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Knowledge and Skills of Hands-only Cardiopulmonary Resuscitation Training among Secondary School Students: An Interventional Study

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ABSTRACT

Objectives: This study aimed to evaluate the effect of a Cardiopulmonary Resuscitation (CPR) Training program (hands only) on retention of knowledge and skills among secondary school female students in Riyadh city. **Methodology:** An intervention study was conducted. The sample was recruited by multistage sampling to elaborate the targeted schools for research implementation. The allocated school was in Riyadh city, with 92 Female Secondary School. The capacity of this school was 508 students, and 117 students who met the inclusion criteria were included in the study. Data were collected using a structured questionnaire and checklist skills evaluation sheet. **Results:** In light of the current study findings, the majority of the students were between 17 and 19 years. The present study showed that almost 100% of students were willing to learn CPR; 81.2% and 76.9% of students felt comfortable and confident to perform CPR when needed directly after training and a 4-month follow up, respectively. All students reported that they benefitted from the program. In general, it was found that BLS knowledge was very poor before training while students' retention of the knowledge and skills ranged from fair to poor after 4-month follow up. **Conclusion:** Although the current study has only examined female students in secondary schools which limit the generalizability of the result, it provides additional evidence with respect to the Ministry of Education and health care service sector to collaborate and introduce the basic life support program into the school curriculum. National programs are needed by well-equipped nurses for teachers and students in schools regarding basic life support and emergency first aid through the Saudi Ministry of Health in cooperation with nongovernmental societies.

Keywords: basic life support, cardiopulmonary resuscitation, retention, students, knowledge, practice, opinion.

INTRODUCTION

Life-threatening situations can occur at any time in daily life. Every person shares the responsibility of having knowledge and performing skills of basic life support and emergency first aid during cases of sudden cardiac arrest, loss of consciousness, and choking. The aim is to prevent further deterioration of the case, to save a life, and to promote recovery.¹ The American Heart Association (AHA) recommended that American schools establish a goal to train all teachers and students in CPR.² Hands-only (compression-only) by stander CPR may reduce the time to initiation of CPR and result in delivery of a greater number of chest compressions with fewer interruptions for the first several minutes after adult out-of-hospital cardiac arrest.³ Studies assessing the success of training courses for teenagers showed that they have been able to assess consciousness and breathing, remember the emergency number, give sufficient information by telephone, put a patient into recovery position, and open the airway.⁴ Hands-only CPR can be performed by anyone and should be performed if the individual is not confident in his or her CPR skills or has not learned conventional CPR.⁵ In 2003, the International Liaison Committee on Resuscitation strongly recommended that CPR training to be incorporated in the standard school curriculum.⁶

There are more than 135 million cardiovascular deaths each year worldwide, and the prevalence of coronary heart disease is increasing. Globally, the incidence of out-of-hospital cardiac arrest ranges from 20 to 140 per 100 000 people, and survival ranges from 2% to 11%. In the United States, >500 000 children and adults experience cardiac arrest, and <15% survive.⁷ In Saudi Arabia, a Basic Life Support (BLS) course is mandatory for all health care

professionals but is elective for other people, and sometimes they are unaware of it. Still, emergency and life-threatening situations can happen at any time and place. A study was conducted on cardiac arrest in Saudi Arabia over 7 years in Riyadh City. The result showed that survival from out-of-hospital arrest was poor despite the presence of experienced and well-trained staff and modern resuscitation equipment in the ED.⁸ Hence, the study aimed to evaluate the effect of a cardiopulmonary resuscitation (hands only) training program on knowledge and skills among secondary school female students in Riyadh city through the following:

- (1) Designing and implementing a training program for secondary school female students about hands-only CPR.
- (2) Assessing the level of knowledge and skills for hands-only CPR immediately after training and 4 months later.

Research Hypotheses

1. A hands-only CPR training program will significantly increase the knowledge of female secondary school students post-training and after 4 months.
2. A hands-only CPR training program will significantly increase the skills of female secondary school students post-training and after 4 months.

METHODS

An intervention study was conducted through a multistage sampling technique used to elaborate the targeted school for the research implementation. Simple randomization allocated 117 students in 2nd and 3rd secondary grades. Inclusion criteria were not previously attending any BLS training and age 17 years and above. Exclusion criteria were physical disabilities and any health problems. Students were divided into 12 groups arranged according to their class level. Five groups were from grade 3, and seven were from grade 2. Each group took 110–120 minutes to complete the training session. First, a pretest took 15–20 minutes to complete. Then, the instructor took 55–60 min to cover the theoretical part and CPR demonstration. After that, the students' redemonstrations, questions, and a posttest took 40–45 min.

The current study used structured self-administered questionnaire (pre-training, post-training, and 4 months post-training test) which was written in Arabic and designed based on the literature review of relevant scientific. It consisted of two parts: first, sociodemographic data of the students and their families and, second, general knowledge about BLS as follows (pre-training) with 11 multiple-choice questions on general knowledge of basic life support covering knowledge regarding the BLS immediately and 4 months after training. For skill assessment, an observation checklist was developed by the researcher based on literature review of the relevant scientific studies. For the Knowledge and Skills Score, the total number of questions was 11. Six of them were designed to measure retention. Each correct question equaled 2 marks; the highest mark was 12/12, which equaled 100%. The total number of skill items was five. Each item equaled 2 marks; the highest mark was 10/10, which equaled 100%. The content validity of the questionnaire was tested through review by five experts from the same field to prove the relevance of the questionnaire statement to study objectives. The principles of ethics, respect, beneficence and justice were considered in this study. The students were considered high risk in research because of their vulnerability. Therefore, consent was obtained from the parents for the students to have training on BLS through a developed approval form. Also, the students were informed about the right to participate or decline participation in the study and to withdraw at any time without effect on their marks.

RESULTS

More than three quarters (76.9%) of the students were 17 years, and almost a quarter (23.1%) ranged in age between 18 and 19 years. The mean age of the students was 17.32. More than half (57.3%) were in the second grade. The emergency situation that the students

had previously encountered was dizziness and fainting among 50% and choking among 25%. More than half (62.5%) of these emergency situations had occurred at the school while 46.15% had occurred at home. The majority of the students had poor knowledge before training regarding the duration of CPR, first step of CPR, and sequence of CPR as revealed by rates of 82.9%, 62.4%, and 64.1%, respectively, while 82.9% had good knowledge as they answered correctly regarding the medical emergency phone number (Table 1).

Table 1: Pre-training Knowledge of Students about CPR

| Items | Correct Answers | | Incorrect Answers | |
|-------------------------|-----------------|-------|-------------------|-------|
| | NO | % | NO | % |
| Duration of BLS course | 20 | 17.1% | 97 | 82.9% |
| First step to start CPR | 44 | 37.6% | 73 | 62.4% |
| Sequence of CPR | 42 | 35.9% | 75 | 64.1% |
| Emergency number | 97 | 82.9% | 16 | 17.1% |

CPR knowledge immediately after the training and at 4-month follow-up showed significant differences between the immediate test (80.3%) and at 4-month follow-up (34.2%) with regard to the rate of CPR (Table 2). Additionally, highly significant differences (p value = 0.007) emerged between the immediate post-training and at 4-month follow up with regard to assessments of scene safety, checking the responsiveness of the victim, and calling for help as their skill scores dropped from good and excellent to poor after 4 months (Table 3).

Table 2: Distribution of Students Related to CPR Knowledge Immediately After the Training and at 4-Month Follow-up (N = 117)

| Items Answer | Immediate Post-test | | | | Follow-up 4 months later | | | | P value |
|--|---------------------|------|-----------|------|--------------------------|------|-----------|------|---------|
| | correct | | incorrect | | correct | | incorrect | | |
| | NO | % | NO | % | NO | % | NO | % | |
| Position of the hands during CPR | 113 | 96.6 | 4 | 3.4 | 111 | 94.9 | 6 | 5.2 | 0.192 |
| Appropriate rate of chest compressions in 1 minute | 94 | 80.3 | 23 | 19.7 | 40 | 34.2 | 77 | 65.8 | 0.058 |
| When to stop hands-only CPR | 114 | 97.4 | 3 | 2.6 | 113 | 96.6 | 4 | 3.4 | 1 |
| How deep the rescuer should push the chest | 95 | 81.2 | 22 | 18.8 | 52 | 44.4 | 65 | 55.6 | 0.026 |
| Sequences of providing CPR | 93 | 79.5 | 24 | 20.5 | 101 | 86.3 | 16 | 13.7 | 0.41 |
| Emergency number in your city | 117 | 100 | 0 | 0 | 114 | 97.4 | 3 | 2.6 | |

Table 3: Distribution of Students Score Value for Their CPR Knowledge Retention Immediately After Training and at 4-Month Follow-up (N = 117)

| Score value | Immediate Post-test | | Follow-up 4 months later | |
|-----------------------------|---------------------|------|--------------------------|------|
| | NO | % | NO | % |
| Score 4 (Poor) | 2 | 1.7 | 3 | 2.6 |
| Score 6 (Fair) | 3 | 2.6 | 24 | 20.5 |
| Score 8 (Good) | 15 | 12.8 | 44 | 37.6 |
| Score 10 (Very Good) | 49 | 41.9 | 36 | 30.8 |
| Score 12(Excellent) | 48 | 41.0 | 10 | 8.5 |

p-value * 0.004

On the other hand, students' scores for CPR knowledge retention immediately after training and at 4-month follow-up showed that, almost half of students got very good scores in the immediate post-test, and 10% dropped after 4-month follow-up. Additionally, 41.0% of students got excellent scores in the immediate test, but only 8.5% of them maintained the same score at the 4-month follow-up test with high significant differences between immediate post-test knowledge scores and 4-month follow-up (Table 4). Additionally, the students who had scores between 8 and 10 in BLS skills dropped to between 6 and 8 at 4-month follow-up after training.

Table 4: Distribution of Students Score Value for BLS Skill Retention Immediate Post-Test and at 4-Month Follow-up

| Score value | Immediate Post-test | | Follow-up 4 months later | |
|----------------------------|---------------------|------|--------------------------|------|
| | NO | % | NO | % |
| Score value 4 (Poor) | 0 | 0.0 | 14 | 12 |
| Score value 6 (Good) | 5 | 4.3 | 42 | 35.9 |
| Score value 8 (Very good) | 26 | 22.2 | 39 | 33.3 |
| Score value 10 (Excellent) | 86 | 73.5 | 22 | 18.8 |

p-value * 0.05

DISCUSSION

Prior studies that have noted the importance of BLS skills in cases of cardiac arrest, where the heart stops pumping blood and it only takes a few minutes for irreversible brain damage to occur. By education and training, the community will be ready against emergency cases. Hands-only (compression-only) by stander CPR may reduce several minutes adult out-of-hospital cardiac arrest. The present study assessed the effect of a Cardiopulmonary Resuscitation Training program (hands only) on retention of knowledge and skills among secondary school female students. As mentioned in the literature review there is a lack of research conducted to educate and assess school students with regard to BLS in Saudi Arabia. It was also noted in the study conducted by Berhanu and Salleeh (2015) that public awareness, knowledge, and attitude toward first aid and BLS has not been satisfactorily covered in Saudi Arabia.⁹ The current study showed that less than a quarter of the students had faced an emergency situation that required appropriate intervention; 8.5% of these situations had happened at school while 10.2% had occurred at home, and 3.4% had occurred in other settings such as the mall or a beach.¹⁰ This is in agreement with the study of Meissner et al. (2012), who reported that 2.6% of emergency situations occur in public locations. The students' baseline BLS knowledge was poor before the training program, which is in agreement with a study by Alanazi et al. (2013) among 575 high school students, which found that more than half (58%) of those students did not have any previous information about CPR.¹¹

Regarding the duration of the BLS course, the majority of the students had incorrect answers in the current study. On the other hand, more than half of the students answered incorrectly regarding the steps and sequences of BLS, which reflects poor knowledge about BLS. This coincides with a study by Goniewicz et al. (2001), which revealed that 67% of students had insufficient knowledge and skill to conduct BLS.¹² The current study results showed significant improvement of knowledge and skills of the students immediately after the theoretical and practical BLS training program, which coincides with the study by Connolly et al (2007), which mentioned that the children included in their study showed highly significant increase in the level of knowledge following the training session.¹³ The current study also showed high significant differences between immediate post-test knowledge score and 4-month follow-up, showing that the mean score achieved by

participants in CPR training had decreased, which indicated that CPR knowledge had deteriorated significantly. This coincides with the study by Rajeswaran et al. (2014), which mentioned that the mean score achieved by participants had decreased to 70.7% after 3 months of CPR training.¹⁴

The students' skills retention score in the present study showed significant differences between immediate and 4-month follow-up posttest scores, in which the level of skills retention had dropped after 4-month assessment. This coincides with the study of Rajeswaran et al. (2014), which reported that the retention level of participants had dropped to 66.8% 3 months after the posttest.¹⁴ Acherman (2009) reported that there was a statistically significant decrease in both CPR knowledge and skill. This also coincides with the finding reported by the AHA about lack of retention of CPR knowledge and skill with passage of time even among health care providers.¹⁵ Despite these results, the current study adds important data about basic life support preparation specifically targeting an important part of the Saudi community. Secondary school students can act as laypeople and save others' lives, improving the outcome of health emergency problems in the community.

CONCLUSION

Introducing, maintaining, and improving BLS knowledge and skills of secondary school-age children will have an important effect in reducing the consequences of medical emergencies occurring in Saudi Arabia with crucial benefits to the public's health and economic savings. Thus, the impact of incorporating BLS training in the curricula of Saudi secondary schools could potentially lead to success in present and future national emergency control, increase patient survival rates, and improve outcomes.

Limitations of the Current Study

The study was limited to female students in secondary schools in the city of Riyadh. Therefore, the findings cannot be generalized.

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