

Student Pharmacist-Led Basic Life Support Training for High School Students Improves Knowledge and Skill Achievement

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ABSTRACT

Introduction: The performance of bystander cardiopulmonary resuscitation (CPR) improves survival among cardiac arrest victims. Near-peer teaching of Basic Life Support (BLS) may be an effective way to deliver resuscitation education. This article aims to assess the effectiveness of a student pharmacist-led American Heart Association (AHA) BLS course on high school students' knowledge and skill achievement. **Methods:** Student pharmacists were trained as AHA instructors and delivered BLS certification courses to high school students. Participants completed pre- and post-assessments adapted from the course learning objectives. Skills performance was evaluated using the AHA's standardized forms. Participants completed questions regarding their perceptions of the pharmacist's role in BLS and confidence in pursuing a career in healthcare. **Results:** There were 321 participants with the majority in 11th or 12th grade (86.6%) and attending public school (99.1%). After completing the training, the mean percentage of correct assessment responses increased from 41.2% to 89% ($p < 0.0001$). All participants correctly performed BLS skills. Most participants strongly agreed or agreed that the course changed their perspective of the pharmacist's role during BLS (74.8%) and increased their confidence in their decision to pursue future careers in healthcare (61.7%). **Conclusion:** Student pharmacist-led BLS training, using near-peer delivery, improves high school students' knowledge and skill achievement. This strategy promotes high school students' positive perceptions regarding pharmacists and their role in BLS, as well as their confidence in pursuing careers in healthcare.

Keywords: Resuscitation education; Basic Life Support; Cardiac arrest; Near-peer teaching

INTRODUCTION

Sudden cardiac arrest remains one of the leading causes of death in the United States. In 2021, the incidence of out-of-hospital cardiac arrest (OHCA) remained at more than 350,000 cases, with only about a 9.1% survival rate in adult victims.¹ To increase survival outcomes in the victims of cardiac arrest, Basic Life Support (BLS) skills including, early recognition of cardiac arrest, activation of the emergency response system, performance of high-quality cardiopulmonary resuscitation (CPR), and rapid defibrillation with an automated external defibrillator (AED) are essential.² As most OHCA occur at home or in public settings, with approximately 50% of cases as unwitnessed events, the performance of bystander CPR is crucial in improving the victim's survival outcome.¹⁻² Despite its critical role, bystander CPR was performed in only 40.2% of the OHCA cases.¹ Additionally, the use of AED in the OHCA was even lower at 10.2%, with many laypersons unaware that AEDs are designed for public use.^{1,3} These findings highlight the importance of BLS education among lay responders.

While several strategies have been studied in resuscitation education, peer teaching has gained substantial interest among educators to implement BLS training among students.⁴⁻⁷ Peer teaching is described as students teaching their fellow students. Previous studies reported that peer instructors' resuscitation training is effective and comparable to professional training and demonstrated excellent participant satisfaction and increased training availability at less cost.⁴⁻⁶ Among student pharmacists, peer-led BLS training significantly improved skills performance and retention 120 days after completing the course.⁷ These positive results indicate that peer teaching is an effective educational strategy for teaching life-saving skills among students.

Recently, near-peer teaching has been explored as another instructional method in various settings. Unlike peer teaching, near-peer teaching is defined as senior trainees who are at least one year ahead in the level of training instructing junior trainees.⁸ In an integrative review of near-peer teaching in undergraduate nursing education, this strategy improved knowledge and skills in learners and consolidated knowledge among near-peer teachers.⁹ Another study evaluated the benefit of a near-peer program in medical students' performance on the Objective Structured Clinical Examination (OSCE). The learners valued the near-peer education program for improvement in confidence before the exams and the peer educators for opportunities to develop teaching skills.⁸ Despite these benefits, evidence of near-peer teaching in resuscitation education is scarce. Among medical students, senior students

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sharing their real-life experience of performing CPR enhanced motivation to learn among first-year students.¹⁰ Recently, a pilot study by Knowlin and colleagues reported that incorporating virtual reality and near-peer mentoring is a potentially novel approach to enhance CPR training among high school students.¹¹ Considering the education level difference between learner and educator, near-peer teaching may not only effectively train learners in essential knowledge and skills in medical emergencies but also encourage learners to gain interest in the educators' advanced training and education.

Given the positive results of peer teaching, the CPR Leadership Team was founded at this University in 2015. A group of student pharmacists are certified as American Heart Association (AHA) BLS instructors and have trained more than 4,000 participants in life-saving skills. Previous studies evaluating the outcomes of the CPR Leadership Team demonstrated successful knowledge acquisition and skills performance by peer and community member trainees.^{7,12} Based on the previous success, it was hypothesized that near-peer training of high school students would be an effective method to deliver resuscitation education. The purpose of this study was to evaluate the effectiveness of a student pharmacist-led AHA BLS course on high school students' knowledge and skills assessment. Additionally, high school participants' changes in perception regarding the confidence in pursuing future careers in healthcare upon completion of the course were evaluated.

METHODS

This was a retrospective, single-center study deemed exempt by the Saint Joseph's University institutional review board. The primary endpoint was a change in BLS knowledge and skills assessment scores of high school students who received student pharmacist-led AHA BLS courses. The secondary endpoints included high school students' perceptions regarding student pharmacist-led BLS training, pharmacist's role in BLS, and their confidence in pursuing future careers as healthcare professionals or pharmacists after completing the AHA BLS course instructed by student pharmacists.

Participants were high school students from the local area enrolled in the AHA BLS training provided by the CPR Leadership Team from August 2018 to October 2022. Some participating students were less than 18 years of age but were accompanied by their high school teachers during the course and were given permission by their guardians to attend. The BLS training was a part of a community outreach program designed to introduce local high school students to the healthcare professional programs offered at the university. Participants were recruited on a first-come first-serve basis and there was no cost incurred by the participants. Each training session was scheduled for four hours. Student pharmacists in the last three professional years (P2, P3, and P4) of their program were trained as AHA instructors and delivered BLS certification courses to high school students. All participants were asked to complete pre-

assessment questions derived from the AHA's BLS course learning objectives. There were no additional pre-course learning activities required outside of the class. During the course introduction, student pharmacist instructors held a brief discussion regarding pharmacists' different practice settings and the role of pharmacists and other healthcare professionals during medical emergencies. Specifically, the instructors discussed pharmacists as pharmacotherapy experts and an integral part of an interprofessional team, with an added emphasis on team dynamics. Each participating student was paired with an adult and infant manikin with no more than a 2:1 ratio of students to manikin. There was at least one instructor for every eight students.

Skills performance was evaluated using the AHA's standardized forms for adult and infant BLS skill checklists. During the initial assessment of the victim, students were expected to check responsiveness, breathing, and pulse; shout for help; activate the emergency response system; and send someone for AED. Then students' performance in providing high-quality chest compressions and breaths with a barrier device was evaluated. Additionally, students were expected to demonstrate the correct use of AED, including powering the device, attaching pads, clearing for cardiac rhythm analysis and shock, safely delivering a shock to the victim, and promptly resuming chest compressions. Upon completing the required skills performance and a written knowledge exam, students were asked to complete post-assessment questions identical to pre-assessment questions and demographic and perception questionnaires.

Changes in assessment scores pre- and post-training were evaluated by using a Wilcoxon Signed Rank Test. A *p*-value less than 0.05 indicated statistical significance. Statistical analysis was conducted using SigmaPlot version 14.0.

RESULTS

A total of 321 high school students were included in the study. A total of seven sessions were offered throughout the study period. All training sessions were completed in-person at the University. Demographics are displayed in Table 1. The majority of participating students were female (63.9%), in 11th or 12th grades (86.6%), and attending public school (99.1%). Twenty-three students (7.2%) reported that they had CPR certification within the past two years, and only two students (0.6%) indicated they had a previous performance of CPR during an emergency.

After completing the student pharmacist-led BLS training, the mean percentage of correct assessment responses increased from 41.2% to 89%, with a change in score of 47.8% (*p* < 0.001), as shown in Table 2. All five questions had an increased number of correct responses upon completion of student pharmacist-led BLS training. All participants correctly performed adult and infant BLS skills assessed by the AHA standardized forms.

Results of the post-course questionnaires are displayed in Table 3. The majority of participants strongly agreed (42.1%) or agreed (47.7%) that student pharmacist-led training enhanced the BLS course. Additionally, most participants responded that before the course, they were not aware of pharmacists' involvement in BLS (63.2%) and that the student pharmacist-led BLS course changed their perspective of the pharmacist's role during BLS (74.8%). Regarding high school participants' confidence in pursuing a future career as a healthcare professional or pharmacist, 61.7% of students responded that the student pharmacist-led BLS course increased their confidence in pursuing a future career as a healthcare professional. Specifically, 23.4% were more confident in their decision to pursue future careers as pharmacists.

DISCUSSION

Resuscitation education among lay responders is vital in increasing the chance of survival for OHCA victims. Educators have explored different instructional methods to deliver BLS training along with traditional, professional teaching. Our findings align with the positive results of near-peer teaching reported in the previous studies.⁸⁻¹¹ Successful knowledge and skills achievement was demonstrated by the significant improvement in assessment scores completed by high school participants. Our study confirms that near-peer teaching is an effective instructional method for delivering resuscitation education. However, when evaluating the assessment scores by individual questions, participants had a significantly lower score on the question regarding the child BLS. Interestingly, a low assessment score on pediatric material is consistent with the results from the previous study evaluating student-led BLS training among community members.¹² This finding may indicate the need to emphasize child BLS materials during the training to ensure successful knowledge retention.

In previous studies, student pharmacist-led BLS training demonstrated successful knowledge achievement and skill performance among peers and community members.^{7,12} Considering the difference in the level of training and education between near-peer instructors and trainees, we hypothesized that through student pharmacist-led training, high school students would gain positive perceptions regarding healthcare professionals and pharmacists, as well as their roles during medical emergencies. Many participating high school students answered that the course enhanced their confidence in pursuing careers as healthcare professionals or, specifically, pharmacists. This finding may indicate additional benefits of near-peer teaching for career exploration among high school students. Additionally, at the time of the study, the state of Pennsylvania did not require high school students to receive CPR training as a part of the curriculum. In 2019, a new law requiring the development of a curriculum to teach high school students hands-only CPR was signed in Pennsylvania.¹³ A recent study by Vetter and colleagues reported higher rates of

bystander CPR performed after OHCA in states that enacted required CPR training in high schools.¹⁴ With the upcoming change, near-peer teaching may be a valuable training strategy to implement the new curriculum.

Our study was limited by the small sample size, with most high school participants coming from a single cohort recruited by the local community partnership. Pre- and post-assessments were completed on the same day, and there was no long-term follow-up to assess BLS knowledge and skill retention. In addition, participants' readiness to perform CPR during emergencies was not assessed. During the COVID-19 pandemic, the BLS training was temporarily halted on campus. When the in-person training was resumed in 2022, we incorporated additional infection control measures into the training sessions to limit shared touch surfaces, such as using one manikin for each participant. All other components of the training session were identical to the pre-pandemic sessions.

To our knowledge, this is the first study to evaluate the impact of BLS training using near-peer delivery led by student pharmacists. Future studies may consider including a larger sample size to confirm the findings in various student and instructor groups. Since the AHA requires recertification of BLS every two years, assessment of how knowledge and skills decay over time after initial certification would further establish the effectiveness of near-peer teaching in resuscitation education. Lastly, assessing participants' willingness to perform bystander CPR would evaluate the confidence level among trainees.

CONCLUSION

Student pharmacist-led BLS training, using near-peer delivery previously described in the literature, improves high school students' knowledge and skill achievement. Additionally, this strategy promotes high school students' positive perceptions regarding pharmacists and their role in BLS, and their confidence in pursuing a career as a pharmacist or other healthcare professional.

Conflicts of Interest: We declare no conflicts of interest or financial interests that the authors or members of their immediate families have in any product or service discussed in the manuscript, including grants (pending or received), employment, gifts, stock holdings or options, honoraria, consultancies, expert testimony, patents, and royalties.

Disclaimer: The statements, opinions, and data contained in all publications are those of the authors.

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Table 1. Demographics of High School Student Participants in AHA BLS Training (N=321)

Baseline Characteristic	n (%)
Female	205 (63.9)
Current grade	
9 th	4 (1.2)
10 th	39 (12.1)
11 th	157 (48.9)
12 th	121 (37.7)
Age (years)	
14	6 (1.9)
15	40 (12.5)
16	135 (42.1)
17	121 (37.7)
18	19 (5.9)
Type of school	
Public	318 (99.1)
Private	2 (0.6)
Charter	0 (0)
Home school	0 (0)
Other	1 (0.3)
Race	
African American or Black	74 (23.1)
Asian or Pacific Islander	117 (36.4)
Hispanic or Latino	31 (9.7)
Native American or American Indian	0 (0)
White or Caucasian	68 (21.2)
Other	27 (8.4)
Prefer not to answer	4 (1.2)
Level of education completed by a parent	
No schooling completed	10 (3.1)
Some schooling	81 (25.2)
High school graduate or General Education Development (GED)	57 (17.8)
Some college credit, but no degree	32 (10.0)
Technical/vocational training	2 (0.6)
Associate Degree	11 (3.4)
Bachelor's Degree	45 (14.0)
Master's Degree	54 (16.8)
Doctorate Degree	8 (2.5)
Prefer not to answer	21 (6.5)
CPR certification within the past two years	23 (7.2)
Previous performance of CPR during an emergency situation	2 (0.6)

Table 2. Pre- and Post- College-Student-Led AHA BLS Training Assessment for High School Students (N=321)

Question	Pre-Assessment Score (%)	Post-Assessment Score (%)	Change in Score (%)	p-value
What is the first step for using an AED?	47.0	96.9	49.9	< 0.0001
Which action is required as part of high-quality CPR for an adult ?	50.2	95.3	45.1	< 0.0001
What indicates you are providing effective breaths using mouth-to-mouth breathing?	73.5	98.8	25.3	< 0.0001
How deeply should you compress the chest of a child victim when providing high-quality CPR?	13.7	66.4	52.7	< 0.0001
An infant is unresponsive and not breathing. The cardiac arrest was unwitnessed. You are alone and do not have a cell phone . What should you do first?	22.1	87.9	65.8	< 0.0001
Overall Assessment Score	41.2	89.0	47.8	< 0.0001

Data shown as mean %

AED: automated external defibrillator; CPR: cardiopulmonary resuscitation

Table 3. High school student perceptions after attending college student-led BLS training (N=321)

Question	SA	A	N	D	SD
Perceptions of the college student-led BLS training					
College student-led training enhanced this course.	135 (42.1)	153 (47.7)	28 (8.7)	3 (0.9)	2 (0.6)
I felt comfortable asking college student instructors questions.	196 (61.1)	107 (33.3)	15 (4.7)	0 (0)	3 (0.9)
I will recommend that other high school students complete Basic Life Support training with the CPR Leadership Team.	210 (65.4)	102 (31.8)	7 (2.2)	1 (0.3)	1 (0.3)
Perceptions of the pharmacist's role in BLS					
Prior to this course, I did not know that pharmacists are involved in Basic Life Support.	81 (25.2)	122 (38.0)	54 (16.8)	45 (14.0)	19 (5.9)
This course changed my perspective of the pharmacist's role during Basic Life Support.	75 (23.4)	165 (51.4)	63 (19.6)	13 (4.0)	5 (1.6)
Confidence in pursuing future careers as healthcare professionals or pharmacists					
This course made me more confident in my decision to pursue a future career as a healthcare professional.	96 (29.9)	102 (31.8)	79 (24.6)	7 (2.2)	0 (0)
This course made me more confident in my decision to pursue a future career as a pharmacist.	22 (6.9)	53 (16.5)	123 (38.3)	39 (12.1)	0 (0)

Data shown as n (%)

SA: strongly agree; A: agree; N: neutral; D: disagree; SD: strongly disagree