# The Effect of Cardiopulmonary Resuscitation Training on the Knowledge of Medical Students at Babol University of Medical Sciences

M. Ghaemi-Amiri (PhD)[1] , S. Rahimi Esbo (MSc)[1] , M. Soltani (MSc)[1] ,

S. Z. Hoseini Motlagh (MSc)[1] , Z. Golamnia Shirvani (PhD)[2] , S. Khajoui (BSc)[3] ,

F. Bagherian (MD)[*4]

1.Education Development Center, Babol University of Medical Sciences, Babol, I.R.Iran.

2.Department of Public Health, School of Public Health, Babol University of Medical Sciences, Babol, I.R.Iran.

3.Student Research Committee, Babol University of Medical Sciences, Babol, I.R.Iran.

4.Department of Emergency Medicine, School of Medicine, Babol University of Medical Sciences, Babol, I.R.Iran.

**Corresponding Author:** F. Bagherian (MD)

**Address:** Department of Emergency Medicine, School of Medicine, Babol University of Medical Sciences, Babol, I.R.Iran.

**Tel:** +98 (11) 32336069. **E-mail:** dr_f_bagherian@yahoo.com

| Article Type | ABSTRACT |
|---|---|
| **Research Paper** | **Background and Objective:** Cardiopulmonary resuscitation (CPR) is a vital intervention which plays a crucial role in increasing survival rates in cardiac arrest patients. Medical students, as future physicians, need to acquire sufficient knowledge and skills in resuscitation so that they can perform effectively in emergency situations. The present study was conducted to investigate the effect of CPR training on the knowledge of medical interns at Babol University of Medical Sciences.<br><br>**Methods:** This quasi-experimental study was conducted with a pretest–posttest design from 2020 to 2021 on 127 sixth- and seventh-year medical interns at Babol University of Medical Sciences. CPR training was provided in a three-hour session based on the 2015 American Heart Association Guidelines by an emergency medicine specialist. The interns' knowledge was assessed using a researcher-made four-option questionnaire in two stages, before and after training.<br><br>**Findings:** The findings showed that CPR training significantly increased the knowledge of the interns (mean pre-test: $12.19\pm4.23$, mean post-test: $28.19\pm5.28$, $p<0.001$). The variables of age, previous experience in resuscitation, and initial knowledge were strong predictors of post-test scores. Moreover, those who had a background in theoretical or practical training scored higher, but the effect of practical experience was stronger compared to theoretical training. |
| **Received:**<br>Feb 17th 2025<br>**Revised:**<br>Apr 5th 2025<br>**Accepted:**<br>May 5th 2025 | **Conclusion:** The results of the study showed that CPR training effectively increased trainees' knowledge, which emphasizes the importance of providing structured and ongoing training.<br><br>**Keywords:** *Cardiopulmonary Resuscitation, Medical Education, Training, Knowledge Assessment, Emergency Medicine.* |

## Introduction

Cardiopulmonary resuscitation (CPR) is one of the most vital measures in emergency situations which can save the lives of people who experience cardiopulmonary arrest (1). CPR includes measures that are performed to restore heart and lung function and oxygenation to the brain in people who experience cardiopulmonary arrest (2). In developed countries, the survival rate from out-of-hospital and in-hospital cardiac arrest is 10% and less than 30%, respectively (3). In Iran, the death rate in CPR operations is more than 90% (4) and the rate of patient discharge from the hospital is less than 7% (5). Cardiac arrest is one of the leading causes of mortality, and achieving rapid and correct intervention in these conditions can increase the chances of survival and quality of life of patients (6). Awareness of CPR and performing simple techniques increases the patient's chances of survival until the arrival of an experienced medical team (7). Therefore, it is very important that all people in the medical field be fully familiar with CPR (8). Among those who need to have adequate training in CPR, medical students have a special place because as future physicians, they must be able to manage the CPR team (9).

According to the results of a study by Eftekharian et al., which was conducted to "investigate the awareness level of medical students regarding CPR based on the latest changes in the resuscitation protocol" and was conducted on all intern and extern students at Jahrom University of Medical Sciences, the level of awareness of the majority of students was at an average level (10). In another study, Shajari et al. investigated the level of awareness of interns at Ali Ibn Abitaleb Medical School in Yazd about pediatric CPR; the results of this study showed that the level of students' awareness of resuscitation was generally lower than average. In the case of advanced resuscitation, the students' awareness was very poor and in basic resuscitation, their awareness was poor, which was also statistically significant (11). Therefore, it is important to evaluate medical students' knowledge and awareness in various educational centers in the country and take measures to improve it. For this reason, medical students have been trained in resuscitation using different educational methods in various universities in Iran, and the effect of this training has been studied (12-14). At Babol University of Medical Sciences, a study by Alijanpour et al. showed that a practical CPR workshop had a greater impact on increasing students' knowledge and awareness than multimedia training, but this study was conducted on only 51 medical students (15). Given the importance of CPR and its education for medical students in each of the country's medical universities and the fact that this study has not been conducted at Babol University of Medical Sciences in recent years, the present study was conducted to determine the effect of CPR training and the experience of participating in and observing CPR on the knowledge of medical students at Babol University of Medical Sciences.

## Methods

This quasi-experimental study was conducted with a pretest–posttest design. After approval by the Ethics Committee of Babol University of Medical Sciences with the code IR.MUBABOL.REC.1399.053, the study was conducted on sixth- and seventh-year medical students of Babol University of Medical Sciences from 2020 to 2021. Census sampling was adopted. All medical interns of Babol University of Medical Sciences who were studying at this period were invited to participate in the study. The exclusion criterion for the study was non-cooperation to participate in the study. Finally, 127 out of 142 students participated in this study. At the beginning of the work, the objectives and methods of the study were explained to the students, and written informed consent was obtained from them. All interns were trained in CPR by an emergency medicine specialist with expertise and experience in the field of CPR during a 3-hour session based on the 2015 American Heart Association Guidelines in a practical manner in the Clinical Skills Center. Student

data were collected using a researcher-made four-option questionnaire before and after training. The questionnaire included three demographic information sections: age and gender, experience of training or performing CPR (4 items), and knowledge of CPR (28 items).

The questionnaire of this study was prepared and adjusted by the research team in 35 items based on the 2015 Guidelines, and in the next stage, its psychometric indicators including face validity (quantitative-qualitative), content validity (quantitative-qualitative), and reliability (internal consistency) were evaluated. In qualitative face validity, 10 medical interns rated the items on the level of difficulty, appropriateness, and ambiguity, and then in quantitative method, they rated the items in terms of importance (with a minimum impact score of 1.5) (16), and all items were retained. In qualitative content validity, the scale was sent to 10 cardiologists, anesthesiologists, emergency medicine specialists, nurses, and operating room specialists who were familiar with the design and psychometrics of the tool. They were asked to review the scale in terms of grammar, use of appropriate words, placement of items in the right place, and scoring, so that editing could be done if necessary. In the quantitative method, the Content Validity Ratio (CVR) and then the Content Validity Index (CVI) were calculated for the items. For CVR, based on the Lawshe table, the minimum acceptable value was determined as 0.62 (17), and 7 items were eliminated at this stage. The minimum acceptable value of CVI was also considered to be 0.78 (18), and all items were retained at this stage. Then, the internal consistency was examined using the Cronbach's alpha index and 0.876 was obtained, which was appropriate (19). Finally, the questionnaire consisted of 28 items. The answers were in the form of four options, and participants who chose the correct answer were given a score of one, and if the wrong answer was chosen, a score of zero was assigned to that question. Finally, the data were entered into SPSS version 27 and analyzed using descriptive and analytical statistics including independent t-test, paired t-test, Spearman correlation coefficient, and linear regression, and $p < 0.05$ was considered significant.

## Results

127 sixth- and seventh-year medical interns of Babol University of Medical Sciences participated in this study (Table 1). The results of this study showed that 59 of the interns had no experience in CPR and 68 had this experience. Table 2 shows the difference in pre- and post-test scores in different demographic groups. The effect of CPR training on medical interns' knowledge was evaluated using an independent t-test, and the results showed that this training had a significant effect in this field (Table 3).

**Table 1. Demographic characteristics of medical interns at Babol University of Medical Sciences**

| Variable | Number(%) or Mean±SD |
|---|---|
| **Gender** | |
| Female | 84(66.1) |
| Male | 43(33.9) |
| **History of theoretical training in CPR** | |
| Yes | 87(68.5) |
| No | 38(29.9) |
| **History of practical training in CPR** | |
| Yes | 56(44.1) |
| No | 71(55.9) |
| Age (years) | 24.62±2.99 |
| Number of times participating in CPR | 18.23±9.72 |

**Table 2. Relationship between demographic variables and post-test and pre-test scores**

| Variable | Pre-test score | | | | Post-test score | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean±SD | Mean difference (95% CI) | p* | Standardized mean difference (95% CI) | Mean±SD | Mean difference (95% CI) | p | Standardized mean difference (95% CI) |
| **Age** ≤24 >24 | 11.47±4.33 13.20±4.04 | -1.73 (-3.27 – -0.20) | 0.027 | -0.41 (-0.05 – -0.79) | 17.59±5.80 21.59±3.53 | -4.00 (-5.52 – -2.27) | 0.001 | -0.82 (-1.19 – -0.44) |
| **Gender** Female Male | 12.02±4.30 12.51±4.12 | -0.49 (-2.06 – 1.09) | 0.541 | -0.12 (-0.48 – 0.25) | 19.02±5.35 19.79±5.16 | -0.77 (-2.73 – 1.19) | 0.441 | -0.15 (-0.51 – 0.22) |
| **Theoretical training in CPR** Yes No | 13.09±4.17 10.21±3.58 | 2.88 (1.34 – 4.42) | 0.001 | 0.720 (0.33 – 1.11) | 17.98±5.23 17.55±4.95 | 2.42 (0.42 – 4.43) | 0.018 | 0.47 (0.08 – 0.85) |
| **Practical training in CPR** Yes No | 13.28±4.30 11.46±4.04 | 1.82 (0.32 – 3.32) | 0.018 | 0.44 (0.08 – 0.80) | 19.68±5.38 18.88±5.28 | 0.80 (-1.13 – 2.72) | 0.415 | 0.15 (-0.21 – 0.51) |
| **History of participating in CPR** Yes No | 13.13±4.00 11.10±4.26 | -2.03 (-5.79 – -3.48) | 0.006 | -0.49 (-0.85 – -0.14) | 21.34±3.86 16.92±5.72 | -4.42 (-6.17 – -2.68) | 0.001 | -0.92 (-1.29 – -0.55) |

*Independent T-Test

**Table 3. The effect of cardiopulmonary resuscitation training on medical interns' knowledge**

| Variable | Mean±SD | Mean difference (95% CI) | p-value* | Standardized mean difference (95% CI) |
|---|---|---|---|---|
| **Test score** Pre-test Post-test | 12.19±4.23 19.28±5.28 | -7.09 (-8.00 – -6.18) | 0.001 | -1.37 (-1.61 – -1.12) |

*Paired T-Test

The effect of age, gender, experience of attending theoretical and practical training, experience of participating in CPR, and pre-test score on the post-test score was investigated by means of univariate and multivariate regression. Linear regression in this study was performed using the Enter method. Initially, the normal distribution of the residual values of the post-test score was examined, and the results of the Kolmogorov-Smirnov test were not statistically significant (p=0.165), so the residual values of the dependent variable had a normal distribution. The Durbin Watson index was 1.976 in multivariate regression. In multivariate regression, variables that were not significant in the univariate were discarded, and the effect of age, theoretical training in cardiopulmonary resuscitation, experience of participating in cardiopulmonary resuscitation, and pre-test score on the post-test score was examined. The regression results showed that the variables of age, history of participation in CPR, and pre-test score were independent

and strong predictors of the post-test score, as this significant relationship was observed in both simple univariate and multivariate linear regression. In the multivariate regression model, the $R^2$ value was 0.376 and the adjusted $R^2$ value was 0.354 (Table 4).

**Table 4. The effect of age, gender, history of theoretical and practical training, history of participation in CPR, and pre-test score on post-test score using univariate and multivariate regression**

| Variable | Univariate regression | | | | Multivariate regression | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | B(SE) | Beta | p | 95% CI | B(SE) | Beta | p | 95% CI | VIF |
| Age (≤24) | 4.00(0.90) | 0.38 | 0.001 | 2.21 – 5.79 | 2.88(0.81) | 0.27 | 0.001 | 1.27 – 4.48 | 1.06 |
| Gender (female, male) | 0.77(0.99) | 0.07 | 0.441 | -1.20 – 2.73 | - | - | - | - | - |
| Theoretical training in CPR (yes, no) | -2.42(1.01) | -0.21 | 0.018 | -4.43 – 0.42 | -0.61(0.90) | -0.05 | 0.496 | -2.39 – 1.17 | 1.12 |
| Practical training in CPR (yes, no) | 0.21(0.27) | 0.07 | 0.436 | -0.33 – 0.76 | - | - | - | - | - |
| History of participating in CPR (yes, no) | 4.42(0.86) | 0.42 | 0.001 | 2.73 – 6.12 | 3.36(0.82) | 0.32 | 0.001 | 1.73 – 4.99 | 1.08 |
| Pre-test score | 0.53(0.10) | 0.42 | 0.001 | 0.33 – 0.73 | 0.35(0.10) | 0.28 | 0.001 | 0.15 – 0.59 | 1.18 |

**SE: Standard Error, VIF: Variance Inflation Factor**

## Discussion

In this study, the comparison of pre- and post-test scores in the two age groups showed that the pre-test score in interns aged 24 and under was significantly lower than that in those aged 24 and over. Moreover, in individuals without experience in resuscitation, it was significantly lower than that in individuals with experience in resuscitation, but the size of this difference was weak in the pre-test and strong in the post-test. Therefore, the increase in knowledge score was greater in interns aged over 24 and individuals with experience in resuscitation, and this could indicate that holding CPR workshops in older interns with more experience would be more effective (20).

Another result of this study was that there was a significant difference between the pre- and post-test scores in those who had received theoretical or practical training. However, this difference in the post-test score was weakened and was not statistically significant in those who had a history of practical training. Finally, the results of this study showed that age, experience in CPR, and pre-test score (interns' basic knowledge of CPR) are independent, strong, and predictive variables of the post-test score. These results indicate the importance of age, experience in the workshop, and prior knowledge in increasing the effectiveness of the workshop for students (21). A study by Papalexopoulou et al. showed that age had a significant negative effect, meaning that older people performed worse. In contrast, higher education had a positive effect, but this effect was not significant (22). This difference could be due to the fact that this study involved ordinary people, while medical students participated in our study.

The results of this study showed that CPR training significantly increased CPR knowledge, and this difference was also strong in terms of power. In a study comparing the effects of traditional training methods and video-based training on student knowledge and performance, Mohamed Elsayed et al. showed that both methods improved students' knowledge, which was also statistically significant (14). However, the increase in knowledge score in the present study was more noticeable, which could be related to the difference in the instructor, the presentation of educational materials, or the measurement tool. In the

study by Alijanpour et al., the increase in the questionnaire score was also similar to the results of this study in both the scientific workshop and multimedia methods (15). In a study by Yazdani et al., nursing students were trained in three serious game groups using a smartphone, simulation, and control, and the effect of training on their attitudes was examined. The results showed that none of these trainings improved students' attitudes towards resuscitation (13). This difference may indicate that the attitude and knowledge of students towards resuscitation are completely different, so efforts should be made to improve them using different methods.

The results of this study showed that CPR training has a significant impact on increasing the knowledge of medical interns and that this training can play a fundamental role in preparing students to manage emergency situations. It was also found that factors such as age, previous experience in participating in resuscitation, and level of initial knowledge, as key variables, have a significant impact on the process of training. The strengths of this study include the use of an emergency medicine specialist in the training process, which helped increase the validity of the results, as well as the use of standard and up-to-date training methods. In addition, the present study was able to provide a comprehensive analysis of the impact of training by considering various variables, such as age, gender, educational background, and experience in participating in resuscitation. Despite these advantages, one of the main limitations of this study is that it was conducted only at Babol University of Medical Sciences, which makes it difficult to generalize the results to other universities. Furthermore, this study focused more on increasing theoretical knowledge and did not evaluate students' practical skills in performing CPR. On the other hand, the duration of the follow-up of the effect of the training was also limited, and the level of retention of the knowledge and skills learned in the long term was not examined. Accordingly, it is suggested that similar studies be conducted in other universities of medical sciences in Iran to increase the generalizability of the findings and to provide the possibility of comparing the effectiveness of different training methods in different populations. Moreover, designing studies that, in addition to assessing knowledge, also examine the practical performance of interns can provide a more accurate insight into the effectiveness of this training. Another suggestion of this study is to compare different training methods, including face-to-face training, simulation, blended learning, and the use of technologies such as virtual reality. Given the results of this study, which showed that prior knowledge and practical experience affect the process of learning, it is suggested that training courses be held periodically and more opportunities for practical experience in simulated or real environments be provided. Finally, it is suggested that practical resuscitation workshops be repeated several times during different academic years to ensure consolidation of knowledge and skills.

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