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ORIGINAL ARTICLE

Basic life support education: the impact of lecture-demonstration in undergraduate students of health sciences

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Abstract

Backgroung: Cardiac arrest is a severe public health problem and a leading cause of death worldwide. According to the American Heart Association (AHA), basic life support (BLS) is the bedrock for improving people's survival after a cardiac arrest. Through scientific evidence, empowering health professionals focuses on education in resuscitation is vital to identify and attend a Cardiac arrest victim. In Brazil, there is a lack of data that evaluates the BLS knowledge of health science students. This study analyzed the knowledge retention of medicine, nursing, and physiotherapy students after one year of having a lecture demonstration on BLS.

Methods: Longitudinal study. Undergraduate students of health science participated in the data collection and answered a questionnaire based on BLS following AHA guidelines. Data were collected during two consecutive years in three different moments (an assessment, a test after a lecture, and an assessment test one year later).

Results: The group improved its score after the class on BLS; the number of correct answers doubled ($p < 0.001$); however, one year later, that score decreased significantly ($p < 0.001$).

Conclusion: No retention of knowledge in health sciences students after a year of a lecture demonstration on BLS.

Keywords: education, learning, students' health occupations, cardiopulmonary resuscitation.

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Authors summary

Why was this study done?
The interest in the present study is due to the high rate of deaths from cardiovascular diseases, which is a severe public health problem. Deaths due to cardiac arrest inside and out-of-hospital environments could have another outcome if more people are trained in resuscitation practices. In this sense, this research aims to analyze the impact of a Demonstration Lecture on Basic Life Support in undergraduate students in health sciences.

What did the researchers do and find?
The researchers applied a questionnaire to 151 students of Nursing, Physiotherapy, and Medicine courses at a university center in Santo André, São Paulo, SP. After one year, the results revealed a significant reduction in their performance, indicating no knowledge retention.

What do these findings mean?
The results show the importance of practicing cardiopulmonary resuscitation (CPR) in basic life support training to improve knowledge retention.
The study's findings suggest that effective education is a key and transforming variable to reduce the number of deaths from cardiac arrest. It is essential to prepare our students during the entire graduation period, extending to all courses in the health area.

INTRODUCTION

Cardiac arrest (CA) is a severe public health problem and a leading cause of death worldwide[1,2], accounting for approximately 15% to 20% of all deaths. Although cardiopulmonary resuscitation (CPR) rates are generally improving worldwide, most individuals who experience sudden cardiac arrest out of hospital do not receive appropriate CPR and will not survive[3].

Empowering health professionals through scientific foundations is the focus of resuscitation education. In an eventual situation of CA, they know how to recognize it and care for the victims. Future health professionals' qualifications and ideal performance depend on the cognitive, behavioral, and psychomotor skills needed to perform CPR successfully[4]. There is a need for health professionals to achieve high-quality CPR[5], and that there is a knowledge and skill retention problem for them in being able to do this[4,6-9]. Despite ongoing advances in prevention and resuscitation science, cardiac arrest survival rates remain below ideal for in-hospital and out-of-hospital CA[5].

According to the American Heart Association (AHA), Basic Life support (BLS) is the bedrock for improving people's survival after a cardiac arrest; CPR is a crucial aspect of BLS associated with better outcomes to preserve lives. Although we have millions of lay rescuers and health professionals trained in resuscitation each year, there are significant gaps in clinical care delivery, such as low assistance in BLS and CPR for CA victims[10].

On the global stage, it is widely known that knowledge of BLS increments the survival options of people who suffer from Cardiac arrest. It is imperative to improve the expertise of future health professionals in this field. Therefore, this study analyzes the impact of a Lecture-Demonstration on Basic Life Support in undergraduate students of health sciences in a Sao Paulo State's Municipality.

MATERIALS AND METHODS

Design and Location

This is a longitudinal study accomplished at the Centro Universitário FMABC, in Santo André, São Paulo, Brazil.

Participants and Eligibility requirements for Inclusion, Exclusion and Discontinuity criteria

A convenience sample of 281 students from the first year of health sciences consented. Students who had previously undergone training in basic life support (BLS) were excluded. A year after, only 151 (figure1) of the group remained at the university in their respective careers; they composed the final sample. The other 130 students were excluded due they changed course, moved to another educational institution, refused to participate, or answered a questionnaire with incomplete demography data.

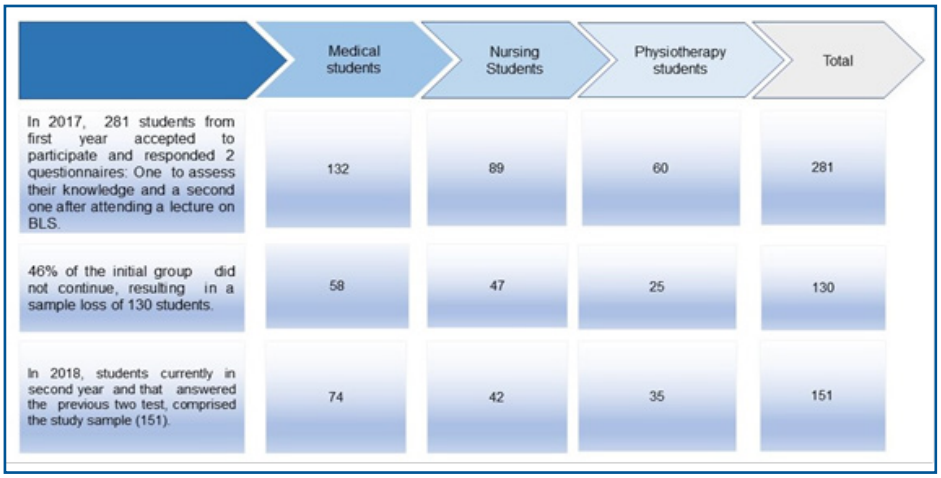

Figure1: Sampling process and participants per course

The final sample comprised students of both gender, over 18 years old, enrolled in the undergraduate courses of Medicine, Nursing, and Physiotherapy. The sample error margin was five percentage, with a standard deviation of 3 to 15 points. With a confidence level of 95%, 80% test power with a two-tailed test, to discriminate differences of correction among the three study stages (of at least ten correct answers), it was necessary to sample at least 35 individuals in each group.

Lecture - Demonstration

Following the active learning methods[11,12], the students attended a 50-minute lecture demonstration on BLS. The students were split into groups of up to 50 individuals according to the classroom size. Two trained professionals with proven BLS and CPR expertise (a physician and a certified nurse) gave the lecture. table 1 illustrates the structure of the demonstration lecture.

The scenario was created based on a clinical case to simulate the correct CPR sequence, including a demonstration using an automatic electrical defibrillator (AED) (Laerdal Medical Corporation, New York, NY, USA).

Two manikins Laerdal (Laerdal Medical Corporation, New York, NY, USA) were used to demonstrate CPR maneuvers (compressions and ventilations) and an interface (face shield handkerchief) to ventilate the manikins.

Table 1: Structure of Lecture-Demonstration on BLS presented to undergraduate students of health sciences – Santo André, São Paulo, Brazil

Stage	Topics/issues approached	Duration
Introduction & Background	-Cardiac arrest a global public health issue; -Scenario in Brazil; -How the knowledge of BLS will help them in their careers; -Basic principles of BLS (the chain of survival).	5 min
Demonstration	-Based on the AHA chain of survival -Recognize signs of cardiac arrest and activation of the emergency response system; -How to perform chest compression and when to stop it; -What to do if CPR fails; -Use of AED. How to use it; -Placing the victim in the recovery position.	30 min
Summing up and Closure	-Questions and answers; -Summary of essential elements of BLS and CPR.	15 min

Data Collection

It was applied a questionnaire based on the BLS-AHA guidelines, a method simplified by Tavares et al. (2015)[9]. It comprised 20 objective questions, each contained four alternatives, being only one the correct answer. The questionnaire covered steps that may save lives as the out-of-hospital chain of survival, identify CA, perform CPR, and use AED.

Data were collected and compiled in three stages during two consecutive years. Baseline, (M1 Moment), the students had up to 30 minutes to answer a questionnaire to assess their knowledge on BLS, then, (M2) immediately after receiving a 50-minutes lecture demonstration on BLS according to AHA guidelines, they had up to 30 minutes to answer the same questionnaire of M1. A year later, the students assessed BLS by answering the same questionnaire applied at M1 and M2.

The same researcher conducted the CPR tests, who corrected the questionnaires through the responses template. The data were compiled and stored in an Excel® program database.

Statistical analysis

Qualitative variables were presented by relative frequency; the quantitative variables were described by median and 95% confidence intervals of the median by evaluating the data distribution by the Kolmogorov-Smirnov test.

The correct answers at the assessment test, post-test, and test after a year were analyzed by the Friedman test with Dunn's multiple-comparison test. The Kruskal-Wallis test with Dunn's multiple-comparison test was used to compare the correct answers in the test after a year.

The level of significance adopted was $p < 0.05$. Statistical analysis was performed using MedCalc® software.

Ethical Considerations

The Research Ethics Committee approved this study of the Centro Universitário FMABC (University Health Center ABC) (protocol 557-716). The participants accepted voluntarily and were able to withdraw from the study at any time. They received an explanation of project details as well as the procedures. Every one of the students who composed the sample signed the Free Informed Consent Term.

RESULTS

Most of the respondents, 74 (49%), were students from medical school, 42 (27.8%) from nursing, and 35 (23.2%) from physiotherapy.

As shown in table 2, the number of successes increased after the BLS lecture at M1 ($p < 0.001$); however, after a year, there was a significant reduction in the number of correct answers ($p < 0.001$).

Table 2: Median of correct assessment answers, the test applied immediately after the lecture on BLS and assessment a year later, by the group and overall performance - Santo Andre, São Paulo, Brazil.

Students	Assessment test	Test immediately after lecture	Test One year after the lecture	p¥
	Median (95%CI)	Median (95%CI)	Median (95%CI)	
Overall	7.0 (7.0-8.0)	15.0 (14.0-15.0)*	8.0 (7.0-8.0) #	<0.001
Medical	7.0 (6.0-7.0)	15.0 (15.0-16.0)*	7.0 (7.0-8.0) #	<0.001
Nursing	9.0 (7.18-10.0)	14.0 (14.0-15.0)*	9.0 (8.0-10.0) #	<0.001
Physiotherapy	5.0 (5.0-7.0)	13.0 (12.0-14.75)*	6.0 (6.0-8.0) #	<0.001

95%CI: 95% confidence interval. ¥: Friedman test. * Significant difference between pre-hit versus post-hit (p <0.001). # Significant difference between post-hit versus hit after one year (p <0.001).

On stratifying the sample, the performance per group was similar to the overall result. All groups showed an increase in correct answers after the BLS lecture (p <0.001). On the other hand, a reduction in the number of correct answers occurred after a year (p <0.001), and these differences were statistically significant (table 2). The nursing group had the highest number of correct answers after a year with a median of 9.0 (95%; 8.0 to 10.0), and the group of physiotherapy achieved the lowest number.

Most of the students failed to answer correctly the questions 1 and 19 (table 3) at the assessment (M1), test after the lecture (M2), and an assessment test after a year (M3).

Table 3: Questions with the highest percentage of failure among health science students - Santo Andre, São Paulo, Brazil

Variable	Medicine	Nursing	Physiotherapy
	% of failure		
Question 1: Indicate the correct sequence of survival chain according to the AHA-BLS guideline			
Assessment test	94.59	90.48	82.86
Test immediately after the lecture	60.81	47.62	68.57
Test a year after	98.65	95.24	91.43
Question 19: Respect use of AED select the correct answer			
Assessment test	94.59	90.48	91.43
Post-test	82.43	88.10	77.14
Test a year after	82.43	95.24	85.71

Note: Questions 1 and 19 (table 3) at the assessment (M1), test after the lecture (M2), and an assessment test after a year (M3).

DISCUSSION

When we analyzed the knowledge retention of undergraduate students of health sciences after one year of attending a lecture-demonstration on BLS, the results revealed that it was unsatisfactory.

Our study showed that the test's overall accuracy immediately after the theoretical-practical lecture had a relevant improvement of almost double correct answers compared to the initial assessment. However, one year later, minimum retention of knowledge was evidenced in the whole group; students had 40% correct answers. It is worth mentioning that the AHA course approval standard requires 84% of the answers in the theoretical evaluation for certification[13].

Our results denote that most of the students failed questions 1 and 19 (table 3), which are crucial topics. A survival chain executed correctly; increases the survival chances of a Cardiac arrest victim. When the AED is correctly handled on the chest of a victim, this device analyzes the patient's rhythm, and immediately after a shock, the maneuvers of CPR must be initiated. These necessary actions exposed in questions 1 and 19 may save lives and be known not only by health care personnel but also by the community.

Undergraduate medical education prepares students to practice in various specialties, and much of the acquired knowledge will inevitably not be used in their future professions[4]. The scientific literature demonstrates a deterioration of learning and BLS skills in less than three months after initial training[4,7]. Ghee *et al.*[8] reported a decline in the score of retention tests performed by the students in Malaysia evaluating the knowledge retention on basic trauma life support in third-year medical students.

Pande *et al.*[6] reported that students had worse performance than the test done a year earlier when they carried out a study with 42 first-year medical students to analyze their knowledge retention on BLS.

As mentioned before and indicated in table 2, the nursing course group achieved the highest number of correct answers, presenting a statistically significant result (p <0.001). In this sense, Nambiar *et al.*[14] conducted a study in India through an AHA-based questionnaire and

evaluated 461 health professionals' knowledge on BLS guidelines and advanced life support (ALS). Their results reflected in the scores showed that nurses knew more about the BLS protocols.

Rajeswaran *et al.*[15] carried out a study on nurses from three district hospitals in Botswana. They applied a pre-intervention test and a post-test. After six months, a new test was performed to determine the retention of knowledge on BLS. They concluded that nurses showed significant improvement after training but evidenced a decline in BLS knowledge retention and skills after six months.

The study by Chandrasekaran *et al.*[16] aimed to investigate BLS awareness among students, physicians, and nurses of medical, dentistry, homeopathy, and nursing schools. A questionnaire with 20 questions included knowledge in abbreviations, sequential steps, and attendance techniques. The results showed that the nursing faculty, who practiced and taught during the study, obtained better scores.

Aqel *et al.*[7] examined the effects of high fidelity simulation on the learning and retention of BLS in nursing students. It was an experimental study where a pre-test and a post-test were performed using two teaching methods: One group did a traditional CPR class followed by a low fidelity simulation. The second had a lecture on CPR accompanied by high fidelity training. As happened in our study, the post-test moment results had a significant increase in correct answers and improved BLS; after three months of training, retention tests were performed, highlighting a loss of knowledge and skills in both groups.

It is estimated that about 1/3 of knowledge will be forgotten within one year if it is not used or recycled, and between 50% and 60% of it will be lost within two years. The AHA 2015 education guidelines state that two-year recycling cycles are not ideal[4,10,17] and showed by publishing a scientific statement in 2018 that the abilities of students decline over time after performing standardized resuscitation courses, either online or face-to-face, corroborating the studies mentioned above[18].

The deficiency of knowledge on Life Support is an issue among undergraduate students of health sciences and health care professionals. It has been reported in several studies where the professional skills were below expectations[13,19,20]. In this context, AHA emphasizes that the importance of improving long-term knowledge retention of basic science depends on its perceived role in a physician's life. If this knowledge is seen as directly relevant to medical practice, it makes sense that this learning is concentrated in an appropriate context, emphasizing future application[4].

According to Kimble *et al.*[21], adult learning theory is formed by questions and ideas to learn better when learning is self-directed. The content studied is of great interest, motivating him internally. Besides, the student should receive relevant feedback and a quantitative reflection as part of the process. Moreover, these psychomotor skills become fundamental for health professionals' practice, remembering that it should be a continuous development practice.

Learning impacts positively what students do, know, or feel like a cause of experience. When students are actively involved in learning, they are most likely influenced in three domains of learning: cognitive, which consists of the acquisition of new knowledge, intellectual development, skill, and attitudes; psychomotor related to specific physical abilities and the affective domain that involves categories associated with the development of the emotional area that includes behavior, attitude, responsibility, respect, emotion and values[22-24].

Our research was focused on analyzing the processes that support cognitive learning (retention of content) after receiving a 50 minutes lecture by applying a questionnaire. Retention is essential in the autonomy process because it is a concept that students understand about storing these contents in memory and rescuing them when necessary[25].

It has been documented[26] that these students can disseminate this knowledge through cognitive consolidation of these contents about BLS. Kawakami *et al.*[27] point out that assessing the teaching-learning process in BLS training programs is considered essential since, without evaluating the results, we cannot accurately obtain indicators of past actions or the definition of future activities. In our study, the students did not undergo practical abilities; hence, we did not evaluate motor capacities' learning.

The AHA teaching strategies of 201810 point out to use spaced learning. It is known that a current schedule of 1 to 2 days of resuscitation training every two years is helpful for short-term learning. However, students often do not retain their skills in the long term. Shorter sessions over months can improve learning outcomes.

In Brazil, resources vary significantly from region to region. It is a continental dimension and regional inequalities, university centers mainly located in each state's capitals and main cities. The dissemination of BLS is seen or perceived as a long-term priority in many of its territories[28].

Courses on BLS are not included in health science careers; hence any training or lecture on BLS are extracurricular activities, which implies some limitations to schedule a plan. So, it is evident the difficulty in retaining knowledge after an isolated lecture demonstration on BLS. Even in the health field, there is an apparent demand for refreshers training after a lecture demonstration on BLS.

CONCLUSION

It was concluded that the retention knowledge on Base Life Support among the medical, nursing, and physiotherapy students in a municipality of Sao Paulo State is unsatisfactory.

Because of the importance of recognizing out-of-hospital cardiac arrest, the BLS maneuvers and the use of automated external defibrillators are essential to increase the survival rate of cardiac arrest victims.

In the short term, we suggest that the students receive continuous assessments to improve their BLS expertise based on AHA guidelines, and this practice should be integrated into the curricula of health professions colleges.

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Conflicts of interest

The authors declare no conflict of interest.

Availability of data and materials

Datasets supporting the conclusions are included in this article. Additional data at the individual students' level is not available as per confidentiality agreements approved by the Ethics Committee.

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Author contributions

Conceptualization: CSCC LCA LFBT BEGD RDR. Data curation: CL RDR LSP. Formal analysis: CL RDR LSP JZR. Investigation: CSCC LFBT RDR. Methodology: CSCC LCA BEGD RDR. Project administration: RDR CSCC. Resources: LCA RDR. Supervision: RDR LC. Validation: CSCC CL LFBT RDR IMPB. Visualization: CSCC LFBT. Writing – original draft: CSCC LFBT RDR. Writing – review & editing: CL LSP BEGD JZR.

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Resumo

Introdução: A parada cardíaca (PC) é um grave problema de saúde pública e uma das principais causas de morte em todo o mundo. De acordo com a American Heart Association (AHA), o suporte básico de vida (SBV) é a base para melhorar a sobrevivência das pessoas após uma parada cardiorrespiratória e a ressuscitação cardiopulmonar é um aspecto crucial. Por meio de evidências científicas, capacitar os profissionais de saúde com foco na educação em ressuscitação é fundamental para identificar e atender uma vítima de parada cardíaca. No Brasil, faltam dados que avaliem o conhecimento em SBV de estudantes de ciências da saúde. Este estudo analisou a retenção de conhecimento de estudantes de Enfermagem, Fisioterapia e Medicina, após um ano de realização de uma palestra-demonstração sobre SBV.

Método: Estudo longitudinal. Estudantes de graduação em ciências da saúde que participaram da coleta de dados e responderam a um questionário baseado no SBV seguindo as diretrizes da AHA. Os dados foram recolhidos durante dois anos consecutivos, em três momentos distintos (uma avaliação, um teste após a aula e um teste de avaliação um ano após a aula).

Resultados: O grupo melhorou sua pontuação após a palestra sobre SBV; o número de acertos dobrou ($p < 0,001$); no entanto, um ano depois, essa pontuação diminuiu significativamente ($p < 0,001$).

Conclusão: Não houve retenção de conhecimento após um ano de uma aula-demonstrativa sobre SBV em estudantes de ciências da saúde.

Palavras-chave: educação; aprendizado, estudantes de profissões de saúde, ressuscitação cardiopulmonar.