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Effects of Cardiopulmonary Resuscitation Education Through Compound Method on Knowledge and Performance of Emergency Medical Services (EMS) Personnel in Golestan, Iran

Mohammad Mehdi Abdolmaleki[1] ,Beheshteh Tabarsy[2], Sepideh Nasrollah[2], Shiva Salehi[3*]

[1] *MSc of Medical Surgical Nursing, Faculty of Nursing and Midwifery, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran.*
[2]*PhD, Assisstant Professor, Department of Nursing, Faculty of Nursing and Midwifery, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran.*
[3]*PhD, Assisstant Professor, Department of Nursing, Faculty of Nursing and Midwifery, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran.* ***(Corresponding author)***

Abstract

Backgrounds and Aim: More than half of all sudden cardiac arrest cases occur out of hospital, and cardiopulmonary resuscitation (CPR) is the responsibility of emergency medical personnel in these cases. Therefore, it is essential for them to have the knowledge and competence to perform the resuscitation. This study aimrd to determine the effect of CPR education on the knowledge and performance of Emergency Medical Services (EMS) personnel.

Methods and Materials: In this quasi-experimental study, 46 emergency medical personnel who were selected through optimum allocation of stratified random sampling were studied to assess their knowledge and performance before and 14 days after the education. The training was implemented in groups (6 hours of theory and 6 hours of practical training on moulage). At the end of the first session, pamphlets were provided to all subjects. The data collection tools included a researcher-made questionnaire on demographics as well as 20 questions to assess knowledge, and a 31-item checklist for observing CPR performance. Face as well as content validities were assessed, and test-retest as well as interrater methods were used for reliability of the tools.

Results: The mean and standard deviation of knowledge scores were 13.06±2.37 as well as 18.19±1.55 and performance scores 20.04±2.8 as well as 28.63±2.8 before and after the intervention respectively, indicating the positive effects of education on knowledge and performance ($p < 0.001$).

Conclusion: CPR education had significant effects on improving knowledge and performance of the subjects. Thus, it seems necessary to hold updated courses on CPR and allocate more time for practical training in teams.

Keywords: Education, Cardiopulmonary Resuscitation (CPR), Knowledge, Performance.

Corresponding author: Shiva Salehi**,** shsalehi@iautmu.ac.ir, ORCID: 0000-0001-6829-5552

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Introduction

Cardiac arrest with mortality rate more than 90% is a global health problem; thus, improvements in medical interventions could save thousands of lives per year [1]. Cardiopulmonary resuscitation (CPR) is a life-saving technique in many emergencies including heart attack. Rapid performance of outdoor CPR is of great importance for a successful outcome [2]. The underlying causes of cardiac arrest are often overwhelming, including myocardial infarction or ventricular arrhythmias. The incident is potentially reversible if rescuers have sufficient time and speed CPR rapidity is directly related to the knowledge and performance of rescuers [3]. The main problem in efficient CPR performance is the lack of knowledge and competence of patients, their entourage, nurses and healthcare teams [4]. Sanchez Garcia et. al (2015) suggested that CPR knowledge in medical personnel of emergencies did not match with international standards including CPR training and healthcare staff are aware of continuing education on CPR. 64.7% of the participants attended in at least 1 CPR course after 2010, but 10.1% never took a refresher course. 90% of medical residents, 7% of nursing staff and 30% of faculties did not obtain the training required by American Heart Association (AHA) in hospital emergency services (one course every two years). The results showed that the higher the number of courses, the higher the level of knowledge regarding CPR [5].

More than half of deaths from cardiac arrest occur out of hospital, where there is no access to skilled medical personnel and facilities. Thus, perhaps, the most important element of healthcare is emergency care, especially its pre-hospital type [1, 6]. A study was conducted about the "effect of knowledge and skill retention reeducation course about CPR on 2 groups of nursing students in Shiraz." Data analysis indicated significant differences in the levels of competence before and after training in the two groups ($t = 8.5$, $p<0.05$) [7].

Roel and Bjork (2020) in their study, "comparing nursing student competence in CPR before and after a pedagogical intervention" found that knowledge of students after training increased significantly ($p=0.001$). They concluded that students' competency in CPR is deficient, indicating that better training is necessary during nursing education [6]. In another study about "assessing the awareness and competence of medical emergency trainees at Mazandaran University of Medical Sciences," findings showed that of 80 trainees, none of them had satisfactory competence regarding CPR, and half of them showed poor awareness [8]. Studies show that different CPR education methods can improve performance, with key indicators including attitude toward CPR, intention to perform CPR, and degree of CPR knowledge and skills [9, 10]. In 2015, the American Heart Association suggested that CPR instructors use multimedia, the internet, simulation and CPR feedback devices to create a hybrid learning environment to improve learning outcomes effectiveness [11]. Education plays an essential role in implementing CPR principles and enhances the reassurance of rescuers to

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acquire CPR knowledge and consolidate their learning.[8] Considering that emergency medical personnel are the first professional team in pre-hospital care at patient side in case of cardiac arrest, their awareness and competence in implementing the most recent and effective CPR protocols have an important role in increasing survival rate [4,7]. After reviewing educational documents of emergency medical personnel in the province and interviewing with them, it was revealed that they had no training regarding CPR during the last 24 months. This study aimed to determine the effects of CPR education on the knowledge and performance of Emergency Medical Services (EMS) personnel .

Methods:

This quasi-experimental before-after study was conducted to investigate the effects of adult CPR training at an urban base in Golestan province, Iran. 46 emergency medical staff were selected with optimum allocation of stratified random sampling. In this type of sampling, different educational groups were divided into four levels: nursing associates, operating room associates, medical emergency associates, and anesthesiology associates. Based on the ratio of each group, random sampling was applied for each group; accordingly, the sample from each field of study could be extended to the whole group of 230 subjects. The following formula was used to determine the sample size, 42. Considering confidence interval of 95%, power of 0.8, effect intensity of 0.6 and sample loss of 10%, 46 subjects were ultimately selected.

$$n_0 = \frac{\left(z\frac{\alpha}{2} + z\frac{\beta}{2}\right)^2 P(1-P)}{d^2} = 42$$

Data collection tools consisted of a two-part researcher-made questionnaire (based on text books, American Heart Association guidelines (2015) [12], and experts' opinions) and a checklist. In addition to demographics, 20 items related to knowledge (1 for correct answer and 0 for incorrect answer) were included in the questionnaire. The 31-item checklist made by the researchers was used to assess the performance which included yes (1 score) and no (0 score) with the range of 0 to 31. Face and content validities were used for both tools. Face validity was assessed quantitatively and qualitatively among the participants. For quantitative analysis of impact score, 15 subjects participated. Items with impact score greater than 1.5 were considered suitable for further analysis, and items less than 1.5 were excluded [13]. For qualitative analysis, each question was answered by 15 subjects and their opinions in terms of level of difficulty, level of expressiveness, ambiguity, simplicity, comprehensibility and confusion were gathered. After consultation with the participants and the research team, the necessary corrections were made. The time required to fill the tools was also recorded. In the qualitative review of content validity, 15 faculty members and emergency department officials checked the syntax, use of appropriate words, location of the items in appropriate place, appropriate range or scoring, simplicity (comprehensibility),

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clarity or ambiguity. Test-retest method was used for reliability (r =0.8[1]). The questionnaire was given twice to 10 participants with an interval of 14 days. Interrater reliability was used for the checklist (r=0.83). This group was later excluded from the sampling. Inclusion criteria were being a pre-hospital emergency expert with at least 2 years of experience, willingness to participate in research and having no training regarding CPR during past year. If they did not participate in more than 1 training session, they were excluded from the study.

The tools were completed once before training via asking the subjects. Then, the researchers invited the participants to a training site and divided them in groups (8-10 subjects in each group for a 2-day training). The content included 6 hours theory and 6 hours practice on CPR with a torso moulage). The training methods consisted of lecture, question-answer, and practice. An educational booklet was given to all subjects. After two weeks, by prior coordination and invitation (including the date and time of post-tests), the researchers called them to answer the questionnaire and the checklist was completed. Data were analyzed using Kolmogorov-Smirnov and paired T tests. Kolmogorov-Smirnov test showed no significant difference between demographic characteristics of the subjects (P<0.001). Paired T-test was then used according to normality of data. To comply with ethical principles and the approval of the ethics committee of Tehran Azad University of Medical Sciences (IR.IAU.TMU.REC.1395.9) permission was obtained. During orientation session, the researchers assured the subjects that participation in the study was completely voluntary, had no effect on their work and all data would remain confidential.

Results

Most subjects (41.3%) were under 30 (mean=32.19±7.01). Half of them had work experience between 5 and 10 years and more than half of them (55.6%) had an associate degree in emergency medicine. The fewest group (4.4%) was nurses. The proportions of other groups were 20% for associate degree in anesthesiology and 20% for associate degree in operating room. 90.7% of the answers to the question “What is the ratio of each basic CPR cycle during chest compression?” were correct but in other questions, less than 80% of the answers were correct. 78.3% did not answer the question “What is the ratio of infant chest compression to breathing in a two-person CPR?”.

More than 90% of the subjects had satisfactory knowledge. all participants answered correctly to the question “Following a cardiac arrest after a few minutes, brain cells suffer irreparable harm after reducing their oxygen supply?”. In the question, “What is chest compression ratio to breathing in a two-person CPR?”, 21.7% answered correctly before the intervention while 67.4% answered correctly after training. This indicated that their knowledge was insufficient, and they needed training in this field. Regarding performance, in the item “Takes action to open the patient’s airway” and “Blocks the patient’s nasal route for mouth-to-mouth resuscitation”, no significant difference was found before and after the intervention (p= 0.157) (p= 0.102), but in other items, the difference was significant (p-value<0.05). Thus, it seemed that

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performance improved by training. Regarding knowledge, 82.6% of the subjects obtained scores of 10 to 15 before training (mean 13.06± 2.37) while it reached to 95.7% after the intervention and the scores increased to 15 (mean 18.19 ±1.55). The lowest score was 8 and the highest score was 15 before training but the corresponding scores were 12 and 19 after the intervention with a significant difference (p<0.001) (Table1).

Table 1: Comparison of knowledge scores of the participants before and after training

Knowledge	**Pre - education**		**Post - education**	
	Frequency	Percentage	Frequency	Percentage
less than 10	4	8.7	0	0
10-15	38	82.6	2	4.3
Over 15	4	8.7	44	95.7
Total	46	100	46	100
Mean±SD	**13.06±2.37**		**18.19±1.55**	
Paired t-test	**t=17.944, df =45, p-value<0.001**			

Findings indicated that before education, 76.1% of the subjects (35 participants) obtained scores between 15 and 22, and 2.2% of the subjects (1 participant) had a score of less than 15, which reached to zero after the intervention and only 21.7% of the subjects (10 participants) got scores over 22. This figure reached to 100% after training. That is, all 46 subjects improved their performance score to 22. Mean performance score was 20.04±2.80 before the intervention, which increased to 28.63±2.08 after it (Table 2). The education had a positive effect on the performance of the participants because the average scores of the performance of the participants were different before and after the test.

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Table 2: Comparison of performance scores of participants before and after CPR education

Performance	Pre - education		Post - education	
	Frequency	Percentage	Frequency	Percentage
Less than 15	1	2.2	0	0
15-22	35	76.1	0	0
Over 22	10	21.7	46	100
Total	46	100	46	100
Mean±SD	**20.04±2.8**		**28.63±2.08**	
Paired t-test	**t=25.369, df =45, p-value<0.001**			

Discussion

It seems that knowledge scores of the participants (the most prevalent causes of cardiac arrest in adults, the golden time for CPR, the proper ways to open the airway and the first action in confronting the person falling on the ground) increased significantly (p<0.001). Similar results were found in Akbari Farmad et al. (2021) and Rolle and Bjork's (2020) studies, which were conducted to assess knowledge and clinical skills among nursing students and nurses. In both studies, knowledge and performance of nursing students and nurses increased significantly after training (p=0.001) [14,6]. The results of study by Akbari Farmad et al. (2021) showed that simulation-based CPR training improved knowledge and clinical skills of nurses [14].

Difference between mean scores of performance before and after education was significant (p <0.001), which is consistent with the results of the study by Hosseini-Irani et al. (2012) that assessed the effects of CPR training on the performance of nurses in selected hospitals of Shahrekord university of medical sciences [15]. The effects of training on the performance of the participants were obvious in these cases: CPR indicates that it is the most influential factor in such cases as “During the examination of the patient’s response, the patient’s respiratory state is observed with chest movement and breathing status”, “If the patient needs CPR, the rescuer would start chest compression immediately”, “If it is a bystander cardiac arrest, massage for 100 times is performed continuously without interruption”, “The rescuer would take action to open the patient’s airway and perform artificial respiration 8-10 times per minute” and “The response rate is examined by tapping patient’s shoulders and calling him loud”, “If the patient does not respond, immediate help is requested”, “The rescuer places the patient in an appropriate position for CPR and opens his

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mouth to check the presence of any external object."

In a study by Saffari et al. (2013) to assess medical sciences students` knowledge and skill about basic CPR, results showed that although some clinical students have relatively good knowledge of CPR compared to non-clinical students, they generally overestimate their skills with their knowledge [16]. Competence in practice is closely related to the theoretical knowledge of the doer [17]. In the present study, theoretical and practical training was performed jointly and led to knowledge and performance improvement. In many studies, its efficacy has been proven [4, 18]. Our findings are consistent with other studies showing that training is effective. No contradictory article topic was found. The levels of education impact were different in various educational methods. Kalhori et al. (2021) indicated that CPR knowledge levels of subjects were as follows: excellent (85 subjects or 16.2%), good (404 subjects or 77%), and average (36 subjects or 6.9%) [19]. In another study conducted by Montaseri et al. (2016), the importance of practical training has been emphasized along with theoretical training for acquiring such skills [20]. Top benefits of workplace CPR training include saving lives, increasing employees' confidence, reducing liability, improving workplace safety [16,17,18]. The selection of only the intervention group and not considering the control group is one of the limitations of this study. Also, the individual differences of the subjects in responding to and participating in training and their previous or updated information from other sources were effective in their response, which was out of the researchers' control.

Conclusion

It seems that educational interventions improve knowledge and performance of emergency medical personnel in the field of CPR. Therefore, it is necessary and inevitable to hold new theoretical and practical CPR courses by allocating more time and training as a team and facing the real environment to actively participate personnel in training. Our results can be important and usable in the fields of education (in different medical groups such as nursing, midwifery, medical students, managers, and staff at different levels in hospital and prehospital), research, management services and clinical fields. Regarding insufficient knowledge of personnel in the field of resuscitation and airway management, it is suggested that research be conducted on training of resuscitation in adults, children, infants, and airway management in emergency medical personnel at short intervals during the year. It is suggested that in retraining nursing and paramedical personnel, CPR be included with more emphasis on the changes of recent guidelines compared to that in 2010, including intraosseous infusion, esophageal tracheal airway, and reasons for the cessation of CPR. According to current research, it is suggested to use different educational methods, such as feedback-based and group discussion, and compare their results in different groups of society.

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Conflict of Interest Disclosures

The authors declare that they have no conflicts of interest

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