CPR. There were no statistically significant differences among the participants based on gender and previous exposure ($p > .05$). Mean scores of all participants in the pretest, posttest I and posttest II were all retrospectively examined; they were examined by the end of the study to determine any significant difference between both groups from the beginning of the study, which could affected the results of posttest II (Table 2).

The correlation between the mean scores of the pretest and posttest I on the knowledge and skill tests indicated no statistically significant differences in the mean scores between the experimental groups and control groups at p .05. The p values for the knowledge and skill pretest were .904 and .354 respectively. In addition, they were insignificant for posttest between both groups for knowledge and skill; they were .074 and .267 respectively. These findings provided an essentially equal starting point for the study as this means that the posttest II results could indicate the effect of the intervention (i.e. boost training session for the experimental group at the 6th week). Furthermore, students with previous exposure had no significantly scores than did those students who did not (p =.150), and age differences between both groups did not indicate any statistical significance (p =.278).

Posttest II findings indicated the presence of significant differences between both groups on both tests (Table 3). Posttest II scores range for the experimental group on the knowledge test was 7-24, with a mean of 14.5 (SD 4.861). The knowledge scores range for the control group on posttest II was 5-16, with a mean of 9.95 (SD 3.364). The comparison of the mean scores for CPR knowledge of both groups indicated that students from the experimental group achieved significantly higher scores (p =.002).

The scores for the skill test of the experimental group ranged from 20 to 25 points, with a mean of 23.5 (SD 1.670). The scores for CPR skills for the control group on posttest II ranged from 11 to 23 correct responses, with a mean of 17 (SD 2.938). Comparison between both groups' mean scores had shown that students in the experimental group have achieved significantly higher scores in CPR skill test (p =.000).

7. Discussion

This study showed that students demonstrated improved retention of CPR knowledge and skill when receiving boost training session supported by simulated scenarios. One significant observation in this study was that there were statistically significant increases in both CPR knowledge and skills for the experimental in posttest II compared with the control group. Students from the experimental group received a boost simulation training session by the end of the week 6 from the initial workshop at week 0. The additional experience represented by this boost training session provided an opportunity for the experimental group to apply CPR knowledge and skills in simulated situations based on what was learned in the initial CPR workshop at the beginning of the study. This finding was consistent with what Ackermann (2009) reported of improved students' CPR performance as a result from the positive effect of the boost session.

Students, who had previous exposure or participation in real CPR situations, did not differ from those who did not. This finding is inconsistent with Benner *et al*. (1996) and Ackermann (2009), who reported improved knowledge and skills in students with previous exposure compared with those who did not have similar experience. However, due to its limitation, this finding requires further investigation in other studies. In addition, there was no significant difference between both genders.

There was a significant decrease in both CPR knowledge and skills over time for students in the control group, who did not receive a boost training session. Although students from the control group received similar training experience supported by simulated scenario, they could not retain CPR knowledge and skills. There was a statistically significant decrease in students' performances in posttest II compared with their performance in posttest I. This finding emphasizes the importance of boost training sessions in enhancing CPR knowledge and skills in students. Similar finding was also reported by Ackermann (2009) and Madden (2005).

This study supports reported findings from other research studies of the positive effect boost sessions had on students' retention of knowledge and skills. These training sessions planned during the semester enhance student knowledge and skill retention in competencies requiring both psychomotor and cognitive skills. Although limited to CPR, findings in this study may also apply on other competencies. This, however, requires further studies be conducted examining each particular competency.

Based on findings in the present study, nurse educators may enhance students' learning experiences and retention in a range of nursing competencies within courses like Fundamentals of Nursing and Adult Nursing. This evidence may also be used to help educators decide on the training plans that promote better learning experiences for students.

Although it was used for both groups, adopting simulation during the boost training session may have improved students' knowledge use, decision-making and skills resulting in significant improvement in students' retention and performance. Further studies, however, are required to measure the effect of simulation on students' retention of knowledge and skills of nursing competencies. Replication with a bigger scale, more representative sample may also provide evidence that this or similar strategies can be beneficial to student learning outcomes.

It is also recommended that educators explore ways, other than the boost training sessions, to increase knowledge and skill retention of nursing competencies essential for students to practice safely and competently as nurses. Examples of these ways include the use of computerized virtual reality and adopting problem-based learning and simulation.

8. Conclusions

The adoption of boost sessions supported by simulation within the semester improves knowledge and skills of CPR competency. Although increasing the frequency of exposure and the use simulation are all strategies used to improve student ability to practice nursing skills competently, future studies are needed to evaluate their effect on different nursing competencies, and on the clinical decision-making abilities of nursing students.

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Table 1. Demographic characteristics of the participants*

Factor		N (%)
Age (years)	21.00	26 (65%)
	22.00	6 (15%)
	23.00	5 (12.5%)
	24.00	2 (5%)
	26.00	1 (2.5%)
Gender	Male	20 (50%)
	Female	20 (50%)
Exposure	Yes	12 (30%)
	No	28 (70%)

*N=40

Table 2. Comparing scores of experimental and control groups on pretest and posttest I

Factor	Means (SD)	Correlation	*P**
Pretest- Knowledge			
Experimental group	9.25 (3.08)	.297	.904
Control group	9.15 (3.07)		
Pretest- Skill			
Experimental group	11.60 (3.60)	.375	.354
Control group	10.80 (3.09)		
Posttest I-Knowledge			
Experimental group	14.45 (2.54)	.374	.074
Control group	13.00 (3.43)		
Posttest I-Skill			
Experimental group	21.40 (1.67)	.081	.267
Control group	21.80 (1.79)		
Exposure			
Experimental group	1.45 (.51)	.201	.150
Control group	1.80 (.41)		
Age			
Experimental group	21.80 (1.28)	-.120	.278
Control group	21.40 (.82)		

*P <.05

Table 3. Comparing scores of experimental and control group on posttest II

	Mean (SD)	Minim	Maxim	*P*
Posttest II- Knowledge test				
Experimental group	14.50 (4.861)	7	24	.002
Control group	9.95 (3.364)	5	16	
Posttest II- Skill test				
Experimental group	23.5 (1.670)	20	25	.000
Control group	17 (2.938)	11	23	

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1. You arrived to a scene whereby an unresponsive victim was lying on the floor. You attached a biphasic AED and the device analyzed a rhythm that requires a shock. You delivered a shock. What will you do next?
   a. Analyze and deliver another shock.
   b. Resume chest compression.
   c. Check for breathing and deliver 2 rescue breaths.
   d. Instruct the other rescuer to call 911.
2. You remove a12-year-old boy from the bottom of the swimming pool. You find that he is unresponsive and limp. No other person is available to help. When should you phone 191?
   a. After have given him 1 minute of CPR.
   b. As soon as you remove him from the pool.
   c. When you see that after several minutes of CPR there is no response.
   d. After giving a few chest compressions and before the rescue breaths.

Figure 1. Example from Knowledge test

BLS Performance Criteria

Participant………………………………………………… Date …………… Group………

Check unresponsiveness	
Activate the EMS	
Check for pulse: a. Time b. Site c. Procedure	
Check for signs of circulation: a. Movement b. Coughing c. Breathing d. Pulse (absent or less than 60 BPM)	
Expose site for compression	
Determine site for compression	
Position arms over victim's chest	
Commence compression: a. Quality b. Rate c. Effectiveness	
Check for breathing: a. Look b. Listen c. Feel d. Time	
Open airway: a. Traumatic positioning b. Non-traumatic positioning	
Breathing is present/ absent: a. If present, chest compression- rate b. If absent, rescue breaths	
Rescue breaths with bag mask: a. Proper positioning of mask b. Proper blow depth c. Proper blow speed-volume d. Check for chest rise e. Reconsider rescue breaths after repositioning	
Perform 3 cycles (Ratios 1 rescuer/ 2-rescuer)	
Put in recovery position	
Total mark	

Instructor's comments:

Decision: **a. Complete.** **b. Needs practice.**

Figure 2. Cardiopulmonary resuscitation skill checklist

	Experimental group	Control group
Week 1	Pretest (Knowledge – Skill) Workshop Posttest I	
Week 6	Boost session (knowledge- Skill)	No intervention
Week 13	Posttest II	

Figure 3. The study plan

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