

# Preparing future Indian medical graduates for emergencies at the Foundation Course: Do the knowledge and self-confidence increase after basic cardiac life support training?

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## ABSTRACT

**Background and Aims:** Medical professionals must be able to perform life-saving skills like cardiopulmonary resuscitation (CPR) during emergency situations, even outside the hospital. The foundation course for the first-year medical students includes first aid and CPR training. This quasi-experimental study was conducted to assess the effectiveness of basic cardiac life support (BCLS) training based on Indian guidelines, on the self-confidence and knowledge regarding CPR of first-year medical students. **Methods:** This study was conducted during the foundation course for first-year medical students. The training included a common lecture for all the students followed by a 4 day long practical training in groups of 45–46 students, each day. BCLS training was carried out in three skill stations – airway, chest compressions and full sequence CPR. Students' skills were recorded real time on a skill assessment manikin after completion of the hands-on training. The students were asked to fill a questionnaire regarding knowledge and self-confidence, before and after the training. The outcome measures were the difference in knowledge and self-confidence with regard to CPR before and after the training. **Results:** Out of the 199 students, 181 were included in the analysis. There was significant improvement in the knowledge score (pre-test – 1.46 versus post-test – 8.27,  $P < 0.001$ ). The overall confidence regarding first aid skills, BCLS knowledge and self-confidence for performing BCLS improved significantly. **Conclusion:** There is improvement in knowledge and self-confidence regarding CPR and the students develop an acceptable level of skills after the training.

**Key words:** Cardiopulmonary resuscitation, emergency treatment, foundation course, simulation training, undergraduate medical education

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## INTRODUCTION

Cardiopulmonary resuscitation (CPR) is a necessary life-saving skill for all medical personnel including the undergraduate students. Various guidelines for CPR are being followed all over the world. Only few studies have been conducted in India and they have reported that the overall knowledge of CPR in healthcare professionals is very poor.<sup>[1,2]</sup> Survival outcome is directly associated with the quality of CPR, and varying degrees of skills are acquired after standard training in the classes. First responders, especially medical professionals, must be sufficiently prepared to save lives even in out-of-hospital cardiac arrest. The undergraduate students are exposed to CPR

through didactic lectures once or twice during their term. No formal training in CPR is given to medical undergraduate students. A new undergraduate curriculum has been implemented from the year 2019. Apart from the academics, the curriculum

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imparts communication skills, computer skills, first aid and basic life support (BLS) training, etc., through a foundation course of 1 month duration soon after the students' entry into the college.<sup>[3]</sup>

Indian guidelines of CPR have been published in 2017.<sup>[4,5]</sup> Indian Resuscitation Council (IRC) recommends teaching basic cardiac life support (BCLS) guidelines to medical personnel and undergraduate medical students in the form of a stepwise approach in the case of outside-hospital cardiac arrest. A few researchers including those in India have studied the effect of CPR training on school-going and undergraduate students.<sup>[6]</sup> Studies on various components and aspects of the newly implemented competency based medical education (CBME) curriculum are going on. Foundation course forms a part of this curriculum and the anaesthesiologist plays an important role in the teaching of BLS in this course. This quasi-experimental study was conducted to assess the effect of BCLS training during foundation course on the knowledge, confidence and skills of first-year medical undergraduate students.

## METHODS

This quasi-experimental study was conducted at a tertiary care teaching hospital after Institutional Human Ethics Committee approval (IHEC: 255/2019, approved on 10/08/2019). This study was registered with Clinical Trial Registry of India (CTRI/2019/10/021702). Written and informed consent from the participants was taken. If the students were <18 years of age, consent was obtained from their parent or guardian. The data collected were kept confidential.

The study was conducted during the BCLS training session (which forms a part of the foundation course) for the newly joined first MBBS students, at a tertiary care teaching hospital and medical college, between October and November 2019. All students who attended the course were invited to participate in the study. The students who refused to participate were excluded.

There was a common lecture for all 182 students. First aid was also taught to the students as a part of the course. A 1 hour didactic lecture was delivered on first aid followed by another 1 hour lecture on BCLS by a trained anaesthesiologist who is a trainer for Indian CPR guidelines. The lecture was followed by training in small groups over a period of 4 days, by consultants

from different specialities like Anaesthesia, Physiology, Medicine, Surgery and Orthopaedics. The trainers from the department of anaesthesia conducted BCLS training based on Indian guidelines. Each day, 45–46 students were trained. Nearly 3 h group-training of first aid and 4 h group-training of BCLS were imparted in different skill stations [Table 1].

The first aid training included palpating the carotid pulse, taking blood pressure, applying splints and bandages on simulated patients. There was group discussion and video demonstration on some emergency scenarios like burns, electric shock and myocardial infarction.

BCLS training was conducted in three skill stations. The first station was meant to impart skills of airway and breathing through airway simulator (Economy adult airway simulator by 3B scientific). This station covered airway manoeuvres, mouth-to-mouth breathing, and bag and mask ventilation. Second station was for the practice of chest compressions on a manikin (Basic Billy CPR simulator by 3B scientific). In the third station, pairs of students performed full sequence CPR. One of the students performed compressions and the other one provided breathing, for the first cycle and they switched their roles in the next cycle. The students to manikin ratio was kept less than 15:1 at each station. Hands-on practice was provided to each student and the students were provided additional time at the stations, if they wanted more practice.

After rotation for three skill stations by the students, CPR skills were assessed on a skill reporting

**Table 1: Training schedule for first aid and BCLS**

	Topic	Time duration
First aid		
Station one	Checking pulse and respiration	30 min
Station two	Identify fracture and apply slings/ bandages	30 min
Station three and four	Group discussion of ten emergency medical situations	1 h
	Questions and doubt discussion, feedback	30 min
BCLS (on manikins)		
	Briefing	15 min
Station one	Practice breathing on airway simulator	30 min
Station two	Practice chest compressions	30 min
Station three	Practice full sequence CPR	45 min
Station four	Assessment on skill reporting manikin after finishing above three stations	1.5 hours
	Feedback and discussion	30 min

BCLS: Basic cardiac life support; CPR: Cardiopulmonary resuscitation

manikin (CPRLillyPro by 3B scientific). This manikin is specially designed to assess skills of CPR. The parameters assessed were chest compression rate (/min), location of hands (correct location in percentage of time) and depth of compressions (correct depth in percentage of time). Data of each participant was recorded electronically in real time through the smart tablet connected with the manikin.

The students were asked to answer a questionnaire before the lecture and after the completion of skill assessment. The questionnaire was designed after a literature review. It was validated by an independent subject expert who was not a part of the study. Pilot testing of the questionnaire was conducted on five second-year medical students and the questions were modified accordingly [Annexure 1].

The first part of the questionnaire had information regarding the students' prior knowledge of CPR or BCLS. The second part consisted of multiple-choice questions on steps of BCLS, rate, depth and location of hands for chest compression, ratio of compression to breathing, etc., and one open ended question on full form of Automated External Defibrillator (AED). The third part included four Likert-type questions on self-reported confidence by the students. Students were asked to self-report their confidence on a scale of 1–4 (1 = not confident, 4 = very confident).<sup>[7]</sup> These questions were regarding their confidence on the knowledge of BCLS, their skills for chest compression and confidence of performing BCLS in a simulated scenario.

The primary outcome was to assess the difference in the level of self-confidence of the students regarding CPR. The secondary outcome was to assess the difference in the knowledge and the level of skills of chest compression after the BCLS training.

Data were entered in Microsoft excel worksheet and was analysed using Graph Pad Prism version 7.0. Descriptive data were presented as mean, median and percentage as appropriate. The difference in knowledge and confidence was assessed using paired *t* test. *P* value <0.05 was considered as statistically significant.

## RESULTS

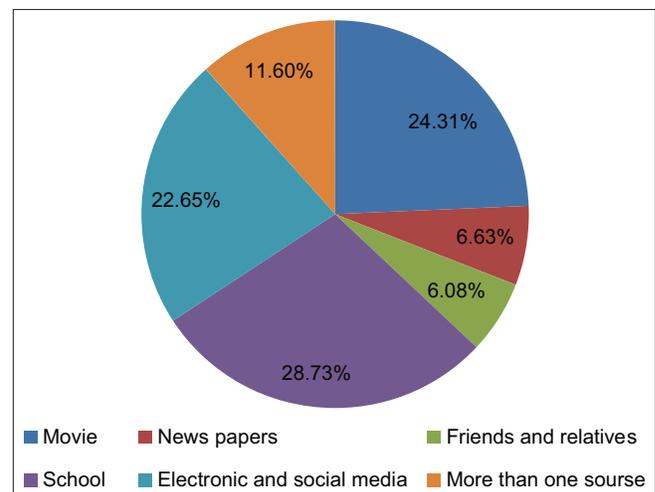
A total of 199 first-year undergraduate medical students were enrolled in the foundation course.

Among them, 182 students attended the course (mean age  $18.6 \pm 0.5$  years, 54% males, 46% females). 17 students were absent and 1 student was excluded because of incomplete questionnaire. A total of 181 students were included in the analysis.

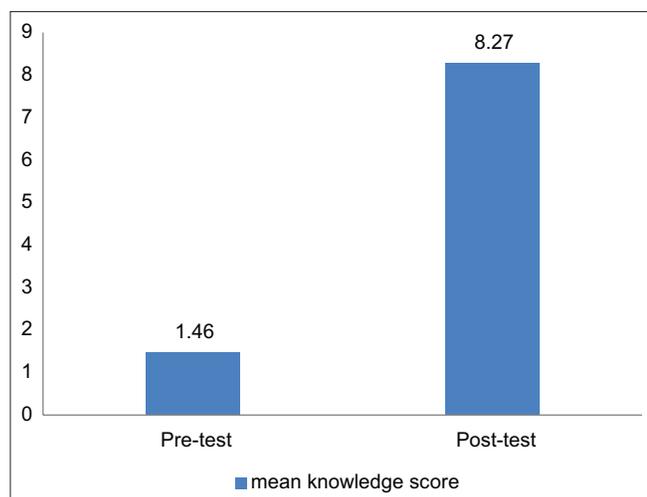
About 95.03% of students had heard about the term CPR. About 75.69% of students had learnt it from school, movies and electronic media, 12.71% knew about it from newspaper and friends, and 11.60% had heard about it from more than one source. Only 17.13% of students had received any prior training in BCLS [Figure 1].

Mean pre-test and post-test scores among the participants were 1.46 and 8.27, respectively (out of 9). The difference was statistically significant (*P* value <0.001, paired *t* test), suggesting that the training significantly improved the knowledge of the students regarding CPR [Figure 2]. The students' correct response for each question was significantly better after the training [Figure 3].

The students were asked to self-report their pre- and post-training confidence regarding the knowledge and the skills related to the performance of CPR [Table 2]. There was a statistically significant improvement in their confidence level (*P* < 0.001). The student's feedback on the training programme was also taken. As per the feedback, 93.92% found the lecture very useful. Hands-on practice session was found very useful by 92.82% of the students. Feedback showed that assessment was found to be very useful by 92.27% of the students. Many students opined to have more time for hands-on practice. In skills assessment,



**Figure 1:** Sources of knowledge about CPR among students prior to the training



**Figure 2:** Comparison of knowledge score before and after the training. P value <0.0001, paired t-test, score out of nine

**Table 2: Difference in self-reported confidence by the students before and after the training (n=181)**

Confidence	Score prior to the training* Mean (SD)	Score after the training* Mean (SD)	P†
Confidence of first aid skill	2.03 (0.64)	3.55 (0.50)	P<0.0001
Confidence of BCLS knowledge	1.62 (0.76)	3.43 (0.53)	P<0.0001
Confidence of performing chest compression	1.57 (0.81)	3.47 (0.56)	P<0.0001
Confidence of performance in real life scenario	1.51 (0.74)	3.43 (0.55)	P<0.0001

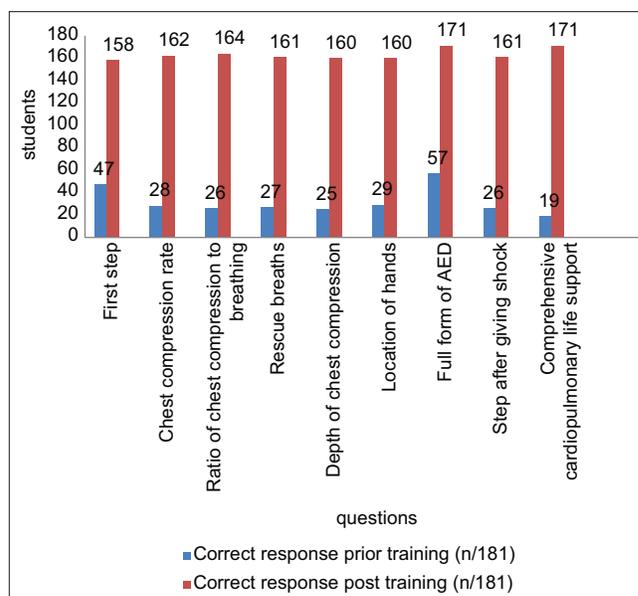
\*Score from 1 to 4 on a Likert scale. †Paired t test applied. SD: Standard deviation; BCLS: Basic cardiac life support

the average rate of compression by the students was 128.52/min. A total of 78.36% of the students could place their hands at the proper location. About 60% of the students could achieve proper depth of compression on the skill assessment manikin.

## DISCUSSION

The recently introduced foundation course includes training of first aid and BCLS for first-year undergraduate students, as early introduction of CPR and BCLS is important. This study was conducted during the foundation course to assess the effectiveness of such training among the students.

This study showed that the confidence regarding the knowledge of CPR and performance of the skills like chest compression and initiation of compressions significantly improved after the training. In a prospective randomised study conducted among secondary school students in Germany, the authors demonstrated that theory and practical sessions improved the students'



**Figure 3:** Question-wise correct response before and after training (n = 181)

knowledge and self-confidence in the initiation of CPR.<sup>[7]</sup> Similarly, a CPR training workshop for first-year MBBS students led to an improvement in the basic knowledge and skills after 4 hours of training. The authors suggested that CPR workshops should be conducted early during the undergraduate course.<sup>[8]</sup> Several other researchers have found that lectures can lead to improvement in the knowledge regarding the basic steps of CPR.<sup>[9]</sup> Even a 1 h single training session can improve the understanding of COLS, as suggested in a quasi-experimental study among school children.<sup>[10]</sup>

The overall knowledge of the medical students was poor prior to the training as per this study. Many previous studies have also found poor knowledge of CPR among the medical and non-medical college students.<sup>[2,11]</sup> In a cross-sectional study among 145 medical students and 60 junior doctors, only 6.2% of students and 31.7% of junior doctors had adequate knowledge about CPR. However, majority of the participants showed a positive attitude towards implementation of regular CPR training.<sup>[2]</sup> Few other authors have also reported deficiencies of overall knowledge in life support, even amongst doctors and medical professionals.<sup>[1,12]</sup>

The skills of chest compression were assessed after the teaching and hands-on training. Improvement in knowledge may be a stepping stone for acquiring skills, which is reflected in this study. Most of the students achieved acceptable level of skills in the

rate of chest compression and hand location (average compression rate 128.52/min and correct placement of hands by 78.36% participants). Only 60% of students could achieve proper depth of chest compression. This may suggest that students need more time for hands-on practice to achieve this skill. As majority of the students did not have prior knowledge of CPR, the skill assessment was done only after the training, thus precluding a before–after comparison. If CPR is taught in the schools, the students may be familiar with the terminologies as well as the skills and this will not be completely new for them.

The training imparted in this study included lecture, video demonstration, group discussion as well as hands-on practice. In a cross-over randomised controlled study, the authors suggested that video demonstration resulted in better skills, with regard to identifying an arrest situation and initiating early chest compressions, as compared to traditional instructor-based training.<sup>[13]</sup> We tried to include many teaching and learning methods to incorporate various learning styles – visual, auditory, reading/writing, kinaesthetic (VARK) keeping in mind that students will have different learning styles and that many would prefer the multimodal approach.<sup>[14]</sup> The overall feedback by the students regarding this training was positive and most of them found the training very useful. However, few students felt that there was limited time for the hands-on practice.

The Indian Society of Anaesthesiologists (ISA) and the IRC have designed and promoted CPR guidelines in the context of the Indian infrastructure and feasibility, in a very simplified, organised and stepwise approach.<sup>[4,5,15]</sup> The ISA and IRC also promote training of BCLS amongst young doctors, and compression only life support (COLS) amongst lay persons, including school students. This can help in creating a network of resuscitators who can help in improving outcomes in cardiac arrest occurring outside the hospital.<sup>[16,17]</sup> Anaesthesiology is now slowly gaining weightage in medical undergraduate teaching in our nation. Anaesthesia consultants carry the responsibilities of teaching undergraduates important life-saving skills during the foundation course.<sup>[16,18]</sup>

This study has various limitations. It did not include the use of an AED. Usually, students are neither trained to self-assess their performances nor are they accurate in the self-assessment of the clinical skills. However, self-assessments and self-reports

by students are recognised as valuable feedbacks for curriculum planners. Video recording of the training and assessment was not done. Comparing the skills objectively, before and after the training, could have strengthened this study.

## CONCLUSION

BCLS training for first-year medical students during the foundation course can significantly improve the knowledge and confidence of the students regarding CPR. It can also help them acquire acceptable skills for performing effective CPR.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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## ANNEXURE 1

### Pre-test Questionnaire

Roll no.

Age/Gender

Date

1. Are you aware of the term CPR (cardiopulmonary resuscitation)?
  - a. Yes
  - b. No
  
2. Where have you heard about CPR?
  - a. Movies
  - b. Newspaper
  - c. Friends or relatives
  - d. School
  - e. Electronic or social media
  
3. Have you received any training for CPR prior to this session?
  - a. Yes
  - b. NoIf yes, what kind of training?
  
4. If you see a person collapsing in front of you at some public place like mall, what will you do first?
  - a. Call for help
  - b. Start CPR
  - c. Check for responsiveness
  - d. Give rescue breaths
  
5. What is the rate of chest compressions in adult CPR as per the Indian guidelines?
  - a. 80–100/min
  - b. 120/min
  - c. Up to 200/min
  - d. 100/min
  
6. What is the ratio of chest compression to breathing in adult Basic Cardiac Life Support (BCLS)?
  - a. 15:2
  - b. 30:2
  - c. 5:1
  - d. 15:1
  
7. Two rescue breaths are best described by all, except
  - a. Each breath given over 1 second
  - b. Should produce visible chest rise
  - c. Given after taking deep inspiration
  - d. Given after taking normal inspiration

8. What is the depth of chest compression in adults?
  - a. At least 2 inches., not >2.4 inches.
  - b. At least 2 inches.
  - c. At least 1.5 inches., not >2 inches.
  - d. 1.5–2 inches.
  
9. What is the location of hands in adult CPR?
  - a. Left side of chest
  - b. Xiphisternum
  - c. Middle of the breast bone
  - d. Lower half of the breast bone
  
10. What is the full form of AED?
11. After giving shock by AED or defibrillator, you will
  - a. Start compressions
  - b. Check pulse
  - c. Check rhythm
  - d. Ventilate the patient
  
12. As per the Indian guidelines, which of the following is a minimum standard stepwise approach for in-hospital cardiac arrest?
  - a. Basic cardiac life support
  - b. Advanced cardiac life support
  - c. Compression only life support
  - d. Comprehensive cardiopulmonary life support
  
13. Rate your confidence of knowledge regarding CPR (select from 1 to 4)
  1. Not confident
  2. Less confident
  3. More confident
  4. Very confident
  
14. How would you rate your confidence regarding first aid skills? (Select from 1 to 4)
  1. Not confident
  2. Less confident
  3. More confident
  4. Very confident
  
15. How would you rate your confidence regarding chest compression? (Select from 1 to 4)
  1. Not confident
  2. Less confident
  3. More confident
  4. Very confident
  
16. You are in a mall and you see a person collapsing in front of you. You want to start CPR. How confident you feel regarding your performance in this situation?
  1. Not confident
  2. Less confident
  3. More confident
  4. Very confident

### Post-test Questionnaire

Roll no.

Age/Gender

Date

1. If you see a person collapsing in front of you at some public place like mall, what will you do first?
  - a. Call for help
  - b. Start CPR (Cardiopulmonary Resuscitation)
  - c. Check for responsiveness
  - d. Give rescue breaths
  
2. What is the rate of chest compressions in adult CPR as per the Indian guidelines?
  - a. 80–100/min
  - b. 120/min
  - c. Up to 200/min
  - d. 100/min
  
3. What is the ratio of chest compression to breathing in adult Basic Cardiac Life Support (BCLS)?
  - a. 15:2
  - b. 30:2
  - c. 5:1
  - d. 15:1
  
4. Two rescue breaths are best described by all, except
  - a. Each provided over 1 second
  - b. Should produces visible chest rise
  - c. Given after taking deep inspiration
  - d. Given after taking normal inspiration
  
5. What is the depth of chest compression in adults?
  - a. At least 2 inches., not >2.4 inches.
  - b. At least 2 inches.
  - c. At least 1.5 inches., not >2 inches.
  - d. 1.5–2 inches.
  
6. What is the location of hands in adult CPR?
  - a. Left side of chest
  - b. Xiphisternum
  - c. Middle of the breast bone
  - d. Lower half of the breast bone
  
7. What is full form of AED?
8. After giving shock by AED or defibrillator, you will
  - a. Start compressions
  - b. Check pulse
  - c. Check rhythm
  - d. Ventilate the patient
  
9. As per the Indian guidelines which of the following is a minimum standard stepwise approach for in hospital cardiac arrest?
  - a. Basic cardiopulmonary life support

- b. Advanced cardiac life support
  - c. Compression only life support
  - d. Comprehensive cardiopulmonary life support
10. Rate your confidence of knowledge regarding CPR (select from 1 to 4)
- 1. Not confident
  - 2. Less confident
  - 3. More confident
  - 4. Very confident
11. How would you rate your confidence regarding first aid skills? (Select from 1 to 4)
- 1. Not confident
  - 2. Less confident
  - 3. More confident
  - 4. Very confident
12. How would you rate your confidence regarding chest compression? (Select from 1 to 4)
- 1. Not confident
  - 2. Less confident
  - 3. More confident
  - 4. Very confident
13. You are in a mall and you see a person collapsing in front of you. You want to start CPR. How confident you feel regarding your performance in this situation? (Select from 1 to 4)
- 1. Not confident
  - 2. Less confident
  - 3. More confident
  - 4. Very confident
14. Give your feedback regarding the lecture of BCLS
- a. Very useful
  - b. Quite useful
  - c. Some use
  - d. Of little use
  - e. Of no use
15. Give your feedback regarding hands-on practice sessions
- a. Very useful
  - b. Quite useful
  - c. Some use
  - d. Of little use
  - e. Of no use
16. Give your feedback regarding skill assessment sessions
- a. Very useful
  - b. Quite useful
  - c. Some use
  - d. Of little use
  - e. Of no use
17. Any other feed back