



The Effectiveness of Cardio-Pulmonary Resuscitation Using High Fidelity Mannequin and Standard Method Among the Selected Students in Faculty of Applied Medical Sciences, University of Tabuk

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ABSTRACT

Background: It is a well-known fact that sudden cardiac arrest is the leading cause of death in the world. During such situations nurses are expected to be efficient and effective in the life saving measures.

Objective: This quasi-experimental study was aimed to evaluate the effect of high fidelity simulation on the students learning of Cardio Pulmonary Resuscitation.

Methods: The knowledge instrument composed of 20 items (multiple choices) and the skills were observed by the 10 items (checklist) using 4-point likert scale. An experimental group attended lecture and practice training with Sim man 3G mannequin whereas the control group attended lecture and the practice training with the standard mannequin.

Results: Independent t test showed a statistically significant difference in psychomotor retention in control group ($t = 2.31$, sig. .030 (2 tailed), $p > 0.05$) between the immediate ($M = 2.96$, $SD = .43$) and delayed ($M = 2.65$, $SD = .20$) in teaching CPR. The result also gives significance difference between the experimental and control both for the immediate and delayed psychomotor test ($t = 6.96$, sig. .000, $p < 0.05$, $t = 13.19$, $t = 13.9$, sig. .000, $p < 0.05$ respectively) when examined the effect of the psychomotor between the experimental and control group in teaching CPR.

Conclusion: The students who were trained with high fidelity mannequin performed better than the standard mannequin. This study emphasize on the incorporation of high fidelity simulation in the nursing program to enhance the knowledge and psychomotor skills of the students.

KEYWORDS : Cardio pulmonary Resuscitation, Simulation effectiveness, High fidelity simulation.

INTRODUCTION

Simulation is an effective tool used to integrate realistic clinical situations in a safe environment, which allows nursing students to develop cognitive and psychomotor skills (1). The use of high-fidelity manikins to simulate real case scenarios helps the nursing students to increase their confidence in providing patient care. Cardiopulmonary resuscitation (CPR) is a rescue procedure to be used when the heart and lungs have stopped working. Nearly 383,000 out-of-hospitals sudden cardiac arrests occur annually, and 88 percent of cardiac arrests occur at home (2). There is a high demand for competent emergency service providers in the Kingdom of Saudi Arabia due to the increasing number of vehicular accidents (3). Hence, effective & efficient delivery of basic life support is important.

Aqel & Ahmad (2014) reported that the CPR and resuscitation skills deteriorate quickly after initial training (4). King, J., & Reising, D. (2011) reported the higher confidence level and the satisfaction among the students who were trained with the high fidelity mannequin (5). CPR quality varies widely between systems and locations. Victims often do not receive high-quality CPR because of provider ambiguity in prioritization of resuscitative efforts during an arrest.

A nursing graduate is expected to handle patients in emergency situations in the workplace. During such situations where the time plays a crucial role in the recovery, nurses are expected to be responsible for the efficient and effective management of patient care services. More importantly, it must be ensured that they are adequately trained in Basic Life Support which is a crucial step in a patients' survival in cardiac arrest.

One of the challenges in nursing education is large demand for clinical placements and needs high number of clinical instructors who will supervise them in the area. Furthermore, owing to its increasing number of enrollees, opportunities for nursing students to translate their

knowledge to skills in the clinical area and use their critical thinking during emergency cases have also decreased. As a result, it may affect the quality of their education due to a limited chance for them to be rotated in the clinical area. Therefore, this quasi-experimental study was conducted to evaluate the effects of simulated cardiopulmonary resuscitation (CPR). The findings of this study may assist educators in integrating high-fidelity simulators in education and training. In addition, the findings may help nursing educators to arrange additional cardiopulmonary resuscitation training sessions in order to improve outcomes among cardiac arrest patients.

Null Hypotheses

- H_{01} : There is no significant difference between the students' knowledge before the lecture (pre-test) and after the lecture (post-test).
- H_{02} : There is no significant difference between the students' knowledge retention when utilizing high-fidelity mannequins and the standard method in teaching CPR.
- H_{03} : There is no significant difference between the student's skills immediate and delayed posttest.
- H_{04} : There is no significant difference between psychomotor skill retention when utilizing psychomotor skills acquisition between the use of high-fidelity mannequins and the standard method in teaching CPR.
- H_{05} : There is no significant relationship between the students' knowledge (posttest) & psychomotor skills (immediate & delayed) about CPR.

METHODOLOGY

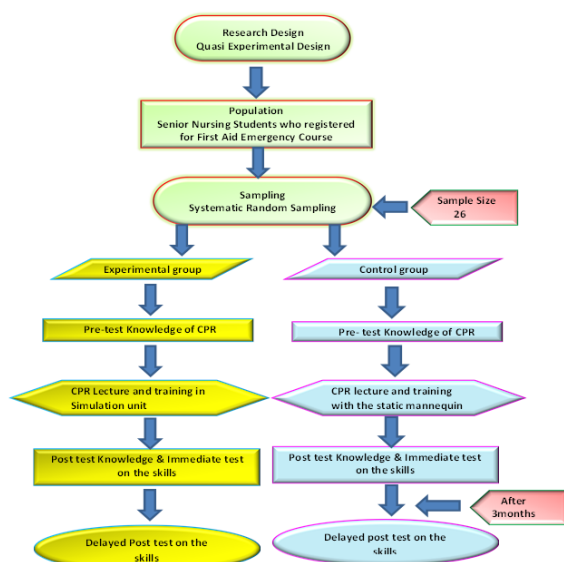


Fig. 1. The Schematic Research Design of the Study Setting

Research Method

The quasi-experimental (pre-test post-test) design was used to evaluate the quality of knowledge and psychomotor skills acquisition between the use of the high fidelity mannequins and the standard method of teaching cardiopulmonary resuscitation among level 8 nursing students.

Population/ Respondents

The respondents of the study were senior nursing students who are enrolled in the First Aid and Emergency Nursing Practical Course of the baccalaureate nursing program in the Department of Nursing Faculty of Applied Medical Sciences.

Sampling

This study included level 8 students from the nursing department. Sample size was 26. They were selected and allocated randomly in equal numbers to the experimental and control groups. The inclusion criteria were kept as voluntary participation and the previous non participation of the CPR course.

Setting

This study was conducted in the Department of Nursing, Faculty of Applied Medical Sciences, University of Tabuk. Simulation laboratory contains high fidelity mannequins supported with advanced technology to enhance the clinical skills of the students. In addition, the BLS room is equipped with the equipment, materials and mannequins that are required by the Saudi Heart Association. The setting for the study was lecture room for the delivery of the CPR module, skill laboratory was for standard method of the CPR practice and the simulation unit was for conducting the high fidelity simulation for the CPR training.

Research Instrument

To determine the level of knowledge acquisition, structured questionnaire was utilized. It was composed of 20-item questions based on Saudi Heart Association guidelines. Content validity of the tool was conducted by 4 experts from the nursing and ACLS field. The index of the content validity was 0.89. Chronbach's alpha reliability was 0.82.

A CPR Skills Checklist also developed by the Saudi Heart Association was utilized to evaluate the students' psychomotor skills acquisition. It consists of 10 items with a four-point scale rating. Test re-test reliability was 0.89. It indicates the tool was feasible for the administration.

Pilot study

Five students were selected for the pilot testing of scenario and the tool. These students were not included for the final study. Experts were appointed to observe the pilot testing. High internal consistency

of the items was observed. (0.82)

Ethical clearance

This study was approved by the Research committee of the department of nursing. Written informed consent was obtained from all the participants. The participants were explained about the purpose, method and the extent of the study. Confidentiality was assured to the participants. The participants were informed about the right of participation and the right of withdrawal from the study any time.

Data Gathering Procedure

The initial step of the study was to conduct pretest for both groups to assess the pre knowledge level regarding CPR. Then, the next day, a 2-hour lecture presentation about CPR was given for all the participants. After the lecture, the students from the experimental group were given orientation and practice training on the high fidelity mannequin (SIM man 3G) for 2 hours with a patient scenario. The control group practice training was done by using standard mannequin in teaching CPR. The sessions was supervised by lecturers of the First Aid Emergency Nursing Clinical course, who are at the same time, certified providers of the Saudi Heart Association Basic Life Support. One week later, an immediate posttest was conducted to assess the knowledge level and the skills. A case scenario was given for them to assess their skills on the standard mannequin for both groups. Skills were assessed by using the checklist (SHA). At the end of the semester (after 3 months) both groups was assessed again for the skills as delayed posttest on the retaining skills of CPR.

Data Analysis

The SPSS, version 21, software was used to analyze the data. Independent t test was used to identify differences between groups (experimental vs control), Paired t test was used to identify the difference between the mean pretest and post test scores of the knowledge and the skills and also linear regression analysis to identify correlations between variables (Knowledge, Psychomotor-Immediate, Psychomotor-Delayed).

RESULTS

Knowledge in the Pre & Post test

Both groups (experimental & control group) had limited knowledge in the pretest comprising to 27%. These findings indicate that introduction about CPR basics to be introduced in the earlier part of the curriculum in nursing. Good gaining of knowledge was noted in the post test. More than three fifth of them had adequate knowledge (65.4%). All students from the experimental group were distributed in the moderate (30.8%) and adequate (69.2%) category. Nearly one fourth of the control group had inadequate knowledge in the post test (23.1%).

Skills in the immediate and delayed Post test

The high fidelity simulation training was much effective than the traditional method of teaching the CPR skills. Most of the students from the experimental group had shown high skill than the control group. All the students from the experimental group had high skills than control group in the immediate test (Figure -2). Similarly delayed test also had shown good response from the experimental group (High skills -90%).

Figure -2

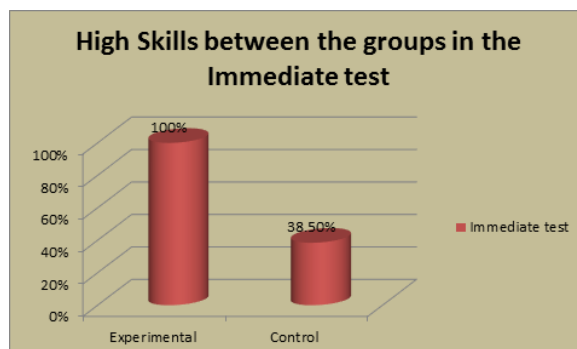


Table 1-

Mean Differences in the Effect of Knowledge (Pretest –Posttest) between Experimental Method and the Control Group.

Mean Differences in the Effect of Knowledge (Pretest –Posttest) between Experimental Method and the Control Group				
Variables	Mean (SD)		t	P Value
	Experimental G.	Control G.		
	N=13	N=13		
Pre test	8.31 (3.28)	8.15 (2.44)		
Post test	16.53(2.93)	14.69(5.69)	.309	.05
	T=-6.749 Sig. .000	T= -3.80 Sig. .001		

An independent t test showed a statistically significant difference ($t = -6.749$, Sig.000 (2 tailed) $p < 0.05$), between the experimental group pretest ($M = 8.31$, $SD = 3.28$) and the experimental group's posttest ($M = 16.53$, $SD = 2.93$) in teaching CPR. In addition, the results indicated a statistically significant difference ($t = -3.80$, sig.001 (2 tailed) $p < 0.05$), between the control group's pretest ($M = 8.15$, $SD = 2.44$) and the posttest ($M = 14.69$, $SD = 5.69$) in teaching CPR. (Table 1). However, when it was tested on the effect of knowledge between the experimental group and control group, the result is no significant relationship with $t = 3.09$, $p > 0.05$. Furthermore, table 1 showed that the experimental group got a higher mean in both pretest ($M = 8.31$) and posttest. ($M = 16.53$) compared to control group pretest ($M = 8.15$) and posttest ($M = 14.69$). This can be interpreted that mathematically there is significantly improvement after the application of either traditional training in the control group or simulation in the experimental group. (Table 1).

Table 2
Mean Differences in the Effect of Psychomotor (Immediate- Delayed) between Experimental Method and the Control Group

Mean Differences in the Effect of Psychomotor (Immediate-Delayed) between Experimental Method and the Control Group					
Variable	Mean (SD)		t	Sig	P Value
	Experimental G.	Control G.			
	N=13	N=13			
Immediate	3.84 (.15)	2.96 (.43)	6.96	.000	.05
Delayed	3.71 (.21)	2.65(.20)	13.19	.000	.05
	T= 1.86 Sig. .075	T=2.31 Sig. .030			

In addition, the results indicated a statistically no significant difference in retention of psychomotor skills in experimental group ($t = 1.86$, sig. 0.075(2 tailed), $p > 0.05$) between the immediate ($M = 3.84$, $SD = .15$) and the delayed ($M = 3.71$, $SD = .21$). Moreover, an independent t test showed a statistically significant difference in psychomotor retention in control group ($t = 2.31$, sig. .030 (2 tailed), $p > 0.05$) between the immediate ($M = 2.96$, $SD = .43$) and the control group ($M = 2.65$, $SD = .20$) in teaching CPR. The result also gives significance difference between the experimental and control both for the immediate and delayed psychomotor test ($t = 6.96$, sig.000, $p < 0.05$, 13.19 , $t = 13.9$, sig. .000, $p < 0.05$ respectively) when examined the effect of the psychomotor between the experimental and control group in teaching CPR. (Table 2) However, as shown in Table 2, an independent t test indicated that simulation is significantly more effective than standard training in improving psychomotor skills of the students in teaching CPR.

The study also indicate that there is no significant relationship ($f = 1.71$, sig. .349, $p > 0.05$) between knowledge (posttest) and the

psychomotor (immediate and delayed) in experimental group and also the same result yielded to control group ($f = 726$, sig. .508 $p > 0.05$) when tested the correlation of knowledge (posttest) and psychomotor (immediate and delayed) using anova. However, using the person correlation, there is a significant relationship between psychomotor delayed and psychomotor immediate (.036, $p < 0.05$).

DISCUSSION

Cardiopulmonary resuscitation has a narrow window of opportunity. It must be started early and followed by defibrillation in a timely manner. With inadequate or delayed CPR, the entire chain of survival is weakened and positive outcomes deteriorate rapidly. This study had showed inadequate level of knowledge in the pretest and considerable improvement in the posttest. However more number of students from the experimental group knowledge was better than the control group. This study had shown all the students from the experimental group had performed with the high skills in the immediate test. But the majority of the students from the control group had moderate skill. This shows the effectiveness of the high fidelity mannequin. Similar effectiveness was seen in the study by Langdorf et al (2014), high fidelity simulation on CPR among the medical students had significantly improved knowledge and psychomotor skills(6). ACLS training including high-fidelity simulation decreases time to CPR and DF and improves performance during resuscitation. A study by Aqel & Ahmad (2014) indicated the improvement of knowledge and skills among the high fidelity mannequin group compared to the control group(4).

This study showed that students demonstrated improved retention of CPR knowledge (posttest) in experimental group with the support of high fidelity mannequin as compared to control group using the standard method. Similar result was made by Tawalbeh & Tubaishat, (2013) on the effect of simulation on knowledge of advanced cardiac life support(7). A study by Aqel & Ahmad (2014) also had reported that the intervention group showed more retention knowledge than the control group(4).

There were significant improvements with the effect of simulation in their psychomotor skills between the experimental group compared to control group in both immediate and delayed.

Similar finding was also reported by Aqel & Ahmad (2014) on their study about high-fidelity simulation effects on CPR knowledge, skills, acquisition, and retention in nursing students(4). The exposure of the students in high fidelity increases their competency level as evidenced by improvement of their skill acquisition compared to those who are exposed only to standard method. Frequent exposure to high fidelity mannequins will also improve their performance which results to quality patient care. The findings of the study will give an implication that simulation should be integrated in the nursing curriculum to further enhance the critical thinking and improve their psychomotor acquisition and retention in all aspects of nursing procedures. The simulation is also a good venue to provide a practical safe environment for nursing students and health professional to enhance their knowledge, skills and attitude. The result of the study did not yielded a significant relationship between the knowledge (posttest) and psychomotor skills (immediate and delayed).

RECOMMENDATIONS

- Replication of this research should be done with higher number of participants.
- Include female students to know the extent of the effect of simulation in the retention of knowledge and psychomotor skills of the female nursing students.
- Comparative studies between the male and female students and the different health professionals to identify the various strategies.
- Extend the delayed posttest to 6 months after the immediate test to further know the effect of simulation in their psychomotor retention.
- Further study should be conducted to know the effect of the simulation in retention of knowledge and psychomotor skills in the real clinical settings.

STUDY LIMITATIONS

This study was limited to the male students from the nursing pro-

gram, and also sample size was limited in number. It is recommended to have higher sample size in the future studies for the representation and generalization of findings.

CONCLUSION

This study emphasize on the incorporation of high fidelity simulation in teaching CPR along with the traditional lectures in the nursing program will enhance the knowledge and psychomotor skills of the students. This innovative teaching methodology positively increases the retention of psychomotor skills of the students. This will also provide opportunity for both students and health care professionals to work in a safe environment and experiencing real life situation.

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