



## The Effect of an Educational Intervention Program on the Knowledge, Attitudes, and Practices of Allied Health Students with Regard to Cardiopulmonary Resuscitation

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### ABSTRACT

**Background:** Cardiac arrest is the leading cause of mortality worldwide. Early intervention with cardiopulmonary resuscitation (CPR) can effectively save lives. Allied health students must possess the essential information, attitudes, and skills necessary for CPR to prepare for their future roles within the medical community. **Purpose:** This paper aims to examine the effect of an educational intervention program on the knowledge, attitudes, and practices of allied health students regarding cardiopulmonary resuscitation. **Methods:** A quasi-experimental research methodology; namely, a one-group pretest-posttest design, was employed. The data collection method involved using a self-administered questionnaire, and the sample consisted of 450 allied health students recruited through the convenience sampling method. The educational intervention program was implemented from 5 November 2023 to 5 February 2024. A valid, reliable questionnaire consisting of 34 items was used to examine the effect of an educational intervention program. The adapted questionnaire was developed based on the guidelines of the European Resuscitation Council (ERC, 2015). This questionnaire consisted of 10 questions about knowledge, 7 about practice, and 17 about attitudes. Descriptive statistics were obtained, and inferential chi-square statistics were used for data analysis. **Results:** Significant differences in knowledge, attitudes, and practice levels were found after the educational intervention program in all questionnaire items ( $p < 0.05$ ), except for one item (the way to rescue breaths in an infant), and the 2015 ERC guidelines concerning basic resuscitation operations ( $p < 0.05$ ). Significant differences were also noted between males and females in their attitudes regarding providing chest compression (CC) to strangers ( $p < 0.05$ ) despite infection concerns ( $p < 0.05$ ) and providing mouth-to-mouth ventilation (MMV) to members of the other gender ( $p < 0.05$ ). **Conclusion:** The CPR educational intervention program improves allied health students' knowledge, attitudes, and practice. The differences in the attitudes of males and females regarding providing CC to strangers despite infection concerns and regarding providing MMV to members of the other gender are significant. Therefore, these results emphasize the importance of CPR education for this group of students to maintain and promote their levels of knowledge, attitudes, and practice regarding CPR. **Implications for Nursing:** The present study's findings indicate that CPR instruction significantly enhances knowledge, attitude, and practice amongst students in the allied health field. Hence, the findings underscore the need to provide CPR education to this cohort of students to preserve and enhance their knowledge, attitude, and skills about CPR. The results can provide valuable insights for nurse educators, nursing managers, and decision-makers to devise successful strategies for improving CPR knowledge, attitude, and application.

**Keywords:** Allied health students, Cardiac arrest, Cardiopulmonary resuscitation (CPR), Knowledge, Attitude, Practice, Jordan.

### **What does this paper add?**

1. Cardiopulmonary resuscitation (CPR) educational intervention programs are essential for enhancing allied health students' knowledge, attitudes, and practice. However, CPR performance may be ineffective due to insufficient knowledge, negative attitudes and ineffective training.
2. Allied health students are future healthcare providers. Therefore, in order to use CPR in the future, allied health students need to be adequately informed, have practice, and have favourable attitudes about it.

### **Introduction**

Cardiac arrest is the cessation of normal blood circulation due to the heart's inability to contract and pump blood effectively (Tripathi & Vyas, 2021). A sudden cardiac arrest is a severe emergency with a low chance of survival (Adeleye et al., 2021). Cardiac arrest is the most common cause of death worldwide (Shashaa et al., 2021), accounting for 15%-20% of total deaths globally (Kassie & Salih, 2021). Moreover, cardiac arrest is a highly prevalent emergency, not only for the adult population, but also for newborns (Onyeaso & Onyeaso, 2017). Cardiovascular diseases (CVDs) are responsible for 31% of deaths worldwide yearly; cardiac arrest and stroke account for 80% of all CVD deaths (Moon & Hyun, 2019). To improve the monitoring of patients who went into cardiac arrest and to reduce morbidity and mortality rates, the early implementation of cardiopulmonary resuscitation (CPR) is crucial (Mansour et al., 2019). Early CPR greatly increases the survival rate (Alazmi & Alzahrani, 2020), and immediate CPR after cardiac arrest doubles and even triples the likelihood of survival (Chauhan & Patel, 2022). However, the chance of survival drops by 7%-10% for every minute CPR is delayed (Vural et al., 2017).

CPR is performed in many medical emergencies, including heart attacks, drowning, electrical injuries, suffocation, and other situations when the circulatory system fails (Alsharari et al., 2018). A CPR intervention is crucial for increasing the chance of a patient who went into cardiac arrest to survive inside and outside the hospital (Zenani et al., 2021). Out-of-hospital cardiac arrest (OHCA) is a substantial public health issue that contributes to a significant portion of deaths globally (Fariduddin & Siau, 2021). OHCA affects more than

700,000 people in Europe and the USA annually (Pivač et al., 2020). The survival rate ranges from 5% to 10% and is extremely low (Wingen et al., 2018). In Jordan, only 3% of patients who suffer from OHCA survive owing to the lack of CPR knowledge and practice (Raffee et al., 2017). Approximately 90% of OHCA victims die before reaching a hospital because of the inadequate understanding of CPR (Rensburg et al., 2021).

CPR can be performed by healthcare professionals, students, and the general population (Milenkovic et al., 2023). The American Heart Association highly advises individuals, companies, and organizations to establish a CPR program to improve the chances of survival of anyone experiencing heart-related emergencies (Thomas & Zagade, 2017). Also, the ERC guidelines concerning basic resuscitation operations recommended the following algorithm of CPR procedure; Clear the airway, check the breathing, and check the pulse (ERC, 2015). Therefore, possessing the appropriate knowledge and practice is crucial for CPR's effective, efficient conduct (Batool et al., 2022). The presence of a CPR-trained individual is a crucial component of successful CPR (Alazmi & Alzahrani, 2020). Thus, educational programs regarding CPR knowledge, attitude, and practice are essential for allied health students. However, a previous study revealed poor knowledge regarding CPR in allied health students in Jordan (Oteir et al., 2019).

Teaching a student the principles of CPR is essential, because Jordan needs emergency medical workers (Shashaa et al., 2021). Allied health students are required to respond to life-threatening events, such as cardiac arrest (Oteir et al., 2019), and college and university students are the community's most qualified bystanders for CPR (Shuk et al., 2017). Future medical professionals are students studying allied health. As a result, to use CPR in the future, all allied health students need to be adequately informed, have practice, and have a favorable attitude about it. Moreover, since cardiac arrest can happen anywhere and at any time, it is crucial to teach allied health students how to perform CPR. Good information, attitude, and practice are also necessary for performing CPR well. However, CPR performance may be ineffective due to insufficient knowledge, negative attitudes, and ineffective training. In addition, some students refuse to perform CPR due to

fear of performing it incorrectly, spreading disease through mouth-to-mouth respiration, or suffering legal consequences (Batool et al., 2022). Thus, examining the attitudes in this study will enhance the understanding of perceived barriers and CPR preparedness. All these factors highlight the importance of educational interventional programs to improve allied health students' knowledge, attitude, and practice regarding CPR.

Interventional studies in Jordan regarding CPR knowledge, attitude, and practice among allied health students are limited. Therefore, to provide pertinent information on this crucial topic for a rising country, such as Jordan, the present study aims to examine the effect of an educational intervention program on the knowledge, attitude, and practice of allied health students regarding cardiopulmonary resuscitation.

### Research Question

What's the effect of an educational intervention program on the knowledge, attitudes, and practices of allied health students with regard to cardiopulmonary resuscitation?

### Methods

#### Design and Setting

The study employed a quasi-experimental design; namely, a one-group pretest-posttest design. It was conducted at a university affiliated with the Jordanian government. The research employed an intervention study design focused on a sample of Jordanian allied health students aged 18 years or older. The intervention program was implemented from 5 November 2023 to 5 February 2024.

#### Participants

The study participants were selected using the non-probability convenience sampling method. The inclusion criteria were as follows. Firstly, participants needed to demonstrate the ability and willingness to participate in the study. Additionally, they were required to be allied health students who were 18 years old or older, regardless of gender. Furthermore, they were expected to possess the ability to read and comprehend the English language. Lastly, those who had yet to receive prior education on CPR were eligible for participation in the study. However, students studying for the first semester were not included in this study,

because they were initially enrolled in general medical courses and could change their focus after completing the semester. Additionally, the reason for their delayed initiation of clinical training needed to be specified.

The sample size was not subject to any restrictions. All allied health students enrolled at the university under investigation who satisfied the specified participation criteria received an invitation to participate in this research endeavor. The sample size was calculated using the formula proposed by Daniel (1999), which indicated that a minimum number of 384 participants was necessary. The purpose of oversampling was to address the issue of attrition or incomplete responses. Hence, the projected number of students was 442.

$$n = \frac{Z^2 P(1-P)}{d^2}, \text{ (Daniel, 1999).}$$

where  $n$  = Sample size,  $Z$ : Confidence level = 1.96,  $P$ : Prevalence or Proportion = 0.5,  $d$ : Precision = 0.05.

$$n = \frac{1.96^2 * 0.5 * (1-0.5)}{0.05} = 384.$$

#### Ethical Considerations

Data was collected after the Institutional Review Board (IRB) of Al-Balqa Applied University approval. The assigned number was (26/3/2/2335). A consent form was collected from each participant. The researchers explained the objectives of this study and the anticipated outcomes. The participants received information regarding the voluntary nature of their participation, emphasizing their entitlement to decline or discontinue their involvement at any point without providing a rationale and without facing any adverse consequences. The confidentiality of the responses of the participants was guaranteed.

#### Data-collection Tools

The study tool was a self-administered questionnaire. It was hosted through Google Forms and had three parts.

The first part of the questionnaire was the demographic data (age, gender, academic year, place of residency, and source of information). The second part of the questionnaire was related to knowledge and practice regarding CPR, which was adopted from (Kwiecień-Jaguś et al., 2020). The questionnaire was meticulously prepared using the rigorous guidelines that the European Resuscitation Council set forth. The questionnaire consisted of 17 close-ended questions

(Kwiecień-Jaguś et al., 2020).

The knowledge part consisted of 10 questions. Students were asked about the appropriate hand placement when applying chest compression (CC), what they would do if someone displayed signs of choking, and what the acronym automated external defibrillator (AED) stands for (Kwiecień-Jaguś et al., 2020). The practice part consisted of seven questions. Students were asked about the sequence of the CPR algorithm, the ratio of CCs during CPR, the proper position of AED pads, and the sequence of using an AED device (Kwiecień-Jaguś et al., 2020).

The students were required to attain a minimum of 60%-69% correct answers to pass the test at a sufficient level. A result falling between 70%-79% indicated that the students had achieved a pretty good level of knowledge. A score exceeding 80% was classified as good, while a correctness rate surpassing 90% was estimated as an excellent level of knowledge and practice. Each correct answer was awarded one point. A total score of 17 points signified that all the answers were correct (Kwiecień-Jaguś et al., 2020). This tool was reviewed and approved by five experts in emergency and critical care medicine (Kwiecień-Jaguś et al., 2020).

The third part of the questionnaire was related to attitudes towards performing CPR and was adopted from (Oteir et al., 2020). This part had 17 questions divided into three categories, covering attitudes about performing CPR generally and attitudes about performing mouth-to-mouth ventilation (MMV) and CC in various groups. These groups included kids, relatives, strangers, people of the other gender, and anyone who might be infected (Oteir et al., 2020). An expert panel confirmed the validity of the questionnaire, which had an acceptable level of reliability (Cronbach alpha = 0.82; (Oteir et al., 2020).

### **Data-collection Procedure**

After obtaining consent, the participants completed a short demographic data form and a knowledge, attitude, and practice questionnaire before joining the educational intervention. The pretest data was collected for over 15 minutes.

Clinical nurses' specialists from Al-Balqa Applied University delivered the intervention to allied health students. The instructors were prepared to administer the questionnaire through lectures and discussions covering

the purpose of the questionnaire, explanations of the questionnaire items, and participants' ethical considerations. The educational content was prepared according to the American Heart Association guidelines, which included theoretical information regarding CPR and step practice of CPR performed on a manikin. In addition, the educational content was assumed to be the same through the creation of an inventory of all existing content, assembling a dedicated team responsible for content delivery, and using a consistent template for the presentations.

Legal, cultural, and religious views of CPR were determined during the teaching session. The researchers held an educational intervention for all participants over one month, lasting 5 hours (two theoretical and three practical hours). The ratio of instructors to students was approximately (1:6). Lectures, discussion, and application on manikins were employed during the intervention.

Posttest data collection started after two months of the intervention. This period enabled the researchers to observe the intervention's long-term effects, facilitating more accurate conclusions. In addition, the participants' recall bias was minimized when they reported experiences after a significant time gap. Therefore, the students were instructed to complete the questionnaire and to assess whether their knowledge, attitudes, and practice regarding CPR were maintained, enhanced, or deteriorated.

### **Data Analysis**

The Statistical Package for Social Sciences (SPSS, version 26) for Windows was used for data analysis. Descriptive statistics, including frequency and percentage, were used to describe and review the demographic data and participants' responses to the questionnaire. Inferential statistics, including the chi-square test, were used to determine the effectiveness of the educational program.

### **Results**

The questionnaire was distributed to 510 students. The total number of participants who participated and completed the questionnaire was 450, with a response rate of (88.2%). Most study participants ( $n = 361$ , 80.2%) aged 19–22 years were females ( $n = 342$ , 76%) and were in their second year of education ( $n = 334$ , 74.2%). Of the participants, 226 (50.2%) live in cities,

and 165 (36.7%) reported university as a source of information (Table 1).

**Table 1. Participants' demographic characteristics**

| Characteristics       | Item                           | n   | (%)  |
|-----------------------|--------------------------------|-----|------|
| Age                   | 19-22                          | 361 | 80.2 |
|                       | 23-25                          | 49  | 10.9 |
|                       | >26                            | 40  | 8.9  |
| Gender                | Male                           | 108 | 24.0 |
|                       | Female                         | 342 | 76.0 |
| Level of education    | First year (second semester)   | 116 | 25.8 |
|                       | Second year                    | 334 | 74.2 |
| Area of living        | City                           | 226 | 50.2 |
|                       | Rural                          | 196 | 43.6 |
|                       | Bedew                          | 28  | 6.2  |
| Source of information | University                     | 165 | 36.7 |
|                       | Program training (pre-& post-) | 149 | 33.1 |
|                       | Social media                   | 51  | 11.3 |
|                       | Other                          | 85  | 18.9 |

N= 450.

### Knowledge Level

A significant difference in knowledge level was found before and after the education interventional

program in all questionnaire items ( $p < 0.05$ ), except the item regarding the way to apply rescue breaths to an infant ( $p = 0.051$ ; Table 2).

**Table 2. Knowledge difference before and after intervention**

| Item                                                                                                                                    | Before |      | After |      | Chi-square<br>(p-value) |
|-----------------------------------------------------------------------------------------------------------------------------------------|--------|------|-------|------|-------------------------|
|                                                                                                                                         | n      | (%)  | n     | (%)  |                         |
| What does the abbreviation BLS stand for?                                                                                               |        |      |       |      |                         |
| A. Basic Life Support*                                                                                                                  | 258    | 57.3 | 356   | 79.1 | 0.002                   |
| B. Basic Lung Support                                                                                                                   | 95     | 21.1 | 40    | 8.9  |                         |
| C. Basic Life Service                                                                                                                   | 97     | 21.5 | 54    | 12.0 |                         |
| You find your friend in the middle of the road, he is unconscious, does not react, and does not breathe properly. What do you do first? |        |      |       |      |                         |
| A. I clear his airways                                                                                                                  | 80     | 17.8 | 21    | 4.7  | 0.000                   |
| B. I make sure we are both safe*                                                                                                        | 152    | 33.8 | 375   | 83.3 |                         |
| C. I begin to give him chest compressions                                                                                               | 114    | 25.3 | 30    | 6.7  |                         |
| D. I give him two rescue breaths                                                                                                        | 104    | 23.1 | 24    | 5.3  |                         |
| Having confirmed that the victim does not react even to strong stimuli such as shaking or loud shouts for help, what will you do next?  |        |      |       |      |                         |
| A. Call an ambulance*                                                                                                                   | 248    | 55.1 | 311   | 69.1 | 0.043                   |
| B. Perform cardiovascular resuscitation                                                                                                 | 78     | 17.3 | 32    | 7.1  |                         |
| C. Place him in the recovery position                                                                                                   | 64     | 14.2 | 54    | 12   |                         |
| D. Continue observations                                                                                                                | 60     | 13.3 | 53    | 11.8 |                         |
| The correct place for the compression of the chest in an adult is:                                                                      |        |      |       |      |                         |
| A. The left side of the chest                                                                                                           | 114    | 25.3 | 15    | 3.3  | 0.000                   |
| B. The right side of the chest                                                                                                          | 74     | 16.4 | 30    | 6.7  |                         |
| C. The center of the chest*                                                                                                             | 198    | 44.0 | 390   | 86.7 |                         |

|                                                                                                                            |     |      |     |      |       |
|----------------------------------------------------------------------------------------------------------------------------|-----|------|-----|------|-------|
| D. The xiphoid process                                                                                                     | 64  | 14.2 | 15  | 3.3  |       |
| The correct place for the compression of the chest in an infant is:                                                        |     |      |     |      |       |
| A. Two fingers placed on the bottom part of the sternum                                                                    | 120 | 26.7 | 15  | 3.3  | 0.000 |
| B. Two fingers placed in the area of the xiphoid process                                                                   | 96  | 21.3 | 33  | 7.3  |       |
| <b>C. Two fingers placed in the central part of the sternum on the breast line*</b>                                        | 142 | 31.6 | 382 | 84.9 |       |
| D. Two fingers placed on the top part of the sternum                                                                       | 92  | 20.4 | 20  | 4.4  |       |
| The correct depth for chest compression in children during BLS is:                                                         |     |      |     |      |       |
| <b>A. 1/3 of the chest depth*</b>                                                                                          | 293 | 65.1 | 406 | 90.2 | 0.001 |
| B. 1 and a half of the chest depth                                                                                         | 57  | 12.7 | 22  | 4.9  |       |
| C. 1/2 of the chest depth                                                                                                  | 63  | 14.0 | 7   | 1.6  |       |
| D. 2 and a half of the chest depth                                                                                         | 37  | 8.2  | 15  | 3.3  |       |
| The correct frequency of chest compressions during CPR for adults and children is:                                         |     |      |     |      |       |
| <b>A. At least 100 compressions per minute*</b>                                                                            | 268 | 59.6 | 348 | 77.3 | 0.000 |
| B. More than 100 compressions per minute                                                                                   | 70  | 15.6 | 36  | 8.0  |       |
| C. 80 compressions per minute                                                                                              | 92  | 20.4 | 37  | 8.2  |       |
| D. 120 compressions per minute                                                                                             | 20  | 4.4  | 29  | 6.4  |       |
| What does the abbreviation AED stand for?                                                                                  |     |      |     |      |       |
| <b>A. Automated External Defibrillator*</b>                                                                                | 157 | 34.9 | 279 | 62.0 | 0.000 |
| B. Automated Electrical Defibrillator                                                                                      | 98  | 21.8 | 67  | 14.9 |       |
| C. Advanced Electrical Defibrillator                                                                                       | 99  | 22.0 | 32  | 7.1  |       |
| D. Advanced External Defibrillator                                                                                         | 96  | 21.3 | 72  | 16.0 |       |
| If your friend suddenly shows symptoms of choking, what will you do?                                                       |     |      |     |      |       |
| A. Immediately hit his chest several times                                                                                 | 164 | 36.4 | 90  | 20.0 | 0.000 |
| <b>B. Compress his epigastrium several times*</b>                                                                          | 129 | 28.7 | 339 | 75.3 |       |
| C. Confirm choking by way of an interview                                                                                  | 74  | 16.4 | 16  | 3.6  |       |
| D. Give him two rescue breaths                                                                                             | 83  | 18.4 | 5   | 1.1  |       |
| Rescue breaths in an infant are performed:                                                                                 |     |      |     |      |       |
| A. Mouth-to-mouth with the nostrils pinched closed                                                                         | 98  | 21.8 | 154 | 34.2 | 0.051 |
| <b>B. Mouth-to-mouth or mouth-to-nose*</b>                                                                                 | 105 | 23.3 | 146 | 32.4 |       |
| C. Only mouth-to-nose                                                                                                      | 149 | 33.1 | 65  | 14.4 |       |
| D. Mouth-to-mouth without the nostrils pinched closed                                                                      | 98  | 21.8 | 85  | 18.9 |       |
| During the basic resuscitation procedure, the condition of the victim should be assessed:                                  |     |      |     |      |       |
| A. Every minute                                                                                                            | 158 | 23.8 | 57  | 12.7 | 0.043 |
| <b>B. Every 5 cycles (30 chest compressions and 2 rescue breaths)*</b>                                                     | 120 | 26.7 | 284 | 63.1 |       |
| C. When the victim starts to breathe correctly                                                                             | 88  | 19.6 | 68  | 15.1 |       |
| D. Before the attachment of the AED electrodes                                                                             | 84  | 18.7 | 41  | 9.1  |       |
| Which of the following is the correct sequence for using an AED defibrillator?                                             |     |      |     |      |       |
| A. Switch on the AED, apply the electrodes, discharge, and analyze the rhythm                                              | 107 | 23.8 | 25  | 5.5  | 0.000 |
| <b>B. Switch on the AED, apply the electrodes, analyze the rhythm, make sure no one touches the victim, and discharge*</b> | 198 | 44.0 | 320 | 71.1 |       |
| C. Apply the electrodes, check the pulse, discharge, and analyze the rhythm                                                | 23  | 5.1  | 84  | 18.7 |       |
| D. Check the pulse, apply the electrodes, analyze the rhythm, and discharge                                                | 122 | 27.1 | 21  | 4.7  |       |

\* Bold font indicates the correct answer.

Most participants (90.2%, n = 406) correctly identified the appropriate depth for CC in children during BLS as one-third of the chest depth. Furthermore, a significant proportion of participants (86.7%, n = 390)

correctly identified the center of the chest as the appropriate location for CC in adults. Similarly, a substantial number of participants (84.9%, n = 382) correctly identified the central part of the sternum on the

breast line as the appropriate location for CC in infants, using two fingers. Additionally, a considerable number of participants (83.3%,  $n = 375$ ) recognized the importance of ensuring the safety of the unconscious and non-responsive friend's consciousness and breathing before initiating BLS interventions.

### Practice Level

All practice items on the questionnaire before and after the education interventional program differed significantly ( $p < 0.05$ ), except the recommendation of using the algorithm of 'clear the airway, check the breathing, check the pulse' for basic resuscitation operations ( $p = 0.056$ ). In addition, most participants ( $n = 321$ , 71.3%) stated that they feel a pulse in an adult's carotid artery (Table 3).

**Table 3. Practice difference before and after intervention**

| Item                                                                                                                                                        | Before |      | After |      | Chi-square<br>(p-value ) |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|-------|------|--------------------------|
|                                                                                                                                                             | n      | (%)  | n     | (%)  |                          |
| Which of the following is the algorithm for basic resuscitation in an adult?                                                                                |        |      |       |      |                          |
| A. <b>Make sure both you and the victim are safe, give two rescue breaths, perform defibrillation, and begin CPR*</b>                                       | 89     | 19.8 | 52    | 11.6 | 0.012                    |
| B. Make sure both you and the victim are safe, call an ambulance, check for a pulse, and begin CPR                                                          | 165    | 36.7 | 276   | 61.3 |                          |
| C. Check for a pulse, give two rescue breaths, make sure both you and the victim are safe, and perform defibrillation                                       | 102    | 22.7 | 13    | 2.9  |                          |
| D. Make sure both you and the victim are safe, begin CPR, give two rescue breaths, and perform defibrillation                                               | 94     | 20.9 | 109   | 24.2 |                          |
| We check for a pulse in an adult on the:                                                                                                                    |        |      |       |      |                          |
| A. <b>Carotid artery*</b>                                                                                                                                   | 193    | 42.9 | 321   | 71.3 | 0.000                    |
| B. Brachial artery                                                                                                                                          | 140    | 31.1 | 32    | 7.1  |                          |
| C. Femoral artery                                                                                                                                           | 65     | 14.4 | 63    | 14.0 |                          |
| D. Temporal artery                                                                                                                                          | 52     | 11.6 | 34    | 7.6  |                          |
| The ratio of chest compressions to breaths during CPR in adults is:                                                                                         |        |      |       |      |                          |
| A. 15:2                                                                                                                                                     | 96     | 21.3 | 62    | 13.8 | 0.000                    |
| B. 15:1                                                                                                                                                     | 157    | 34.9 | 36    | 8.0  |                          |
| C. 30:1                                                                                                                                                     | 134    | 29.8 | 84    | 18.7 |                          |
| D. <b>30:2*</b>                                                                                                                                             | 63     | 14.0 | 268   | 59.6 |                          |
| The 2015 ERC guidelines concerning basic resuscitation operations recommend the following algorithm of procedure:                                           |        |      |       |      |                          |
| A. Compress the chest, clear the airway, check the breathing                                                                                                | 129    | 28.7 | 79    | 17.6 | 0.056                    |
| B. Clear the airway, check the pulse, check the breathing                                                                                                   | 128    | 28.4 | 79    | 17.6 |                          |
| C. <b>Clear the airway, check the breathing, check the pulse*</b>                                                                                           | 193    | 42.9 | 292   | 64.9 |                          |
| The correct placement of defibrillation electrodes from the AED set is on the front chest, always with the long axis parallel to the long axis of the body: |        |      |       |      |                          |
| A. <b>One on the right side of the sternum, below the clavicle; the second one on the 5<sup>th</sup> intercostal space of the maxillary line*</b>           | 162    | 36.0 | 259   | 57.6 | 0.000                    |
| B. The electrodes may be applied on the chest in any place on both sides of the victim’s sternum                                                            | 96     | 21.3 | 68    | 15.1 |                          |
| C. One under the left clavicle along the sternum, the second one above the victim’s cardiac apex                                                            | 94     | 20.9 | 54    | 12.0 |                          |
| D. The electrodes should be placed 2 fingers above the victim’s intercostal angle                                                                           | 98     | 21.8 | 69    | 15.3 |                          |

\* Bold font indicates the correct answer.

### Attitudes' Level

Significant differences in all attitude items were found before and after the education interventional program ( $p < 0.05$ ). The majority of study participants

reported having positive attitudes towards knowledge and skills to perform CPR ( $n = 432$ ), to provide CC to relatives ( $n = 410$ ), and to provide MMV to children ( $n = 428$ ; Table 4).

**Table 4. Attitudes difference before and after intervention**

| Item                                                                                        | Before |     | After |     | Chi-square<br>(p-value) |
|---------------------------------------------------------------------------------------------|--------|-----|-------|-----|-------------------------|
|                                                                                             | Yes    | No  | Yes   | No  |                         |
| <b>General attitudes</b>                                                                    |        |     |       |     |                         |
| I would like to learn and practice CPR, encouraged by cultural values and religious beliefs | 276    | 174 | 376   | 74  | 0.000                   |
| I would like to receive CPR from professionals when needed                                  | 221    | 229 | 421   | 29  | 0.000                   |
| I believe that CPR is necessary and can increase the patient's survival                     | 198    | 252 | 412   | 38  | 0.000                   |
| I have the confidence to perform CPR                                                        | 231    | 219 | 399   | 51  | 0.000                   |
| I have the knowledge and skills to perform CPR                                              | 319    | 131 | 432   | 18  | 0.000                   |
| CPR is characterized as being harmful                                                       | 272    | 178 | 386   | 64  | 0.000                   |
| I avoid providing CPR as I am afraid of legal liabilities                                   | 175    | 275 | 359   | 91  | 0.000                   |
| <b>Providing CC to</b>                                                                      |        |     |       |     |                         |
| Strangers                                                                                   | 276    | 174 | 349   | 101 | 0.000                   |
| Relatives                                                                                   | 245    | 205 | 410   | 40  | 0.000                   |
| Children                                                                                    | 167    | 283 | 398   | 52  | 0.000                   |
| Other gender                                                                                | 256    | 195 | 298   | 152 | 0.058                   |
| Despite infection concerns                                                                  | 112    | 338 | 326   | 124 | 0.000                   |
| <b>Providing MMV to</b>                                                                     |        |     |       |     |                         |
| Strangers                                                                                   | 234    | 216 | 367   | 83  | 0.000                   |
| Relatives                                                                                   | 139    | 311 | 332   | 118 | 0.000                   |
| Children                                                                                    | 259    | 191 | 428   | 22  | 0.000                   |
| Other gender                                                                                | 273    | 177 | 371   | 79  | 0.000                   |
| Despite infection concerns                                                                  | 220    | 230 | 339   | 111 | 0.005                   |

Significant differences were found between males and females in terms of their attitudes regarding providing CC to strangers ( $p < 0.05$ ) and infection concerns ( $p < 0.05$ ). In addition, a significant difference was found in providing MMV to members of the other gender ( $p < 0.05$ ).

The majority of males reported having positive attitudes towards knowledge and skills to perform CPR

( $n = 105$ ), to provide CC to children ( $n = 103$ ), and to provide MMV to children ( $n = 100$ ). Females had positive attitudes in all items compared with males. The majority of females had positive attitudes towards the likelihood of receiving CPR from professionals when needed ( $n = 330$ ), providing CC to relatives ( $n = 311$ ), and providing MMV to children ( $n = 328$ ; Table 5).

**Table 5. Attitude difference between males and females**

| Item                                                                                      | Males |    | Females |    | Chi-square<br>(p-value) |
|-------------------------------------------------------------------------------------------|-------|----|---------|----|-------------------------|
|                                                                                           | Yes   | No | Yes     | No |                         |
| General attitudes                                                                         |       |    |         |    |                         |
| Would like to learn and practice CPR, encouraged by cultural values and religious beliefs | 87    | 21 | 289     | 53 | 0.062                   |
| I would like to receive CPR from professionals when needed                                | 91    | 15 | 330     | 14 | 0.301                   |
| I believe that CPR is necessary and can increase the patient's survival                   | 84    | 24 | 304     | 38 | 0.072                   |
| I have the confidence to perform CPR                                                      | 99    | 9  | 300     | 42 | 0.126                   |
| I have the knowledge and skills to perform CPR                                            | 105   | 3  | 327     | 15 | 0.051                   |
| CPR is characterized as being harmful                                                     | 96    | 12 | 308     | 34 | 0.217                   |
| I avoid providing CPR as I am afraid of legal liabilities                                 | 101   | 7  | 258     | 84 | 0.110                   |
| Providing CC to                                                                           |       |    |         |    |                         |
| Strangers                                                                                 | 88    | 20 | 261     | 81 | 0.030                   |
| Relatives                                                                                 | 99    | 9  | 311     | 31 | 0.231                   |



|                            |     |    |     |     |       |
|----------------------------|-----|----|-----|-----|-------|
| Children                   | 103 | 5  | 295 | 47  | 0.924 |
| Other gender               | 94  | 14 | 204 | 138 | 0.328 |
| Despite infection concerns | 80  | 28 | 246 | 96  | 0.019 |
| <b>Providing MMV to</b>    |     |    |     |     |       |
| Strangers                  | 91  | 17 | 276 | 66  | 0.732 |
| Relatives                  | 98  | 10 | 234 | 108 | 0.341 |
| Children                   | 100 | 8  | 328 | 14  | 0.640 |
| Other gender               | 92  | 16 | 279 | 63  | 0.029 |
| Despite infection concerns | 86  | 22 | 253 | 89  | 0.648 |

## Discussion

This study examines the effect of an educational intervention program on allied health students' knowledge, attitude, and practice regarding cardiopulmonary resuscitation. Knowledge is theoretical information regarding CPR acquired through training, education, and practice (Batoool et al., 2022). Many factors, including the theoretical training provided throughout nursing education, practical training, personal experiences, and clinical observations, influence nursing students' fundamental professional knowledge and practice (Kose et al., 2019). Therefore, students should be encouraged to learn and actively practice CPR procedural skills beyond only theoretical CPR information (Vural et al., 2017).

Knowledge regarding CPR is essential for undergraduate students, especially those interested in careers in allied health because they could save lives in an emergency (Al-Shamiri et al., 2017). Updating theoretical and practical training is one of the most recommended ways to increase CPR knowledge (Yilmaz & Simsek, 2019). The current-study results reveal significant differences in the levels of knowledge and practice after the education interventional program, except for providing rescue breaths to an infant and the 2015 ERC guidelines concerning basic resuscitation operations. This result indicates that theoretical training on CPR is crucial and can be related to the information that the participants received and the training of the participants on CPR during the intervention program. Poor CPR knowledge can be attributed to inadequate training (Alazmi & Alzahrani, 2020). Training is linked to improved CPR understanding, because training is essential to increasing knowledge and confidence in conducting CPR when necessary (Abelsson & Nygårdh, 2019; Alfahey & Alkarani, 2021). Most of the study participants had positive attitudes toward CPR. In addition, the posttest for students was performed after 1 month. Therefore, the students retained information

regarding CPR. A previous study reported that retention is essential for preserving appropriate information (Fariduddin & Siau, 2021).

Furthermore, most study participants reported the university as the source of information. This finding can explain the improvement in knowledge and practice levels. Notably, universities are the primary source of CPR teaching and training (Alnajjar & Abou Hashish, 2021).

An efficient CPR must be conducted in a specific sequence and manner to save many lives. The number of correct responses provided by the students on the knowledge questionnaire is exceptionally high, but the level of knowledge in some areas can still be raised. A student's level of knowledge on rescue breathing, victim assessment, and AED needs to be improved. Therefore, periodic training sessions are required to improve students' knowledge. Our research on nursing students' CPR knowledge and practice is crucial for developing novel CPR curricula. The knowledge basis and clinical CPR abilities improve with a good curriculum, appropriate clinical exposure, and frequent hands-on training (Aliyu et al., 2019). This result is consistent with those of a previous study, which found a significant improvement in knowledge level before and after the intervention, and the most minor improvement item was rescue breaths (Chang et al., 2023; Kose et al., 2019; Moon & Hyun, 2019; Onyeaso & Onyeaso, 2017; Owojuyigbe et al., 2015). However, a previous study reported no significant improvement in the levels of knowledge and skills after training (Süss-Havemann et al., 2020).

The present-study results reveal significant differences in all attitude items before and after the education interventional program. This result can be explained by different socio-cultural backgrounds and knowledge and practical training programs. A previous study reported that students who received training regarding CPR had better attitudes and self-confidence

to perform CPR (Alfakey & Alkarani, 2021; Shuk et al., 2017). In addition, improved attitudes and confidence in performing CPR may result from increased CPR knowledge (Ko et al., 2023). Therefore, this finding highlights the significance of CPR education, the training of university students, and the advantages of CPR for them.

This finding is consistent with previous studies, which observed positive attitudes toward CPR and improvement in CPR attitudes after intervention (Alazmi & Alzahrani, 2020; Chang et al., 2023; Fariduddin & Siau, 2021; Oteir et al., 2020). In addition, a previous study found that participants expressed a strong desire to perform CPR and agreed that CPR training is necessary (Mansour et al., 2019; Shuk et al., 2017).

Student's attitudes toward CPR are influenced by gender (Kassie & Salih, 2021). Females have more positive attitudes towards CPR than males, indicating a better awareness and understanding of CPR. This finding can be related to different sample sizes amongst the categories and the fact that females are more impulsive and empathetic towards patients, because they have higher emotional intelligence (Alnajjar & Abou Hashish, 2021). In addition, females in the present study are more confident in performing CPR than males. Self-confidence is one of the most significant factors in rapid intervention during cardiac arrest (Yılmaz & Simsek, 2019). This result is similar to a previous study conducted at Al-Qassim University in Saudi Arabia (Mansour et al., 2019), which found more positive attitudes among participating females.

The present study reveals a significant difference between males and females in their attitudes regarding providing CC to strangers, infection concerns, and providing MMV to members of the other gender. This result might contradict the fact that the Jordanian culture is sensitive towards mouth-to-mouth ventilation, especially between men and women. This result is consistent with a previous study that found a few participants expressing second thoughts because of litigation or the spread of infections (Alnajjar & Abou Hashish, 2021). In addition, a previous study found that females had positive attitudes toward performing CPR on members of the other gender, and both genders had positive attitudes towards performing CPR despite any infectious disease (Oteir et al., 2020). However, a previous study reported that the most significant barriers to performing CPR were a lack of confidence, worry

about spreading disease, and potential legal issues (Alfakey & Alkarani, 2021; Lu et al., 2015; Shuk et al., 2017). Oteir et al. (2020) found that females are reluctant to perform MMV on strangers and relatives.

### **Implications for Nursing**

In summary, the present study's findings indicate that CPR instruction significantly enhances knowledge, attitude, and practice among students in the allied health field. Hence, the findings underscore the need to provide CPR education to this cohort of students to preserve and enhance their knowledge, attitudes, and skills about CPR. The results can provide valuable insights for nurse educators, nursing managers, and decision-makers to devise successful strategies for improving CPR knowledge, attitudes, and application. This study proposes incorporating CPR education inside the undergraduate curricula at different academic stages in conjunction with practical training. Comprehending CPR's importance necessitates applying innovative instructional and assessment methodologies. The study's findings can be utilized by faculty members in universities and by policymakers to formulate effective measures, including implementing routine training, establishing regulations, and providing continuous in-service education.

This study has some limitations. Firstly, the design used was a one-group pretest-posttest design. Thus, no control group was used to compare the effects of intervention between the two groups. Secondly, the participants were first-year students in their second-semester and second-year students. Therefore, generalizing the study results to all allied health students is challenging. Thirdly, this study was only conducted in government universities and excluded private universities. Finally, a discrepancy in participation rate was found between males and females, which may have affected the accuracy of knowledge, attitude, and practice estimation. Despite these limitations, this study sheds light on the state of knowledge, attitude, and practice in allied health students and provides probable opportunities for enhancing the outcomes.

### **Conclusion**

The present study demonstrates that implementing a CPR educational intervention program enhances allied health students' knowledge, attitudes, and practice. Also, females have more positive attitudes towards CPR than

males. In addition, there is a significant difference between males and females in their attitudes regarding providing CC to strangers, despite infection concerns, and providing MMV to members of the other gender. Further investigation is needed to confirm the findings of the current study. Conducting research on various factors that can influence CPR is necessary. Also, to obtain a comprehensive grasp of CPR knowledge, attitudes, and practice, mixed-method and qualitative research approaches must be incorporated into the study design, including diverse populations, such as graduate students, healthcare practitioners, and individuals within the community.

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## Conflict of Interests

The authors declare that no conflict of interests is associated with this study.

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