Research Square

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The Effect of Basic Life Support Training on Willingness in Performing Bystander Hands- only Cardiopulmonary Resuscitation Among High School Students in Patna, Bihar

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Research Article

Keywords: out-of-hospital cardiac arrest (OHCA), basic life support (BLS) training, hands-only CPR, high school students, CPR readiness, healthcare access

Posted Date: March 8th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-8945095/v1

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Additional Declarations: No competing interests reported.

Abstract

Purpose

Out-of-hospital cardiac arrest (OHCA) poses a significant global health challenge, especially in India with dismal bystander CPR rates (1.3%). We investigated the effect of basic life support (BLS) training on high school students' willingness to perform hands-only CPR in Patna Bihar, aiming to highlight students' potential as vital responders and advocate for integrating CPR training into school curriculums, potentially mitigating OHCA mortality rates in India.

Methods

This quasi-experimental study assessed the effect of BLS training on high school students' willingness to perform bystander hands-only CPR in Patna, Bihar. It was carried out over two days in five onsite BLS training sessions and using convenience sampling, 592 students from two private schools participated, with a pre-post intervention design. A structured questionnaire measured changes in knowledge, confidence, and willingness to perform CPR before and after training, revealing insights into the effectiveness of BLS education among adolescents.

Results

Of the 592 participants, 73.3% were aged 14 to 16 years. A significant majority (86.2%) lacked prior BLS training. While general awareness of BLS was high (71.5%), detailed knowledge remained low (13.2%), indicating a gap between awareness and actionable knowledge. Post-training, willingness to perform CPR increased significantly ($p < 0.001$) to 97.8%. The predominant reason for hesitation among 205 children regarding CPR was fear of incomplete or poor performance, cited by 34.0% of respondents. Overall, structured training significantly improved both knowledge and confidence for effective emergency response among high school students, with over 97% achieving satisfactory knowledge levels and similar proportions exhibiting confidence post-training.

Conclusion

Mandating BLS training in school curricula can therefore enhance healthcare access, as demonstrated by the significant improvement in CPR readiness post-training.

1. INTRODUCTION

Out-of-hospital cardiac arrest (OHCA) is recognized as a major public health problem worldwide [1], with a global incidence of 55 per 100,000 person per year.[2] Consistent with this trend, OHCA is one of the

leading causes of death in India. However, there is a lack of proper data due to the absence of a national cardiac arrest registry in the country.

Cardiopulmonary resuscitation (CPR) is an emergency procedure that consists of chest compressions, which may be combined with artificial ventilation. This aims to preserve intact brain function until further interventions can restore spontaneous blood circulation and breathing in a person who is in cardiac arrest.[3] Bystander CPR is identified as an important factor contributing to improved survival rates after an OHCA.[4,5] Research has shown that 30-day survival rates are 2.6 times higher for patients for whom bystander CPR is performed than for those without CPR.[4]

Despite the lifesaving potential of CPR, there is a concerning disparity between the incidence of cardiac arrests and the rate at which bystander CPR is administered, which consistently remains suboptimal. The bystander CPR rate in India is found to be much lower than in most other countries, at a dismal value of 1.3%, due to the lack of awareness and training among people, and poorly developed emergency medical services.[6]

Students make up a significant percentage of laypersons who are capable of providing effective CPR and are also a source of spreading information about the same. They are a demographic that, if well-trained, can become a valuable resource in increasing bystander CPR rates within their communities. The American Heart Association encourages CPR training for high school students and also emphasizes the need for BLS training to be mandatorily included in the school curriculum.[7–9]

Recently, chest compression-only CPR without mouth-to-mouth breathing (hands-only CPR) has been proposed as an alternative to standard CPR, noting the reluctance to perform mouth-to-mouth breathing among bystanders.[10–18] The study in question analyzed the effect of basic life support training on willingness to perform bystander hands-only cardiopulmonary resuscitation among high school students in Patna, Bihar. The hypothesis was that BLS training would lead to a significant increase in their willingness to perform CPR, assessed before and after the study intervention, which consisted of providing CPR training using manikins, via a validated questionnaire. This research is particularly significant in the context of Patna, where access to immediate medical assistance can be challenging, and the impact of bystander CPR can be substantial as it consists of very simple doable steps for any layperson.

The study contributed to filling the lacunae in available literature on the awareness of CPR, and the effect of such training on the willingness to perform bystander hands-only CPR among Indian high school students. The data, previously available only from countries outside of India, and the only such Indian study, catered to undergraduate and postgraduate medical students of India.[19] The findings from this study would encourage schools and government/educational boards to include the training for this vital life skill in their curriculum, which could eventually contribute to a higher number of “trained good-samaritans”, and subsequent lowering of mortality due to OHCAs in the Indian Society.

The primary objective of this study was to assess the effect of basic life support (BLS) training on the willingness of high school students in Patna to perform bystander hands-only cardiopulmonary resuscitation (CPR). The secondary objectives included assessing the level of knowledge and awareness of BLS among high school students in Patna and to examine its correlation with their willingness to perform bystander hands-only CPR. Additionally, the study also aimed to measure the change in knowledge scores and self-assessed confidence scores before and after the BLS training, and to investigate the reasons for hesitation in performing bystander hands-only CPR among high school students, both before and after receiving BLS training.

2. METHODS

2.1 Study Design:

Quasi-experimental pre-post intervention design

2.2 Sample Size and Sampling Technique:

Using the Cochran Formula, the minimum required sample size was calculated at 678 students, based on a presumed 83% willingness rate and a 95% confidence interval. Due to data loss (mainly from incomplete pre- and post-training questionnaires as a large number of students from both the schools did not fill out either the pre or the post training questionnaire, suspected reasons for which are explained in later sections.), the final sample size was 592 students. Convenience sampling was used for participant selection across two schools in Patna, India.

2.3 Duration and Procedure:

The study was conducted from October to November 2023, during which a pre- and post-training questionnaire was administered to assess students' knowledge, confidence, and willingness. The training sessions, which lasted over two days, were divided into five sessions, with around 120 students in each group.

The training procedure involved several key steps. Initially, participants completed a pre-training questionnaire via Google Forms to collect baseline data on their knowledge, confidence, and willingness to perform CPR. The BLS training sessions, conducted over two days during school hours (7:00 AM to 12:20 PM), included five sessions comprising a 10-minute PowerPoint presentation on the principles of hands-only CPR, a 3-minute instructional video from the AIIMS Patna eBLS YouTube channel demonstrating proper CPR techniques, and hands-on practical exercises. During these exercises, students practiced correct hand placement, chest compression depth, and body positioning on mannequins under the supervision of third-year medical students from AIIMS Patna, who provided immediate feedback to improve technique. Following the training, participants completed a post-training questionnaire to evaluate changes in their knowledge, confidence, and willingness to perform CPR. While School 1 distributed the post-training survey via WhatsApp, resulting in lower response rates, School 2 administered it immediately in hard copy after the training, which improved completion rates

Two schools participated, and the training was incorporated into regular school hours. All students completed consent forms and a pre-training questionnaire.

In School 1, the pre-training questionnaire was distributed via WhatsApp, but limited phone access and low engagement resulted in incomplete responses. Consequently, fewer students filled out the post-training questionnaire, likely due to fatigue or misunderstanding the necessity of completing it after the training..

In School 2, the pre-training questionnaire was also distributed via WhatsApp, but with clearer instructions. The post-training survey was given in hard copy immediately after training, improving response rates and minimizing data loss.

Challenges were primarily encountered in School 1, where several factors affected data collection and the overall training evaluation process. One major issue was **limited access to technology**, as some students lacked phones or internet access to complete the pre-training and post-training questionnaires distributed via Google Forms. Additionally, there were **student engagement issues**; despite reminders, some students who attended the training did not complete the forms, leading to gaps in data collection.

Another significant challenge was the **misinterpretation of the questionnaire's purpose**. Many students viewed the pre-training questionnaire as a mere registration form, which resulted in a relatively high completion rate for the pre-training survey. However, only 228 students filled out the post-training questionnaire. This drop was likely due to the repetition of questions in the pre- and post-training questionnaires or a lack of perceived necessity to complete the form after the training. Furthermore, **delayed responses between training and survey completion** negatively impacted knowledge assessment, as students had difficulty recalling information, resulting in lower "knowledge" scores.

Several mitigation strategies were implemented in School 2 to address the challenges faced in School 1 and improve the reliability of data collection. First, the **purpose of the questionnaire was clarified**. Although the pre-training questionnaire was again administered via Google Forms, students were explicitly informed that it was not merely a registration tool but an essential part of the study, ensuring that response levels remained adequate.

Second, an **immediate post-training assessment** was conducted. Unlike in School 1, where the post-training questionnaire was distributed online via WhatsApp, in School 2, it was administered in hard copy immediately after the training session. This approach minimized delays, reduced the likelihood of data loss, and enhanced the accuracy of knowledge assessment by capturing responses while the training was still fresh in the students' minds.

These methodological adjustments successfully addressed the challenges encountered in School 1, significantly improving response rates, data reliability, and overall student engagement.

2.4 Study Variables and Statistical Analysis

The study measured several key variables using a structured questionnaire:

1. **Demographics**: Basic information on age, gender, and grade level.
2. **Previous BLS Training**: Participants reported any prior CPR training.
3. **Awareness**: Six questions assessed baseline awareness, with scores summed to create an "awareness score." Each correct response was scored as + 1, while incorrect responses received a score of 0. The total scores from this section were summed to compute an "awareness score." This measure was only collected pre-training to assess baseline awareness levels about BLS.
4. **Knowledge**: Another eight questions tested CPR knowledge, scored the same way as “awareness score”, with scores summing to a "knowledge score." A threshold of 50% (score of 4 or more) classified participants as having satisfactory knowledge, while scores below four were deemed unsatisfactory
5. **Self Assessed Confidence in Performing CPR**: Students self-assessed their confidence on a 10-point visual analogue scale. A score of 5 or more indicated good confidence.
6. **Willingness to Perform CPR**: Willingness was measured on a 4-point Likert scale, using a set of six questions, with a maximum possible score of 24. A threshold of six was used to define willingness categories: scores of six or less indicated a lack of willingness to perform CPR, while scores above six suggested a willingness to engage in CPR during emergencies.

Categorical variables were described using frequencies and percentages, and continuous variables using means and standard deviations. McNemar’s test compared pre- and post-training willingness to perform CPR. Binary logistic regression analyzed predictors of willingness, including age, sex, and knowledge. Chi-square tests explored associations between attendance and reluctance to perform CPR.

3. RESULTS

3.1 Descriptive analysis of school students on various parameters

Table 1
Descriptive Analysis of Participant Characteristics (N-592)

Variable	Levels	Counts	%
Age	12 to 14 years	93	15.7%
	14 to 16 years	434	73.3%
(mean-14.4±.99)			
	More than 16 years	65	11.0%
Sex	Female	285	48.1%
	Male	307	51.9%
	Less than 60%	19	3.2%
Marks	60 to 75%	115	19.4%
	More than or equal to 75%	458	77.4%
	8th Standard	72	12.2%
Class	9th Standard	359	60.6%
	10th Standard	161	27.2%

Table 1 summarizes the demographic characteristics of the participants. Most students (73.31%) are aged 14 to 16 years, with a near-equal gender distribution (51.86% male, 48.14% female). The majority are in grades 9 (60.64%) and 10 (27.20%), while 12.16% are in grade 8. Academically, 77.36% scored 75% or higher, 19.43% scored between 60–75%, and 3.21% scored below 60%. The average age of participants was 14.4 ± 0.99 years.

Prior BLS Training Experience Among students

A large majority (86.2%) have not previously been trained. Among those who have been trained, most received their last training within the past year, accounting for 59.8% of those trained. Retraining appeared to be infrequent, with more than half (57.32%) reporting no subsequent training sessions. BLS training predominantly occurred at schools (79.27%).

Knowledge of BLS and EMS among Students

While 71.45% are familiar with BLS, 68.24% have heard of EMS, indicating good but slightly lower awareness of emergency medical services. A large majority (88.68%) recognize BLS as useful in emergencies. However, knowledge of where BLS can be performed is limited, with only 13.2% aware of its locations, and 63.7% incorrectly believing it cannot be performed, while 23.1% did not know.

Knowledge of Emergency Numbers before training

The data shows varying levels of awareness. The most recognized number is 112, known by 48.7% of students. Numbers 108, 102, 100, and 101 are less familiar, with recognition rates of 20.6%, 14%, 9.5%, and 7.3%, respectively. This suggests that while 112 is well-known, there is a need to improve awareness of other critical emergency numbers like 100 and 101.

3.2 Knowledge, confidence, and willingness to perform BLS before and after training.

Table 2: **Knowledge of BLS before training among Students (N-592)**

Response Before Vs After

Table 2
reveals significant gaps in students' Basic Life Support (BLS) knowledge before the intervention, with only 8.4% correctly identifying the BLS sequence, and less than 35% accurately understanding pulse location, chest compression rate, and the compression-to-breath ratio.

BLS Knowledge Aspect	Type	Counts (Before)	% of Total	Counts (After)	% of Total
Unconscious Check	Correct	264	44.6%	542	91.6%
	Incorrect	328	55.4%	50	8.4%
Respiratory Arrest Check	Correct	352	59.5%	507	85.6%
	Incorrect	240	40.5%	85	14.4%
Pulse Location	Correct	199	33.6%	551	93.1%
	Incorrect	393	66.4%	41	6.9%
Chest Compression Rate	Correct	206	34.8%	541	91.4%
	Incorrect	386	65.2%	51	8.6%
Compression to Breath Ratio	Correct	198	33.4%	553	93.4%
	Incorrect	394	66.6%	39	6.6%
Compression Depth	Correct	231	39.0%	562	94.9%
	Incorrect	361	61.0%	30	5.1%
Correct Knowledge of Sequence	Correct	50	8.4%	251	42.4%
	Incorrect	542	91.6%	341	57.6%
Chest Compression Location	Correct	247	41.7%	386	65.2%
	Incorrect	345	58.3%	206	34.8%

Post-intervention data depicts a substantial improvement in knowledge. Correct responses for unconscious checks increased from 59.5% to 91.6%, and for respiratory arrest checks, from 59.5% to

85.6%. Knowledge of pulse location and chest compression rate rose from below 35% to 93.1% and 91.4%, respectively. Understanding of the compression-to-breath ratio and compression depth improved from below 35% to 93.4% and 94.9%. However, knowledge of the correct sequence and chest compression location saw more modest gains, improving from 8.4% to 42.4% and from 35% to 65.2%, respectively.

Table 3
Knowledge and perceived Confidence before and after training in Performing BLS (N = 592)

Aspect	Category	Counts Before	% of Total	Counts After	% of Total
Prior Knowledge	Unsatisfactory	380	64.2%	16	2.7%
	Satisfactory	212	35.8%	575	97.3%
Confidence in performing BLS	Not confident	241	40.7%	42	7.1%
	Confident	351	59.3%	549	92.9%

The Table 3 depicts most students, 64.2%, demonstrated unsatisfactory prior knowledge in BLS. Conversely, in terms of confidence, a higher percentage, 59.3%, felt confident in performing BLS. The post-intervention data indicated a remarkable enhancement in both knowledge and confidence among students regarding Basic Life Support (BLS) to 97.3% and 92.9% respectively

Table 4
Willingness to Perform BLS Before and After Training

Willingness to perform CPR	Counts Before	% of Total	Counts After	% of Total
No	50	8.5%	13	2.2%
Yes	542	91.6%	575	97.8%

Table 4 showed before training, a vast majority of students, 91.6%, were willing to perform CPR. Prior to training, a larger proportion (8.5%) had expressed hesitation or lack of willingness. After the intervention, only 2.2% of students remained unwilling to perform CPR, while an overwhelming majority, 97.8%, showed willingness.

3.3 Changes in Knowledge, Confidence, and Willingness to Perform Basic Life Support (BLS) Before and After Training.

Table 5
Change in the level of knowledge, Confidence, and Willingness after training (N = 592)

	Post training knowledge (McNemar χ^2=356.2, df-1, p<.001)		
Pre-Training	**Unsatisfactory**	**Satisfactory**	**Total**
Unsatisfactory	12	368	380
Satisfactory	4	208	212
Total	16	576	592
	Post training confidence (McNemar χ^2=167.1, df-1, p<.001)		
Pre-Training	**Not Confident**	**Confident**	**Total**
Not Confident	23	218	241
Confident	19	332	351
Total	42	550	592

	Post training Willingness (McNemar χ^2=24.0, df-1, p<.001)		
Pre training	**No Willingness**	**Willingness**	**Total**
No Willingness	3	47	50
Willingness	10	532	542
Total	13	579	592

The McNemar test showed a highly significant shift in students' BLS knowledge, with the percentage of students with satisfactory knowledge rising from 35.8% pre-training to 97.2% post-training. Confidence in performing BLS also significantly increased ($p < .001$), with students reporting confidence rising from 59.3% before training to 92.9% afterward. Similarly, willingness to perform CPR saw a substantial change ($p < .001$), with those unwilling to perform CPR dropping from 8.4% pre-training to 94.0% willing post-training.

3.4 Association between knowledge, confidence, and willingness to perform BLS before and after training.

Table 6
Binomial logistic regression for Willingness to Perform CPR Based on Various Factors

		No Willingness to Perform CPR (n, %)		Univariable OR (95% CI, p-value)	Multivariable OR (95% CI, p-value)
Factor	**Category**				
	Female	21 (7.4)	264 (92.6)	Ref	
Sex	Male	29 (9.4)	278 (90.6)	0.76 (0.42–1.36, p = 0.365)	
	Previously not trained	44 (8.6)	466 (91.4)	Ref	
Prior Training					
	Previously trained	6 (7.3)	76 (92.7)	1.20 (0.53–3.21, p = 0.692)	
	12 to 14 years	7 (7.5)	86 (92.5)	Ref	
	14 to 16 years	41 (9.4)	393 (90.6)	0.78 (0.31–1.70, p = 0.560)	
Age Category					
	More than 16 years	2 (3.1)	63 (96.9)	2.56 (0.60–17.60, p = 0.250)	
	Less than 60%	2 (10.5)	17 (89.5)	Ref	
	60–70%	8 (7.0)	107 (93.0)	1.57 (0.22–6.96, p = 0.58)	
Marks Category					
	> 75%	40 (8.7)	418 (91.3)	1.23 (0.19–4.50, p = 0.787)	
	Unsatisfactory	42 (11.1)	338 (88.9)	Ref	

		No				
		Willingness	Willingness to		Univariable OR	Multivariable
		to Perform	Perform CPR		(95% CI,	OR (95% CI,
Prior Knowledge					3.17 (1.54–7.40,	2.82
regarding BLS	Satisfactory	8 (3.8)	204	(96.2)		(1.35–6.61,
					p = 0.004)	
						p = 0.01)
	Not confident	31 (12.9)	210	(87.1)	Ref	
Confidence regarding					2.58 (1.43–4.76,	2.31
performing BLS	Confident	19 (5.4)	332	(94.6)		(1.27–4.28,
					p = 0.002)	
						p = 0.007)

Table 6 presents the results of a binomial logistic regression analysis examining factors influencing willingness to perform CPR. Variables with a p-value ≤ 0.2 in univariable analysis were included in the final model, which considered "Prior Knowledge regarding BLS" and "Confidence regarding performing BLS."

The analysis found that satisfactory prior knowledge of BLS significantly increased the likelihood of willingness to perform CPR (odds ratio 2.82, 95% CI: 1.35–6.61, p = 0.01). Confidence in performing BLS was also a strong predictor (odds ratio 2.31, 95% CI: 1.27–4.28, p = 0.007). Factors such as sex, prior training, age, and academic performance were excluded from the final model, as their p-values were > 0.2, indicating they were not significant predictors of CPR willingness.

Odds Ratio Plot

3.5 Reasons for hesitation to perform a bystander hands-only CPR.

Figure 3 highlights the reasons for hesitation in performing CPR among 205 students. The most common concern was the fear of poor performance, cited by 34.0% of respondents, followed by the fear of harming the victim (12.3%) and the fear of disease transmission through mouth-to-mouth resuscitation (8.3%). Legal consequences were a minor concern, noted by only 3.2% of participants, while personal, religious, or ethical reasons were the least cited at just 1.5%.

4. DISCUSSION

4.1 Descriptive Analysis

The gender distribution was balanced, with no significant difference in CPR performance between males and females. High academic performance among participants suggests that students with stronger academic capabilities may also better engage with and retain CPR training, enhancing their ability to apply skills effectively.

4.2 BLS Training Experience

A significant proportion of students (86.2%) had no prior BLS training, highlighting a gap in CPR education within schools. Despite this, 79.3% of the training occurred in school settings, emphasizing the importance of educational institutions as venues for CPR training. School-based CPR programs are critical for increasing bystander CPR rates and equipping students with life-saving skills.

4.3 Knowledge of BLS and EMS

Although 71.5% of students were aware of Basic Life Support (BLS), knowledge about specific procedures, such as the correct locations for CPR application, was much lower (13.2%). This indicates a gap between general awareness and actionable knowledge. The lower awareness of Emergency Medical Services (EMS) (68.2%) compared to BLS suggests a need for broader emergency response education in schools to enhance overall preparedness.

4.4 Willingness to Perform BLS

Post-training, 97.8% of students expressed willingness to perform CPR, a significant improvement from 8.5% before the training. This increase reflects the effectiveness of the training in boosting both confidence and intent. The reduction in fear and anxiety about performing CPR, alongside enhanced competence, contributed to this shift in attitude.

4.5 Impact of Training on Knowledge, Confidence, and Willingness

After training, over 97% of students demonstrated satisfactory knowledge and confidence in performing CPR. These results show that structured BLS training not only improves theoretical understanding but also builds the confidence required to apply CPR in emergencies. The training equipped students with the skills and readiness to perform CPR, highlighting its role in preparing them for real-life situations.

5. CONCLUSION

This study demonstrates that Basic Life Support (BLS) training significantly improves high school students' knowledge, confidence, and willingness to perform hands-only CPR. Engaging a large number of students, the training led to a marked increase in CPR knowledge and confidence, with most

participants expressing a willingness to act in emergencies. Notably, the study highlighted challenges during implementation, including technological barriers and misinterpretations, which were addressed to improve future training phases. The findings emphasize that BLS training not only enhances technical skills but also alleviates psychological barriers, such as fear of causing harm or legal repercussions. The study advocates for integrating BLS training into school curricula across India to build a generation capable of responding to medical emergencies. By equipping students with life-saving skills, this research has the potential to improve survival rates from out-of-hospital cardiac arrests, contributing to broader public health outcomes.

Declarations

Statement:

The Institutional Ethics Committee, All India Institute of Medical Sciences, Patna reviewed & discussed this STS of Ms. Naomie Rushat Mredha to be conducted under your guidance titled "The effect of basic life support training on willingness in performing bystander hands-only cardiopulmonary resuscitation in selected Government High School students in Patna." The proposal was approved in the meeting held on 29th September, 2023.

6. CONFLICTS OF INTEREST

None to declare.

Author Contribution

Credit Author Statement• Conceptualization: N.R. Mredha, P. Kumar• Methodology: N.R. Mredha, P. Kumar, S. Ahmad• Data Curation: N.R. Mredha• Advisor / Co-guide: C. M. Kumar• Formal Analysis: P. Kumar, S. Ahmad• Investigation: N.R. Mredha, C. M. Kumar• Writing – Original Draft: N.R. Mredha, P. Kumar, S. Ahmad• Writing – Review & Editing: N.R. Mredha, P. Kumar, S. Ahmad

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Figures



Figure 1

Change in the level of Pre and Post Training Knowledge, Willingness and Self Assessed Confidence Score to Perform CPR

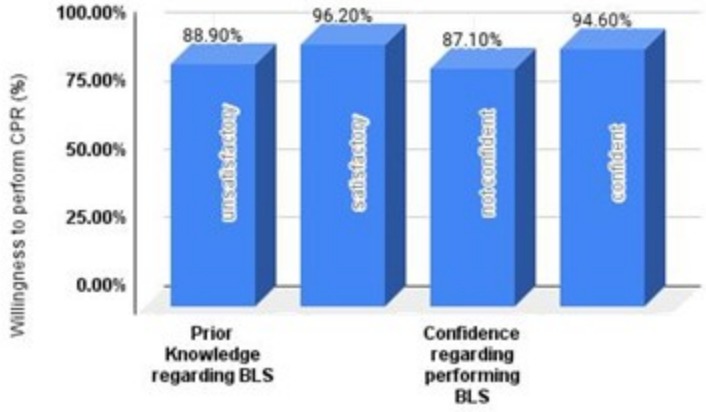


Figure 2

Impact of prior knowledge and self assessed confidence on willingness to perform CPR

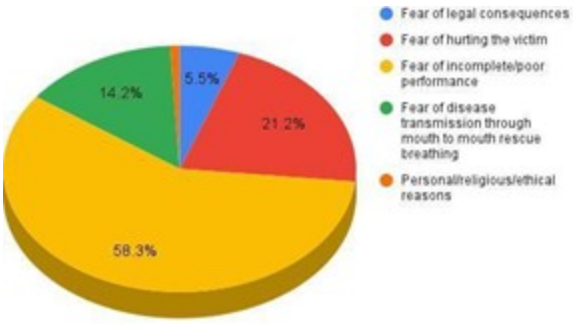


Figure 3

Reasons for hesitation to perform CPR

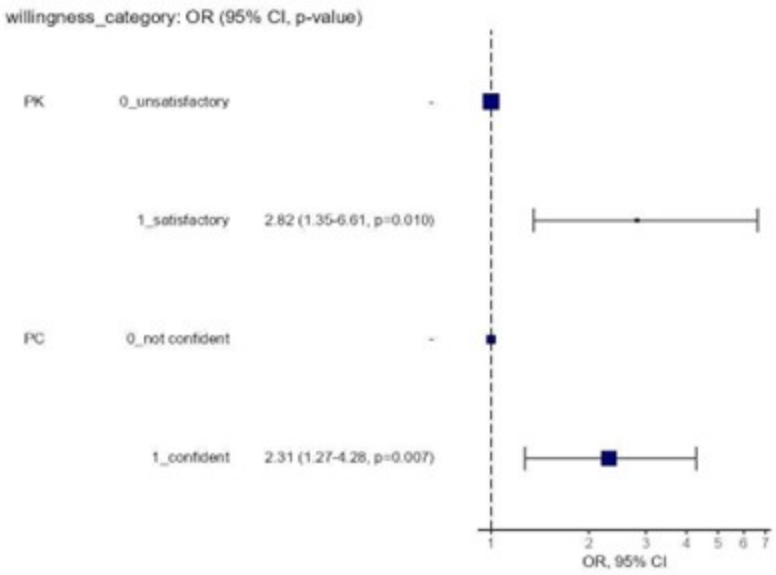


Figure 4

Unnumbered image in the Result section.