doi.org/10.1590/ce.v29i0.96830 Cogitare Enferm. 2024, v29:e96830

Cogitare Enfermagem

ORIGINAL ARTICLE

KNOWLEDGE OF SECONDARY SCHOOL STUDENTS ABOUT BASIC LIFE SUPPORT

HIGHLIGHTS

1. 59.3% have basic life support training.
2. Integrate basic life support into training programs.
3. Train regularly to develop the necessary skills.

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ABSTRACT

Objective: Evaluate high school students' knowledge about basic life support and analyze the associations between the level of knowledge and sociodemographic and academic variables. **Method**: Quantitative, descriptive, cross-sectional, and correlational study. The sample consisted of 59 high school students from a Secondary School in the metropolitan area of Porto - Portugal. Descriptive analyses, Pearson's correlation coefficient, and t test (or non-parametric tests when assumptions were not met) were used. **Results**: 35 (59.3%) had basic life support training, and 52 (88.1%) were interested in undergoing the training. Only seven (11.9%) were aware of an automatic external defibrillator and 14 (23.7%) identified when to seek specialized help. **Conclusion**: Knowledge about basic life support can contribute to achieving better outcomes in situations of cardiorespiratory arrest, and students should increase their skills in this area by using training in the school context.

KEYWORDS: Students; First Aid; Cardiopulmonary Resuscitation; Knowledge.

HOW TO REFERENCE THIS ARTICLE:
Silva MSGO da, Ferreira MMSV, Rodrigues AM, Sousa CNS de. Knowledge of secondary school students about basic life support. Cogitare Enferm. [Internet]. 2024 [cited "insert year, month and day"]; 29. Available from: https://doi.org/10.1590/ce.v29i0.96830.

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INTRODUCTION

According to the World Health Organization (WHO), there are about 20,000 people who fall victim to sudden death every day. In Europe and North America, there are between 50 to 100 cases of Cardiorespiratory Arrest (CRA) per 100,000 inhabitants each year. CRA occurs outside healthcare institutions annually, affecting 250,000 to 300,000 people worldwide[2]. Portugal is no exception, with 21,603 people being victims of CRA[3], constituting a public health problem.

Early recognition, activation of emergency medical services, and the performance of basic life support (BLS) are key factors in increasing a person's chances of survival. All these steps depend on the knowledge and actions of third parties. Mostly, these situations occur in the community, making it essential that any citizen is qualified to provide the necessary assistance based on international recommendations. Basic life support knowledge increases social responsibility and human values[4].

Cardiac arrest consists of the cessation of circulation and breathing, recognized by the absence of heartbeats and respiration in an unconscious victim[5], resulting in a clinical picture of unconsciousness, apnea, lack of response to stimuli, and absence of palpable pulses[6]. Frequently, CRA occurs in the adult population, and its incidence tends to increase with age. Due to cardiovascular risk factors, men have a three to four times higher risk of CRA compared to women; however, this discrepancy has been decreasing. After a CRA, the victim loses a 10% chance of survival every minute that passes. In this way, after five minutes without assistance, the victim has only a 50% chance of survival[7].

The BLS consists of a set of standardized procedures aimed at maintaining circulation and ventilation until specialized help arrives, improving the chances of survival[8]. It is essential for someone who witnesses a CRA to intervene quickly, based on the chain of survival. The links in the chain are: a) early recognition and activation of the emergency medical system; b) immediate resuscitation with the institution of BLS maneuvers; c) early defibrillation; and, d) advanced life support (ALS)[8]. It consists of recognizing and attempting to immediately correct the failure of the respiratory and/or cardiovascular systems until the arrival of the specialized team. The procedures, when carried out effectively and quickly, allow for a reduction in mortality rates associated with CRA and increase the probability of survival. The difficulties experienced in performing cardiopulmonary resuscitation are due to lack of knowledge, inadequate training, lack of skills, and lack of confidence to perform the procedure[10].

The training, guidance, and skill development in young people, especially among students, is essential for the recognition and early intervention of BLS in emergencies. It also provides different teaching-learning scenarios, active interaction among participants promoting autonomy, horizontality of the agents involved, and multidisciplinarity[11].

The objectives were defined as: to assess the knowledge of high school students about basic life support and to analyze the associations between the level of knowledge and sociodemographic and academic variables.

METHOD

Quantitative, descriptive, cross-sectional, and correlational study representative of the initial stages of a broader action-research study up to the preliminary diagnosis phase.

The sample involved students attending the 10th grade (*n* = 59) at a Secondary School in the Metropolitan Area of Porto, Portugal. Non-probabilistic convenience sample according to the inclusion criteria: Students enrolled in the 10th grade, who participated in the training session on BLS, with informed consent signed by the guardian. These 10th-grade students are between 14 and 15 years old and are in the first of three years that make up secondary education. After the 12th grade, the student can continue their studies in higher education.

A favorable opinion was obtained from the Ethics Committee P17-S28-14/09/2022 and from the educational institution for conducting the study. Consent was requested for the participation of students in this study where objectives, intervention, and research team were presented to the legal representatives. Authorization for the use of the assessment instrument was also requested and granted.

The intervention was structured in a first expository part during which the theoretical contents were presented, using video visualization, and in the second part, a demonstration and simulated practice training on mannequins was carried out. The intervention and data collection were carried out during October 2022 in the planned course of the school lessons.

The questionnaire was divided into three parts: 1) sociodemographic and academic data; 2) training and experience in BLS; and 3) opinions and knowledge about BLS[11]. Characterization questions were inserted in the sociodemographic and academic data. The training and experience in BLS were assessed by the type of training and previous experiences in the area.

The level of knowledge was assessed by 20 questions about BLS, based on the 2021 guidelines of the *European Resuscitation Council*. Concept of survival chain; Knowledge of the medical emergency number; Assessment of safety conditions; Assessment of consciousness state and absence of breathing as CRA signs; Airway (AW) clearance; Breathing assessment technique; Maximum time dedicated to the breathing assessment technique; Rate of chest compressions and ventilations with one or several rescuers; Request for specialized help; Start of CPR maneuvers with chest compressions and/or ventilation; in which situations to suspend BLS maneuvers; Correct location, Chest depression, Rate of chest compressions per minute; When to place a victim in the recovery position; Knowledge of Automatic External Defibrillator (AED) for defibrillation.

The data analyses were performed using the *statistical* software IBM SPSS *Statistics* (version 28). It started by creating the variable Knowledge related to BLS, which, for each element of the sample, counts the number of correct answers to the 20 multiple-choice questions about knowledge related to BLS. As for the 20 questions that assess knowledge about BLS, a score of 1 point was given for correct answers and 0 points for wrong answers. The final score assigned to knowledge about BLS ranges from 0 to 20 points, with the score being directly proportional to the knowledge acquired.

Subsequently, a descriptive analysis of the variables under study was carried out. Pearson's correlation coefficient was used to analyze the relationship between the level of knowledge about BLS and age. To analyze the relationship between that level of knowledge and other sociodemographic and socio-educational context variables, the *t* Student's t-test for two independent samples was used, after validating the assumption of normality of the sample means and the assumption of homogeneity of variances. In cases where the assumption of homogeneity of variances fails, the Welch *t* test was used. In the case of the variable indicating whether the student has ever helped someone in life-threatening danger, the assumption of normality could not be validated due to the size of one of the

groups to be compared, so the non-parametric Mann-Whitney test was used. A significance level of 0.05 was considered.

RESULTS

59 students from the 10th grade participated, aged between 15 and 17 years (*M* = 15.66 years; *SD* = 0.63). In this sample, 29 (49.2%) are female, 25 (42.4%) are male, five (8.4%) did not identify with this gender duality, preferring not to respond, attend courses that fall into the area of Visual Arts (*n* = 15; 25.4%) or Science and Technology (*n* = 44; 74.6%).

In Table 1, it is noted that 35 (59.3%) students have training and experience in BLS, with the vast majority (*n* = 34; 97.1%) having acquired this training at school. The most frequent was finding students who never had to help someone in life-threatening danger (*n* = 52; 88.1%), but regarding those who had to do it, choking was the most reported situation. It is noted that, of the 7 students who have already helped someone in life-threatening danger, 6 (85.7%) had BLS training.

Regarding training in the area, among students who had never helped anyone, in the female gender (*n* = 22; 75.9%), as well as in the group of students who do not identify with gender duality (*n* = 3; 60.0%), the majority had training and experience in BLS, the same does not happen in the male gender, where the majority (*n* = 15; 60.0%), do not have this training (Table 1).

Table 1 - Training and experience in BLS. Porto, Portugal, 2022

Variable	Total		Female (*n* = 29)		Male (*n* = 25)		They do not identify with gender duality (*n* = 5)	
	n	%	*n*	%	*n*	%	*n*	%
Do you have training and experience in BLS?								
No	24	40.7	7	24.1	15	60.0	2	40.0
Yes	35	59.3	22	75.9	10	40.0	3	60.0
If so, at which institution did you complete BLS training?								
School	34	97.1 (1)	22	100.0 (1)	10	100.0 (1)	2	66.7 (1)
Firefighters	1	2.9 (1)	0	0.0 (1)	0	0.0 (1)	1	33.3 (1)
Have you ever had to help someone in life-threatening danger by providing assistance, help, or BLS?								
No	52	88.1	26	89.7	23	92.0	3	60.0
Yes	7	11.9	3	10.3	2	8.0	2	40.0
If so, in what situation?								
Asphyxia	3	42.9 (2)	2	66.7 (2)	1	50.0 (2)	0	0.0 (2)
Drowning	2	28.6 (2)	1	33.3 (2)	0	0.0 (2)	1	50.0 (2)

Burn	1	14.3 [2]	1	33.3 [2]	0	0.0 [2]	0	0.0 [2]
Loss of senses	1	14.3 [2]	0	0.0 [2]	1	50.0 [2]	0	0.0 [2]
Missings	0	0.0 [2]	0	0.0 [2]	0	0.0 [2]	1	50.0 [2]

Note. [1] percentage calculated considering the total number of students who had BLS training. [2] percentage calculated considering the total number of students who helped someone in life-threatening danger by providing assistance, help, or BLS.
Source: The authors (2023).

When asked to what extent they feel capable of performing BLS, five students (8.5%) responded that they feel completely incapable, 17 (28.8%) stated they have doubts about their abilities, 25 (42.4%) said they have theoretical knowledge that has never been put into practice, and 12 (20.3%) feel capable of performing BLS.

From Table 2, it is possible to verify that, in the female gender, the most frequent was to find students who have theoretical knowledge but have never put it into practice (*n* = 15; 51.7%) and the least frequent was to find students who felt completely incapable of providing BLS (*n* = 2; 6.9%). However, although the least frequent response remains the same in the male gender (*n* = 3; 12.0%), the most frequent was finding male students who had doubts about their ability to help someone (*n* = 9; 36.0%).

In the group of students who did not identify with gender duality, the most frequent finding was students who felt completely capable of providing BLS (*n* = 2; 40.0%), but also students who, although having theoretical knowledge, had never put it into practice (*n* = 2; 40.0%). It is also possible to verify that, in the group of students who had BLS training, the most frequent was to find students with theoretical knowledge, but never put it into practice (*n* = 19; 54.3%) and the least frequent was to find those who felt unable to provide BLS (*n* = 1; 2.9%). Among students who never had BLS training, it was more common to find male students who had doubts about their ability to help someone (*n* = 11; 45.8%) (Table 2).

Regarding the scientific field, it was observed that 11 (73.3%) students from Visual Arts and 14 (31.8%) from Science and Technology indicated that they have theoretical knowledge but have never put it into practice, although the latter recorded an equal number of students with doubts about their ability to help someone (Table 2).

Table 2 - Ability to perform BLS, by gender, according to whether or not they have training and experience in Basic Life Support and by scientific area. Porto, Portugal, 2022

Ability to perform BLS	**Female (*n* = 29)**		**Male (*n* = 25)**		**They do not identify with gender duality (*n* = 5)**	
	n	**%**	***n***	**%**	***n***	**%**
I feel completely unable to provide BLS	2	6.9	3	12.0	0	0.0
I have doubts about my ability to help someone	7	24.1	9	36.0	1	20.0
I have theoretical knowledge but have never put it into practice	15	51.7	8	32.0	2	40.0
I feel capable of providing BLS	5	17.2	5	20.0	2	40.0

Ability to perform BLS	Without training or experience in BLS (*n* = 24)		With training and experience in BLS (*n* = 35)	
	n	%	*n*	%
	4	16.7	1	2.9
	11	45.8	6	17.1
	6	25.0	19	54.3
	3	12.5	9	25.7
Ability to perform BLS	Visual Arts (*n* = 15)		Science and Technology (*n* = 44)	
	n	%	*n*	%
	0	0.0	5	11.4
	3	20.0	14	31.8
	11	73.3	14	31.8
	1	6.7	11	25.0

Source: The authors (2023).

Regarding the training needs and importance attributed to BLS, 52 (88.1%) students feel interested or need to acquire more knowledge and training, with 55 (93.2%) considering it important to carry out training and 40 (67.8%) showing willingness to undertake such training. More than half of the sample (*n* = 35; 59.3%) states that the school provides BLS training in the curricular or extracurricular form, stating that it was mainly provided in the 10th grade (see Table 3).

Table 3 - Training needs and importance attributed to BLS. Porto, Portugal, 2022

Variable	**Total**	
	n	**%**
Do you feel interested or need to acquire knowledge or training in BLS?		
No	7	11.9
Yes	52	88.1
Does the school you attend offer BLS training, either as part of the curriculum or as an extracurricular activity?		
No	24	40.7
Yes	35	59.3
If the school provided this training, in which academic year does it take place?		
7th grade	1	2.9 [1]
8th grade	4	11.4 [1]
9th grade	15	42.9 [1]
10th grade	21	60.0 [1]

Do you consider it important to conduct training on BLS?		
No	4	6.8
Yes	55	93.2
Are you available to conduct training on BLS?		
No	19	32.2
Yes	40	67.8

Note. [1] percentage calculated considering the total of 35 students whose school provides BLS training, either in the curriculum or extracurricular form.
Source: The authors (2023).

In Table 4, opinions about BLS are presented. It was found, with the exception of the statements "I would never provide BLS to strangers" and "I would never provide mouth-to-mouth resuscitation to strangers," that the majority agreed very much or extremely with the remaining statements. This situation is more evident in the statement "Teachers should have knowledge about BLS," with 57 (97%) out of 59 agreeing very much or extremely with the statement. Regarding who should conduct the training on BLS, a higher percentage, 51 (86%), strongly or very strongly agreed with INEM or the Firefighters as training entities, although a high percentage of students, 49 (83%), had the same opinion about schools.

The statement "I would never provide BLS to strangers" was the one with which students disagreed the most, with the majority of the sample (*n* = 36; 61%) disagreeing or agreeing little with the statement. The statement "I would never provide mouth-to-mouth resuscitation to strangers" followed, with 23 (39%) of the students disagreeing or agreeing little. It highlighted the high percentage of students who agree very much or extremely with these statements, 21 (36%) in the case of the first and 23 (39%) in the case of the last, with the statement "I would never provide mouth-to-mouth resuscitation to strangers," extreme opinions occurred with the same frequency. It is noteworthy the high percentage (*n* = 40; 68%) who agree very much or extremely with the statement "Any citizen can perform BLS", although those who have the same opinion about the need for all citizens to have knowledge about BLS are also in large numbers (*n* = 40; 85%) (Table 4).

Table 4 - Students' opinions on BLS. Porto, Portugal, 2022

Students' opinion on BLS	I don't agree		I agree a little		I moderately agree		I agree a lot		I completely agree	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Any citizen can perform BLS	2	3.4	8	13.6	9	15.3	15	25.4	25	42.4
All citizens should have knowledge about BLS	0	0.0	2	3.4	0	0.0	8	13.6	42	71.2
Teachers must have knowledge about BLS	1	1.7	1	1.7	0	0.0	9	15.3	48	81.4
Firefighters must have knowledge about BLS	2	3.4	1	1.7	1	1.7	2	3.4	53	89.8
Healthcare professionals should have knowledge about BLS	1	1.7	0	0.0	2	3.4	2	3.4	54	91.5
Higher education students should have knowledge about BLS	1	1.7	1	1.7	6	10.2	10	16.9	41	69.5

BLS should be part of the curriculum in secondary or higher education	1	1.7	1	1.7	9	15.3	18	30.5	30	50.8
The military must have knowledge about BLS	1	1.7	1	1.7	2	3.4	5	8.5	50	84.7
The police must have knowledge about BLS	1	1.7	1	1.7	1	1.7	7	11.9	49	83.1
The training on BLS should be carried out at the workplace	2	3.4	0	0.0	9	15.3	19	32.2	29	49.2
The training on BLS should be carried out in cultural and recreational associations, aimed at community groups	1	1.7	2	3.4	11	18.6	14	23.7	31	52.5
The training on BLS should be conducted by INEM	2	3.4	0	0.0	6	10.2	12	20.3	39	66.1
The training on BLS should be conducted by the Ministry of Health	2	3.4	2	3.4	6	10.2	13	22.0	36	61.0
The training on BLS should be conducted by the Portuguese Resuscitation Council	3	5.1	3	5.1	6	10.2	14	23.7	33	55.9
The training on BLS should be conducted by the Portuguese Red Cross	3	5.1	1	1.7	5	8.5	15	25.4	35	59.3
The training on BLS should be conducted by the Firefighters	2	3.4	1	1.7	5	8.5	11	18.6	40	67.8
The training on BLS should be conducted by the Civil Protection	3	5.1	3	5.1	8	13.6	12	20.3	33	55.9
SBV training should be conducted by schools	2	3.4	0	0.0	8	13.6	16	27.1	33	55.9
I would never provide BLS to strangers	31	52.5	5	8.5	2	3.4	8	13.6	13	22.0
I would never provide mouth-to-mouth resuscitation to strangers	10	16.9	13	22.0	13	22.0	8	13.6	15	25.4
The fear of legal implications can make it difficult for someone to provide BLS	4	6.8	3	5.1	16	27.1	16	27.1	20	33.9

Source: The authors (2023).

Regarding students' knowledge of BLS, Table 5 shows the number of students who answered each of the 20 knowledge test questions correctly.

Table 5 - Number of students who correctly answered each of the questions in the BLS questionnaire. Porto, Portugal, 2022 (*n* = 59)

Question	***n***	**%**
Q1. Knowledge of the survival chain	32	54.2
Q2. Knowledge of the National Medical Emergency Number	57	96.6
Q3. Verification of safety conditions	26	44.1

Q4. Assessment of a victim's level of consciousness	45	76.3
Q5. Signs of cardiopulmonary arrest	36	61.0
Q6. VA permeabilization	16	27.1
Q7. Breathing assessment technique	41	69.5
Q8. Maximum time dedicated to the breathing assessment technique	24	40.7
Q9. Compressions/ventilations rate with a resuscitator	34	57.6
Q10. Compression/ventilation rate with multiple rescuers	40	67.8
Q11. Under what circumstances is circulation assessed	21	35.6
Q12. Moment of requesting differentiated help	14	23.7
Q13. Start of CPR maneuvers with compressions or ventilation	39	66.1
Q14. Knowledge of the pocket mask and its use	27	45.8
Q15. Under what circumstances to suspend BLS maneuvers	28	47.5
Q16. Correct location for performing chest compressions	26	44.1
Q17. Chest depression (in cm) during chest compressions	27	45.8
Q18. Chest compressions rate per minute	19	32.2
Q19. When placing a victim in the recovery position	18	30.5
Q20. Knowledge of the abbreviation AED	7	11.9

Source: The authors (2023).

As for the national medical emergency number, it is practically known by the entire sample (n = 57; 96.6%). More than half of the sample knows the concept of the chain of survival (n = 32; 54.2%), the procedures to assess a victim's level of consciousness (n = 45; 76.3%), the signs of CRA (n = 36; 61.0%), the technique for assessing breathing (n = 41; 69.5%), the compression/ventilation rate with only one rescuer (n = 34; 57.6%) or with several (n = 40; 67.8%), and how to start cardiopulmonary resuscitation maneuvers according to current recommendations (n = 39; 66.1%). In the other questions, the percentage of correct answers is less than 50%, with the last question standing out, regarding the knowledge of the abbreviation AED, as only 7 (11.9%) out of 59 correctly identified the abbreviation for AED.

Additionally, to assess the knowledge related to BLS, the total number of correct answers to the 20 questions of the BLS questionnaire was counted for each student, and it was found that this number ranged from 3 to 16 correct answers (M = 9.78; SD = 3.21), with no statistically significant correlation observed between the score of this test and the student's age (r (57) = -.105; p = .427).

Table 6 presents the analysis of the differences in the questionnaire scores on BLS, between the groups defined by various sociodemographic and socio-educational context variables. From the analysis of Table 6, it is concluded that the different sociodemographic variables and socio-educational context do not significantly influence the test results.

Table 6 - Knowledge related to BLS, according to sociodemographic variables and socio-educational context. Porto, Portugal, 2022

Variable	n	M (DP)		d.f.	t	p
Gender						
Female	29	10.41 (3.43)		52	0.761	.450
Male	25	9.76 (2.79)				
The scientific area they attend						
Visual Arts	15	9.73 (3.92)		56	-0.181	.857
Science and Technology	43	9.91 (2.93)				
Training and experience in BLS						
No	24	8.88 (2.64)		57	-1.828	.073
Yes	35	10.40 (3.45)				
The school you attend offers BLS training						
No	24	8.88 (3.57)		57	-1.828	.073
Yes	35	10.40 (2.83)				
If so, does the training only start in the 10th year?				29	-0.443 (1)	.661
No	19	10.37 (3.40)				
Yes	14	10.79 (1.97)				
Availability for training on BLS?						
No	19	9.00 (3.73)		57	-1.293	201
Yes	40	10.15 (2.91)				
	n	*M (DP)*	*Md*	*U*	z	*p*
Have you ever helped someone in life-threatening danger						
No	52	10.00 (3,16)	10.00	131,500	-1.189	.242
Yes	7	8.14 (3.39)	10.00			

Notes. Regarding the gender variable, it was decided not to include in the inferential analysis the group of five students who did not identify with the gender duality, as they are very few in number; (1) Statistic calculated using the Welch *t* test; d.f. = degrees of freedom; Md = Median

Source: The authors (2023).

DISCUSSION

For evidence-based practice change to occur, it is important to understand the needs of the population, increase satisfaction, and ensure people's safety. About 59.3% have training and experience in BLS. Of these, 97.1% acquired training in a school context. Of the male students, 60% do not have BLS training and 68% showed willingness and motivation to undergo training. The data aligns with the study developed11, in which 57% had BLS training at some stage of their lives. In a study[12], it was found that most people are familiar with the steps of BLS. However, the information must be accessible to everyone and be an integral part of the program content in order to develop and improve knowledge and practical skills. Empowerment tends to generate greater self-confidence for carrying out interventions. The acquired skills are not consolidated because they do not constitute a regular practice, with few training activities for updating knowledge. When asked about how capable they feel to perform BLS on someone, 8.5% feel completely incapable, and 28.8% stated they have doubts about their ability to help someone. The periodic training in BLS improved the knowledge, skills, and effectiveness of BLS practices during training and in real situations, positively affecting self-esteem and self-efficacy[14].

Regarding opinions about BLS, it was found that 61% disagree with the statement "I would never provide BLS to strangers" and 39% disagree that "I would never provide mouth-to-mouth resuscitation to strangers." It is essential to train people who are not health professionals but who are empowered and confident enough to act, from the early years of schooling to higher education[15]. Similarly, it was found that 87.8% of the participants believed that "Any citizen can perform BLS," and 84.8% showed awareness of the need for all citizens to have knowledge about BLS. A study[16] emphasizes the importance of improving knowledge by systematically including it in curricular programs, referring to the use of communication media such as *Facebook*®, *Twitter*®, television ads, and the internet for information about BLS.

About 35.6% know under what circumstances they should assess circulation and 23.7% when to ask for specialized help; 32.2% are aware of the rate of chest compressions per minute, and 30.5% know when to place a victim in the recovery position; about 11.9% were able to identify the abbreviation for AED. Results are consistent with studies that mention difficulties in recognizing situations that require urgent intervention[7,17]. The evolution of algorithms and the pandemic situation have led to some changes in compression/ventilation rates, which may be a confusing factor in knowledge. It is important to quickly assess the victim in order to decide on the appropriate intervention: PLS or BLS[8]. Children and young people, even without mastery and knowledge of the technique of chest compressions, can play an essential role in alerting adults about situations of potential need for BLS[17].

This study presents limitations, namely the small sample size, which may hinder the identification of significant differences in the results found. The assessment of knowledge was carried out through a questionnaire that evaluates theoretical knowledge, not addressing practical skills.

CONCLUSION

General knowledge of EES about BLS is insufficient, requiring improvement in airway management, differentiated help requests, chest compression rate per minute, when to place a victim in the recovery position, and knowledge of the AED abbreviation.

The completion of the training provided the acquisition of knowledge and skills related to BLS practices, with male students expressing more doubts about their ability to assist someone. The need to intervene in the identified areas of lesser knowledge is evident, defining intervention strategies aimed at training and raising awareness for CPR practices.

There is a need to develop studies that allow the assessment of knowledge before, after training, and *follow-up* evaluation to understand the effectiveness of training programs and the consolidation of knowledge in educational scenarios of secondary education.

ACKNOWLEDGMENTS

This study was funded by the Fundação para a Ciência e a Tecnologia – FCT (Portuguese Ministry of Science, Technology and Higher Education), under the grant UIDB/05380/2020. Open access funding provided by FCT|FCCN (b-on)

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Received: 27/02/2024
Approved: 24/07/2024

Associate editor: Dra. Luciana Nogueira

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Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work - **Silva MSGO da, Ferreira MMSV, Rodrigues AM, Sousa CNS de.** Drafting the work or revising it critically for important intellectual content - **Silva MSGO da, Ferreira MMSV, Rodrigues AM, Sousa CNS de.** Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved - **Silva MSGO da, Ferreira MMSV, Rodrigues AM, Sousa CNS de.** All authors approved the final version of the text.

ISSN 2176-9133