

# Effectiveness of Teaching and Demonstration in Improvement of Knowledge and Skill on CPR among School-going Adolescents: A Quasi-experimental Study

Rajadurai Meenakshisundaram<sup>1</sup>, Anand Raj Ramavel<sup>2</sup>, Nayyara Banu<sup>3</sup>, Akmal Areeb<sup>4</sup>, Esther Monica Jared Premkumar<sup>5</sup>, Salman Saeed<sup>6</sup>

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## ABSTRACT

**Background:** Cardiopulmonary resuscitation (CPR) is one of the most evolving areas of saving actions that improve the survival rates following cardiac arrest and educating high school students can play a dynamic role in case of emergencies in society. Education of school students in CPR is a strategic goal for the improvement of bystander CPR in rural society. If adolescents were trained to perform CPR during school physical education hours, this may be a cost-effective approach to CPR training. This study is conducted to assess the effectiveness of health education in the improvement of knowledge of CPR among school-going adolescents.

**Aim:** To assess the effect of a training program on students' knowledge of CPR.

**Objective:** (A) To determine the background knowledge of high school students about cardiac arrest and basic life support in adult victims of cardiac arrest. (B) To determine the association between knowledge of cardiopulmonary resuscitation and skills with selected demographic variables.

**Materials and methods:** This is a quasi-experimental study conducted among adolescents aged 13–15 years attending schools in rural areas of South India. The study was conducted between Jan 2022 and Jan 2023. 680 students were included in this study. The universal sampling method was used to enumerate the participants to reduce the impact of the dropout rate. The data was collected using a pre-tested semi-structured questionnaire by interview method. Basic teaching of CPR for the participants included 2 hours of oral teaching using lecture method, question and answer discussion method as well as 2 hours of practical session using demonstration, practice on a manikin, provision of feedback and correction of errors.

**Results:** A total of 680 participants were grouped into three categories according to their knowledge scores: (A) fair, (B) Moderate, and (C) Good scores obtained in pre-training observation and post-training observation. Initially, there were 666 (97.9%) in the fair category, most of them improved after training as seen in the post-training observation results, with 97 (14.3%) persons in the fair (A) category. There was not a single student in the good category of the score before intervention, which increased to 665 (45.6%) in the good category of knowledge. The mean score of pre-training is 2.55, and the post-training score is significantly increased to 9.5.

**Conclusion:** An improvement is observed in knowledge of CPR post-training with planned teaching and demonstration. Hence, this method can be considered a logical solution for improving knowledge about CPR in cases of emergency life-saving skills in a particular group of society.

**Keywords:** Adolescents, Cardiopulmonary resuscitation, Knowledge, School-going student.

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## INTRODUCTION

The approach to cardiac arrest and expeditious cardiopulmonary resuscitation (CPR) is of utmost importance at all echelons of healthcare, ranging from multi-speciality hospitals to primary health centres, as well as amongst school students. Prompt CPR has been shown to enhance survival rates, underscoring the significance of CPR knowledge among healthcare professionals, laypeople, and students alike. Urban areas have instituted protocol-driven management of medical emergencies and prompt CPR administration at Tertiary Care Hospitals. In the event of out-of-hospital cardiac arrest (OHCA), timely bystander-initiated CPR and rapid defibrillation considerably elevate the odds of survival. Indeed, bystander CPR has been demonstrated to increase the likelihood of survival by two to four times<sup>1</sup>. The value of mouth-to-mouth (MTM) training among school students was first investigated in Norway in 1961, while chest compressions were recommended for laypeople by the American Heart Association in 1974.<sup>2,3</sup>

<sup>1-6</sup>Department of Emergency Medicine and Critical Care, Apollo KH Hospital, Ranipet, Tamil Nadu, India

**Corresponding Author:** Rajadurai Meenakshisundaram, Department of Emergency Medicine and Critical Care, Apollo KH Hospital, Ranipet, Tamil Nadu, India, Phone: +91 9600055552, e-mail: drmrjadurai@gmail.com

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After the inception of existence, primal impulses kick in, dedicated to safeguarding and prolonging it. The essence of life itself is inclined towards survival and avoiding mortality. This, in essence, constitutes the fundamental course of natural life. Nevertheless, life is fraught with myriad hurdles, yet instinctual impulses seek out and identify mechanisms for the protection of this precious existence. With our conscientious intervention, some fatalities can be averted. An instance of this is the ability to prevent death from cardiac arrest by administering prompt CPR.

Revitalization denotes the skill of reanimating a lifeless body or consciousness. Endeavours to revive individuals have a long-standing history. One of the most dynamic domains of lifesaving measures that augment survival rates subsequent to cardiac arrest is CPR.

It is crucial for individuals within society to possess Basic Life Support (BLS) proficiency to rescue lives and enhance the collective health of their community. The significance of these competencies is even more critical for paramedical personnel encountering life-endangering scenarios. Our investigation substantiated that hands-on expertise is instrumental in refining BLS proficiency. Initially, CPR instruction was exclusively intended for healthcare practitioners, but it was subsequently observed that a considerable number of these incidents take place outside the hospital setting, necessitating prompt bystander intervention. Consequently, CPR is considered to be a universal skill. Research has demonstrated that the quality of life is notably enhanced for victims who receive bystander CPR promptly, even in the absence of expert intervention.<sup>4-6</sup>

Cardiopulmonary resuscitation constitutes a methodical therapy that strives to maintain essential organ operations until the innate cardiac function can be reinstated. Emergency resuscitation is executed on individuals who are gravely unwell and lack oxygen. Revitalization encompasses all interventions that are implemented to resuscitate patients who have abruptly ceased breathing as a result of respiratory or cardiac dysfunction. Cardiac arrest is among the prevalent causes of cardio-respiratory failure. It denotes a sudden state of respiratory arrest and circulatory failure, which is interchangeable with the term sudden death. This signifies that the sufferer's heartbeat, blood circulation, and respiration have ceased abruptly and unpredictably.<sup>7</sup> Time is of the essence in achieving successful cardiopulmonary resuscitation. When a person stops breathing voluntarily, their heart also ceases beating, marking the onset of clinical death. Within four to six minutes, the oxygen-sensitive brain cells commence to deteriorate, rendering restoration of oxygen supply vital.<sup>8</sup> Failure to restore adequate oxygenation leads to irreversible brain damage and eventual biological death.

## Aim

To assess the effect of the training program on students' knowledge of cardiopulmonary resuscitation.

## OBJECTIVES

(A) To determine the background knowledge of high school students about cardiac arrest and basic life support in adult victims of cardiac arrest.

(B) To determine the association between knowledge of cardiopulmonary resuscitation and skills with selected demographic variables.

## Hypothesis

The research hypothesis was stated as H1: The mean post-test knowledge and skill score of the high school students will be significantly higher than the mean pre-test knowledge and skill score regarding training on BLS and CPR. Score pre-typed questionnaire.

## MATERIALS AND METHODS

### Study Design

This study is quasi-experimental study conducted among the adolescents aged from 13 to 15 years.

### Study Population

All school going adolescents aged from 13 to 15 years studying 9th and 11th standard in the Ranipet district were included in the study.

### Study Duration

Study was conducted during January 2022 to January 2023.

### Sample Size and Sampling Method

For sample size calculation, the overall pre-test knowledge mean score + SD of 9.12 + 1.97 and post-test mean score + SD of 13.4 + 2.89 was utilised as reported in a study done by Kabina Rathna et al.<sup>9</sup> To obtain a significant improvement of 8% of the mean difference, a 95% level of significance and 80% power was used to calculate the sample size. Thus, a minimum sample size of 662 was obtained. As there is a chance of a high dropout rate owing to the study design, a universal sampling method was employed to recruit the participants. A total of 680 subjects are included in the study.

### Study Tool and Data Collection

A pretested semi-structured questionnaire was utilised to collect data. It comprises two parts, part 1 with questions on demographic details, and the status of reception of any prior information on CPR. Part 2 comprises 15 questionnaires assessing the participant's knowledge of CPR. A checklist was used to analyse the quality of CPR performed by the participant. Pre-testing of the structured questionnaire was done to check the clarity of items, feasibility, and practicability of the tool. The students took 15–30 minutes to complete the questionnaire and the items were clear and understandable to them.

### Intervention

A pre-intervention test was conducted to assess the basic knowledge of the participants on CPR. The data was collected using a demographic information form, a knowledge questionnaire, and an observational checklist of CPR performance devised by the researcher. The basic teaching of CPR for the intervention group included 2 hours of oral teaching using lecture and question and answer as well as 2 hours of practical teaching using demonstration, practice on a mannequin, provision of feedback, and correction of errors.

The structured planned training was titled "Basic Life Support by CPR Technique". The training was planned for two sessions, which were prepared to enhance and reinforce the knowledge and skills of degree students. It consisted of the following content areas: Introduction, specific human anatomy and physiology of the circulatory and respiratory system; the heart-lung-brain relationship; meaning and definition of CPR, indication of CPR,

steps of CPR, demonstrations, terminations, complications of CPR and failure of CPR.

The lecture cum demonstration and discussion method was selected as an appropriate method of teaching the students. It was planned to teach in the groups, as group teaching permits to exchange of views, broadens knowledge through wider interaction, and allows for practicing the technique to improve skills and be competence. The use of LCD, PowerPoint slides, and a demonstration on a mannequin for CPR were considered appropriate to increase the impact of teaching.

## RESULTS

Out of 680 study participants, 394 (57.9%) were boys and the remaining 286 (42.1%) were girls. In the study, 534 (78.5%) students were studying the 9th standard, while the remaining 146 (21.5%) students were studying the 11th standard. The distribution of study participants based on age is presented in Table 1.

The students were grouped into three categories according to their knowledge scores as fair (A), moderate (B), and good (C) scores. The score obtained by the participants in the pre-training and post-training assessments were given in Table 2.

**Table 1:** Baseline characteristics of the study population

Characteristics	Frequency	Percentage
Age		
15 years	339	49.9
16 years	233	34.2
17 years	108	15.9
Gender		
Boys	394	57.9
Girls	286	42.1
Class		
9th standard	534	78.5
11th standard	146	21.5
Residential area		
Rural	446	65.6
Urban	234	34.4
SES		
Lower	270	39.7
Middle class	268	39.4
Upper middle	107	15.7
Upper	35	5.1

**Table 2:** Score levels of the study participants

Score level	Pre-training	Post-training
Fair (A) (0–5)	666	97
Moderate (B) (6–10)	14	273
Good (C) (11–15)	0	310

**Table 3:** Comparison of total score (pre- and post-training)

	Pre-training	Post-training	Mean difference	95% CI	p-value
CPR/BLS	2.549 (1.346)	9.576 (3.501)	7.027	7.310 to –6.746	< 0.001

Initially, as per the pre-training assessment of knowledge on CPR, there were 666 (97.9%) students in the fair category; all the participants with fair knowledge scores showed improved knowledge after training as seen in the post-training observation results showing only 97 (14.3%) persons in the fair category. There were no participants in the good score category before training, which increased to 310 (45.6%) in the good category of knowledge after training. Only 2% of students were in the moderate score, i.e., from 6 to 10 category before training but there was an improvement to 40% after training of the students (Table 3).

Overall student's score before training is 2.55 + 1.35 after training their total score regarding CPR/BLS improved to 9.58 + 3.50. This increase is statistically significant with a p-value of < 0.001.

Comparison of means by independent t-test for age, sex, educational stream, living status, and socio-economic status of the students expressed in Table 4.

## DISCUSSION

In the present study, overall scores significantly improved after training. This meant that the information level has an impact on knowledge and skills scores. Similar findings were revealed in the study conducted by Ruth Rekha et al. to evaluate the effectiveness of planned teaching programs among the staff nurses of BLS in terms of knowledge and skill.<sup>10</sup> The study observed that the post-test knowledge score mean difference was 1.53 percent and the standard deviation was 3.24.

Our study findings were also supported by a study done by Anthony Pillai, who studied Advanced Cardiac Life Support (ACLS) among intensive care nurses.<sup>11</sup> The results showed that most nurses interviewed were only able to answer correctly half the questions asked. The result indicated that the nurses had a lack of knowledge and need for a structured training package in ACLS, followed by frequent reinforcement of ACLS the knowledge and skills of nurses practicing in an intensive care unit improved.<sup>11</sup>

Similarly, in pattern with the present study, Berden HJ et al. studied a valid reproducible system for determining BLS skills that can help to evaluate the effect of instruction courses and estimate the results of educational activities. The study used five criteria with standards and guidelines of the American Heart Association (AHA) such as inadequate technique may be reflected by a fail score, a skilled person should achieve a passing score, the effect of training must be reflected by an improvement of score and system should be simple to apply and CPR attempts were performed on the manikin. It was tested on 40 ambulance nurses and 148 lay persons twice. The system satisfied five criteria and offers a reliable and reproducible evaluation of Basic Life Support skills.<sup>12,13</sup>

## CONCLUSION

In this study, 680 participants were included and grouped into three categories based on their knowledge scores: Fair, moderate, and good scores obtained in pre- and post-training assessments. Among there, 666 (97.9%) were initially in the fair category, and all showed improvement after training, resulting in only 97 (14.3%) individuals remaining in the fair category according to the post-training observation results. There mean knowledge score before the

**Table 4:** Comparison of means by independent *t*-test

Parameters	Pretest mean (SD)	Post-test mean (SD)	Mean difference	95% CI	<i>p</i> -value
Age					
15 years	2.549 (1.346)	9.576 (3.501)	7.027	-7.427 to -6.627	< 0.001
16 years	2.552 (1.347)	9.573 (3.481)	7.021	-7.502 to -6.540	
17 years	2.553 (1.345)	9.634 (3.439)	7.081	-7.781 to -6.381	
Gender					
Boys	2.549 (1.346)	9.576 (3.501)	7.027	-7.398 to -6.656	< 0.001
Girls	2.552 (1.347)	9.581 (3.484)	7.029	-7.463 to -6.595	
Class					
9th standard	2.549 (1.346)	9.576 (3.501)	7.027	-7.345 to -6.709	< 0.001
11th standard	2.553 (1.345)	9.634 (3.439)	7.081	-7.682 to -6.480	
Residential area					
Rural	2.549 (1.347)	9.568 (3.497)	7.019	-7.367 to -6.671	< 0.001
Urban	2.556 (1.347)	9.636 (3.445)	7.080	-7.555 to -6.605	
SES					
Lower	2.549 (1.346)	9.568 (3.497)	7.019	-7.467 to -6.571	< 0.001
Middle class	2.553 (1.348)	9.565 (3.477)	7.012	-7.459 to -6.565	
Upper middle	2.557 (1.349)	9.622 (3.437)	7.065	-7.508 to -6.622	
Upper	2.555 (1.340)	9.908 (3.199)	7.353	-8.014 to -6.692	

training on BLS/CPR was 2.55 + 1.35, which significantly increased to mean score of 9.58 + 3.50 after training. These differences in knowledge scores before and after training were statistically highly significant (*p* < 0.001). Regardless of the initial knowledge scores, the post-training scores were significantly high and similar in all categories of age, sex, education stream, living status, and socio-economic status of the students.

Based on the aforementioned results, it can be suggested that the training with teaching and demonstration has a great potential as an ideal method for BLS/CPR training. Therefore, planned teaching and demonstration can be considered logical solutions for improving knowledge and skills about CPR in cases of emergency life-saving skills. Including this in the curriculum of schools could make it a universal subject learnt by all.

### Recommendation

- School students must be educated about basic life support and should be made aware of emergencies that may arise in society at any time.
- Coverage through mass media should be included.
- All citizens must understand basic life support and its uses and recommendations and their responsibility.
- Broad media coverage can also generate awareness among the citizens about life-saving skills before the reach of any medical support.
- A study can be undertaken in a different setting with different target populations such as Police, Security Guards of residential societies, school children, school teachers, college students of different disciplines, parents, drivers, the fire force, and traffic policemen and youth.
- A self-instructional module can be developed on the learning needs of basic life support.
- Similar studies could be undertaken using another teaching strategy like video film, film shows, or telephonic instruction.

### Ethical Clearance

Participants were included in the study after obtaining consent from the adolescents and consent from their parents. The study was approved by the institutional ethics committee.

### ORCID

Rajadurai Meenakshisundaram  <https://orcid.org/0000-0002-5811-3062>

Anand Raj Ramavel  <https://orcid.org/0009-0008-0162-4946>

Nayyara Banu  <https://orcid.org/0009-0005-8663-733X>

Esther Monica Jared Premkumar  <https://orcid.org/0009-0003-8086-1635>

Salman Saeed  <https://orcid.org/0009-0006-7676-2863>

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