Teaching Basic Life Support to Students of Public and Private High Schools

José Maria Gonçalves Fernandes[1,2], Amanda Lira dos Santos Leite[1], Bruna de Sá Duarte Auto[1], José Elson Gama de Lima[2], Ivan Romero Rivera[1,2], Maria Alayde Mendonça[1,2]

Faculdade de Medicina da Universidade Federal de Alagoas[1], Hospital Universitário Professor Alberto Antunes - Universidade Federal de Alagoas[2], Maceió, AL - Brazil

Abstract

Background: Despite being recommended as a compulsory part of the school curriculum, the teaching of basic life support (BLS) has yet to be implemented in high schools in most countries.

Objectives: To compare prior knowledge and degree of immediate and delayed learning between students of one public and one private high school after these students received BLS training.

Methods: Thirty students from each school initially answered a questionnaire on cardiopulmonary resuscitation (CPR) and use of the automated external defibrillator (AED). They then received theoretical-practical BLS training, after which they were given two theory assessments: one immediately after the course and the other six months later.

Results: The overall success rates in the prior, immediate, and delayed assessments were significantly different between groups, with better performance shown overall by private school students than by public school students: 42% ± 14% vs. 30.2% ± 12.2%, p = 0.001; 86% ± 7.8% vs. 62.4% ± 19.6%, p < 0.001; and 65% ± 12.4% vs. 45.6% ± 16%, p < 0.001, respectively. The total odds ratio of the questions showed that the private school students performed the best on all three assessments, respectively: 1.66 ($CI_{95\%}$ 1.26–2.18), p < 0.001; 3.56 ($CI_{95\%}$ 2.57–4.93), p < 0.001; and 2.21 ($CI_{95\%}$ 1.69–2.89), p < 0.001.

Conclusions: Before training, most students had insufficient knowledge about CPR and AED; after BLS training a significant immediate and delayed improvement in learning was observed in students, especially in private school students. (Arq Bras Cardiol. 2014; 102(6):593-601)

Keywords: Cardiopulmonary Resuscitation; Education; Basic Life Support; High School Students.

Introduction

Although the potential beneficial effect of cardiopulmonary resuscitation (CPR) has been well established, less than one in three victims of out-of-hospital witnessed cardiopulmonary arrest (CPA) receive lifesaving help from a bystander[1]. In Brazil, it is estimated that approximately 200,000 CPAs occur annually, with half of the cases occurring out-of-hospital environment[2]. In 2004, the American Heart Association (AHA) recommended that American schools establish a goal to train all teachers and students in CPR[3], in agreement with the guidelines of the International Liaison Committee on Resuscitation (ILCOR), which a year earlier strongly recommended the inclusion of Basic Life Support (BLS) in the school curriculum[4,5].

Mailing Address: José Maria Gonçalves Fernandes •
Universidade Federal de Alagoas, Faculdade de Medicina - Av. Lourival Melo Mota, s/n, Cidade Universitária. Postal Code: 57072-900, Maceió, AL - Brazil
E-mail: jmgfernandes2004@yahoo.com.br
Manuscript received September 13, 2013; manuscript revised December 2, 2013; accepted January 17, 2014

DOI: 10.5935/abc.20140071

Since then, many U.S. states and some European countries have included the teaching of BLS into the curriculum of high-school students and use of automated external defibrillator (AED)[4], as did Norway, which since the beginning of the sixties has established the compulsorily teaching of CPR to schoolchildren[6].

Schools are ideal laboratories to teach the population about basic techniques that comprise BLS[7], considering that adolescents are usually able to perform chest compressions with the same efficacy as adults[8] and are usually present at the scene of a medical emergency, such as homes, malls, airports, stadiums etc.[5]; in Brazil, approximately 8.4 million students are enrolled in high school and of these, 86% study in public schools[9].

However, there is no current legislation that guarantees compulsory BLS training in schools or studies comparing the performance of students in CPR between public and private schools. On the other hand, to produce indicators of education and assist education managers in the evaluation of quality, equity and efficiency of teaching and learning, it is necessary to measure and compare the performance and the skills developed by the students[10]. Thus, the aim of this study was to evaluate and compare the prior knowledge and the degree of immediate and delayed learning among

high-school juniors attending one public and one private high school, after training in BLS and use the automated external defibrillator (AED).

Methods

The present is a longitudinal, prospective study, carried out in one public and one private school, both in the city of Maceió, state of Alagoas, Brazil. These schools were chosen because they had a significant number of participants in the National High School Exams (ENEM) of 2009 and rank among the best in their respective categories. Inclusion criteria were: to be enrolled in the junior year of high school in the selected school; to be chosen by the school coordinator to participate in the project and sign, along with parents or tutors, the free and informed consent form. Exclusion criteria were: students who had had training in CPR and those who could not attend all activities.

The data collection tool was a questionnaire with 15 multiple-choice questions on general knowledge of basic life support distributed as follows: three questions related to the identification of a CPA; four questions regarding the correct sequence of CPR maneuvers; two questions related to compression/ventilation; three questions related to the management of the AED and three questions related to knowledge about CPR and sudden death. Each correct answer was worth 1 point and, therefore, 15 points (the maximum possible score) corresponded to a success rate of 100%.

First, the students answered the questionnaire. After that, they received theoretical and practical training lasting 180 minutes, given by two medical students according to the following sequence: theoretical background of BLS, chain of survival, correct CPR performance with emphasis on chest compressions, AED use and correct positioning of the victim after recovery in accordance with the international scientific consensus of 2010[11,12]. On the same day, and immediately after the theoretical-practical session, the students were reassessed through the same questionnaire. Six months after the course was administered and without previous knowledge of the students regarding the scheduling, the medical students returned to the schools and reapplied the same questionnaire. The same material was used in both schools for practical activities: two adult CPR training manikins (CPR-80CA - Simulacare); disposable masks for mouth-to-mouth breathing and an automated external defibrillator for training (AED Trainer - Cmos Drake). The project was approved by the Ethics Committee in Research of the Federal University of Alagoas, under N. 005604/2011-54.

Statistical Methods

Categorical variables were compared using Fisher's exact test. Continuous variables were expressed as percentages and mean ± standard deviation (for normal distribution) or median with 25th and 75th percentiles (for non-normal distribution), tested for normality using D'Agostino-Pearson omnibus test and analyzed with Student's *t* test or nonparametric Mann-Whitney test.

To identify possible differences in learning among students from the same school, analysis of variance (ANOVA) for repeated measures (followed by Tukey's test) or Kruskal-Wallis test for non-normally distributed data were used. The total odds ratio (OR) and the OR of each question with 95% confidence intervals (95%CI) was calculated to compare the differences in prior knowledge and learning between students of the two schools. Statistical significance was considered as a p value < 0.05 or when the 95%CI of the odds ratio excluded the value 1.

Sample size was calculated at 19 students for each school, considering a significance level of 0.05 (two-tailed) and a statistical power of 85% to detect a 20% difference in learning, based on the results of the ENEM 2009, which showed a mean difference between the two schools of 24% with an estimated standard deviation of 20%[13]. Considering the risk of nonparticipation, the number of students in each school was increased.

Results

Of the eighty-seven volunteers who initiated the activities, thirty students from each school (seven males in each group) answered all three questionnaires. Eighteen and nine students from the public and private schools, respectively, refused to participate in the second or third evaluation. The mean age in the public school was slightly older than in the private school: 16.8 ± 0.70 years vs. 16.5 ± 0.68 ($p = 0.04$). Both schools showed no significant differences regarding gender ($p = 1.0$).

The rates of correct answers of public school students in the prior, immediate and at six months after training were, respectively, 30.2% ± 12.2% (95% CI: 25.7% to 34.8%); 62.4% ± 19.6% (95% CI: 55.1% to 69.8%) and 45.6% ± 16% (95% CI: 39.6% to 51.5%). When compared, these rates were significantly different (Figure 1). On the other hand, the rates of correct answers of private school students in the prior, immediate and at six months after training were, respectively, 42% ± 14% (95% CI: 36.5% to 47%); 86% ± 7.8% (95% CI: 82.6% to 88.5%) and 65% ± 12.4% (95% CI: 60.2% to 69.5%). When compared, these rates were also significantly different (Figure 2).

After, the questions related to the identification of CPA, the correct sequence of CPR maneuvers, the compression/ventilation ratio and AED management were grouped and analyzed, they showed a significant overall increase in knowledge after training with satisfactory late retention of learning among students from both schools (Tables 1 and 2).

Public School vs. Private School

The rates of correct answers among the public school students were significantly lower than those of private schools in the three assessments, as shown in Figure 3. Table 3 shows the odds ratios for the fifteen questions in the three moments between students of the two schools. In the prior evaluation, the private school students showed higher numbers of correct answers in most questions, although only one of them showed statistical significance; after the training, this trend persisted and the private school students were significantly better in 7 and 8 of the fifteen questions, respectively, at the immediate and delayed evaluations.

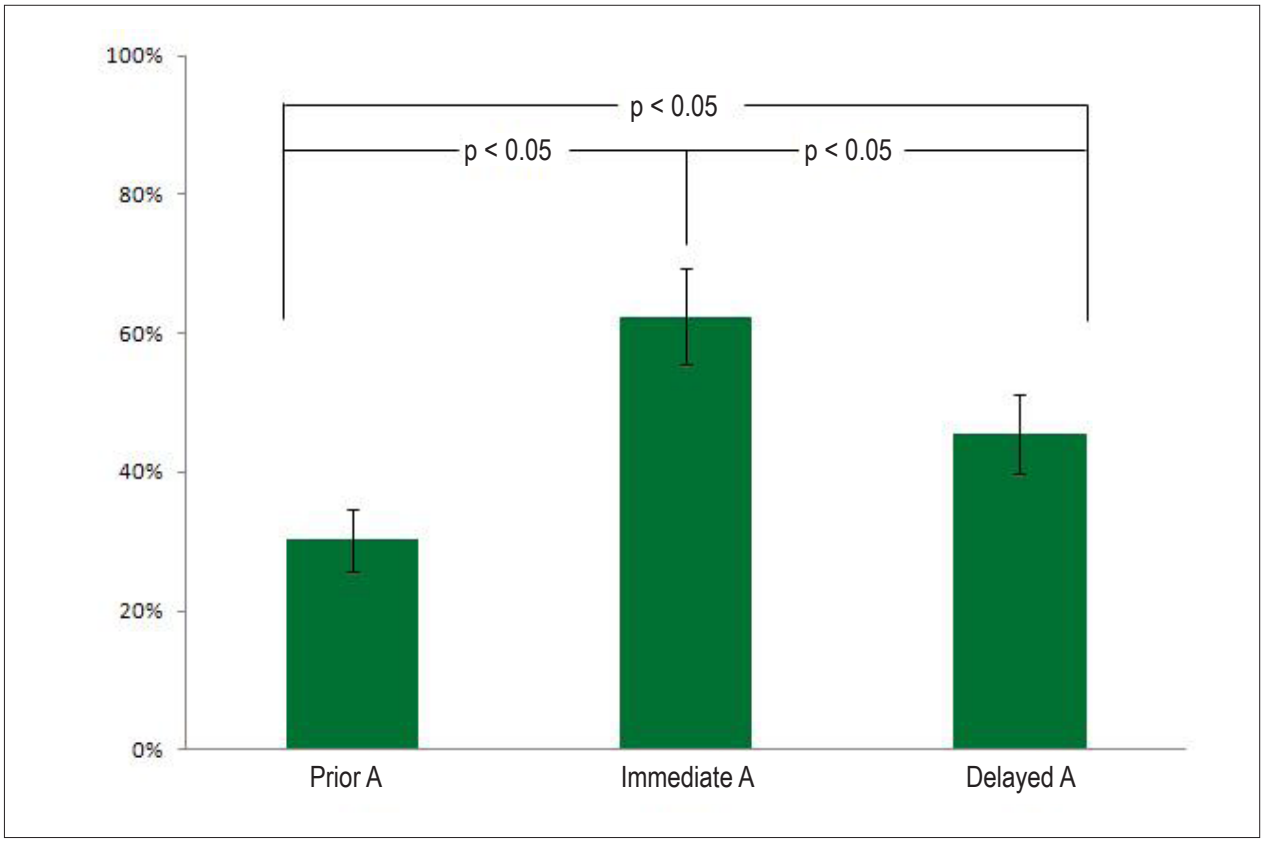

Figure 1 – *Means of correct answers with 95% confidence intervals in the prior, immediate and late evaluations among public school students.*

When the grouped questions were compared, the private school students showed, in the immediate evaluation, significantly higher number of correct answers related to the recognition of the CPA, the correct CPR sequence and AED management (Figure 4); at the late evaluation, this superiority was markedly repeated for the questions concerning CPR maneuvers and compression/ventilation ratio; however, there were significant only for the latter (Figure 5).

Both schools, after the training, obtained rate increases that exceeded 100% of correct answers when compared to baseline knowledge in the immediate evaluation ($p < 0.001$). After six months of training, such increase was still statistically significant compared to baseline knowledge: 53% for the public school and 55% for the private school ($p < 0.001$), demonstrating satisfactory increase and retention of knowledge by the students (Figure 3).

Discussion

This study showed that students in the junior year of high school from public and private high schools showed high rates of learning immediately after receiving the course on basic life support, as well as a satisfactory level of proficiency when evaluated six months after the training, especially the private school students, which had a significantly higher performance in the three evaluations in relation to the public school students.

Studies comparing BLS teaching among students of public and private high schools are scarce. Parnell et al[14] assessed the knowledge and attitudes regarding resuscitation of high school students in New Zealand and found slightly higher rates of knowledge among private school students when compared to public school students, although both had low awareness of CPR principles. This was, however, a cross-sectional study in which a single questionnaire was applied to a mixed population of students trained and not previously trained in CPR.

Miró et al[7], in a longitudinal study, assessing the influence of several factors associated with learning in students from high schools in Barcelona, Spain, observed satisfactory levels of immediately learning and after one year of training in CPR, respectively, 58% and 42%, with significantly better results for students from private schools. However, in this study, approximately 44% of the students had already participated in first-aid courses or were unable to inform that and, after a multivariate analysis, they found no independent association between private school teaching with performance and knowledge retention.

There is substantial evidence that retention of BLS knowledge and skills for its application rapidly decline after the initial training[15]. Several authors have studied this issue, but there is no consensus in the literature regarding the optimal time interval between trainings, which can vary according to

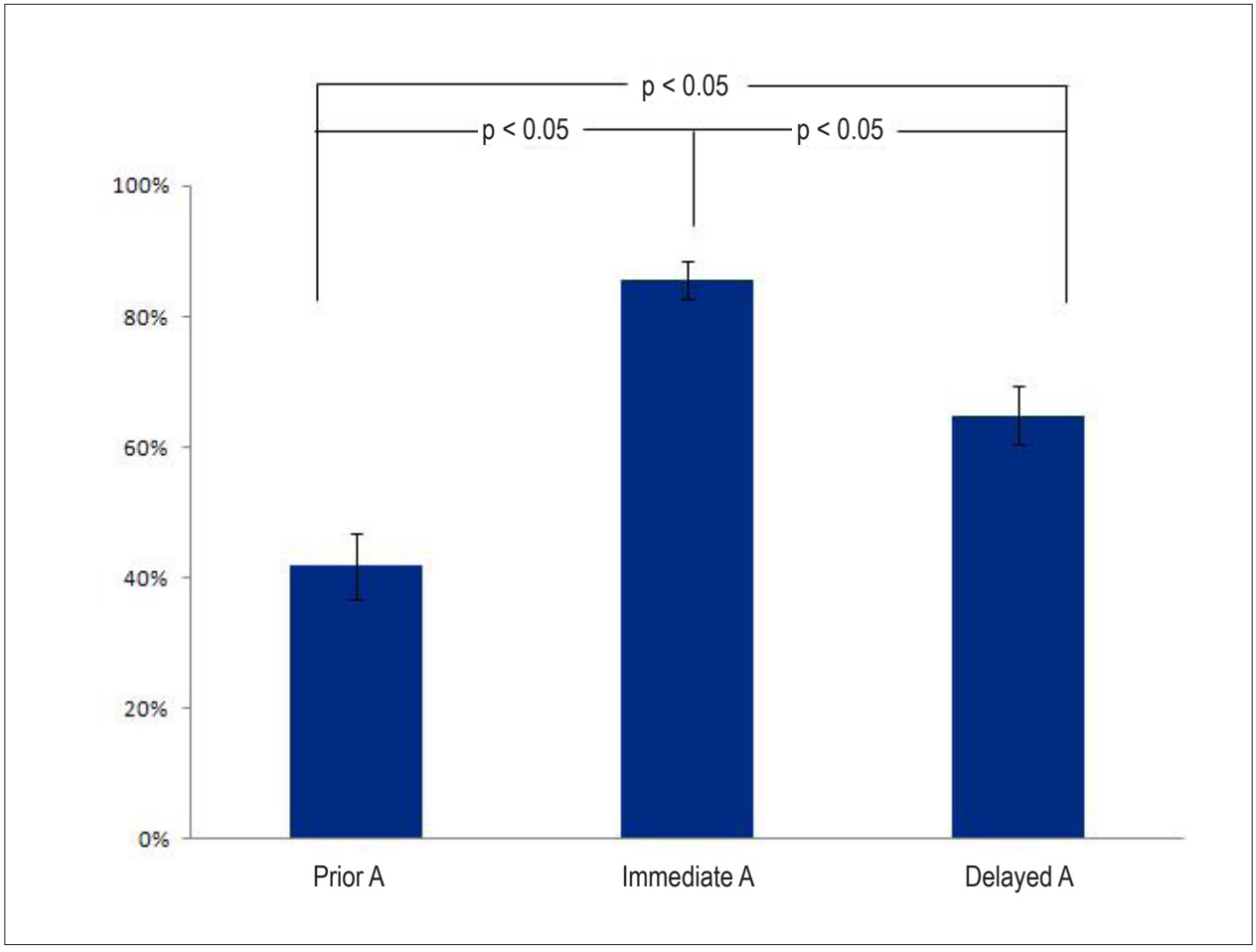

Figure 2 – *Means of correct answers with 95% confidence intervals in the prior, immediate and late evaluations among private school students.*

Table 1 – Rates of correct answers given by Public School students to grouped questions

Grouped Questions	Prior Evaluation	Immediate Evaluation	Delayed Evaluation	p (ANOVA / Kruskal- Wallis)
CPA - Identification (%)	31 ± 23	59 ± 27	40 ± 28*	< 0,001
CPR - Maneuvers (%)	19 ± 19	47 ± 21	47 ± 32†	< 0,001
Compression/Ventilation ratio (%)	25 ± 34	100 (50 – 100)	48 ± 31	< 0,001
AED - Management (%)	34 ± 28	67 ± 28	62 ± 29†	< 0,001

*Data expressed as mean ± standard deviation or median and 25-75th interquartile range. *p > 0.05 vs. Prior Evaluation; †p > 0.05 vs. Immediate evaluation. CPA: Cardiopulmonary arrest; CPR: Cardiopulmonary resuscitation; AED: Automated external defibrillator.*

Table 2 – Rates of correct answers given by Private School students to grouped questions

Grouped questions	Prior Evaluation	Immediate Evaluation	Delayed Evaluation	p (ANOVA / Kruskal- Wallis)
CPA – Identification (%)	28.8 ± 23	80 ± 24	46 ± 30	< 0.001
CPR – Maneuvers (%)	38 ± 27	100 (67 – 100)	67 (33 – 100)	< 0.001
Compression/Ventilation ratio (%)	50 (0 – 50)	100 (100 -100)	100 (50 – 100)*	< 0.001
AED – Management (%)	43 ± 32	84 ± 19	69 ± 17	< 0.001

*Data expressed as mean ± standard deviation or median and 25-75th interquartile range. *p > 0.05 vs. immediate evaluation. CPA: Cardiopulmonary arrest; CPR: Cardiopulmonary resuscitation; AED: Automated external defibrillator.*

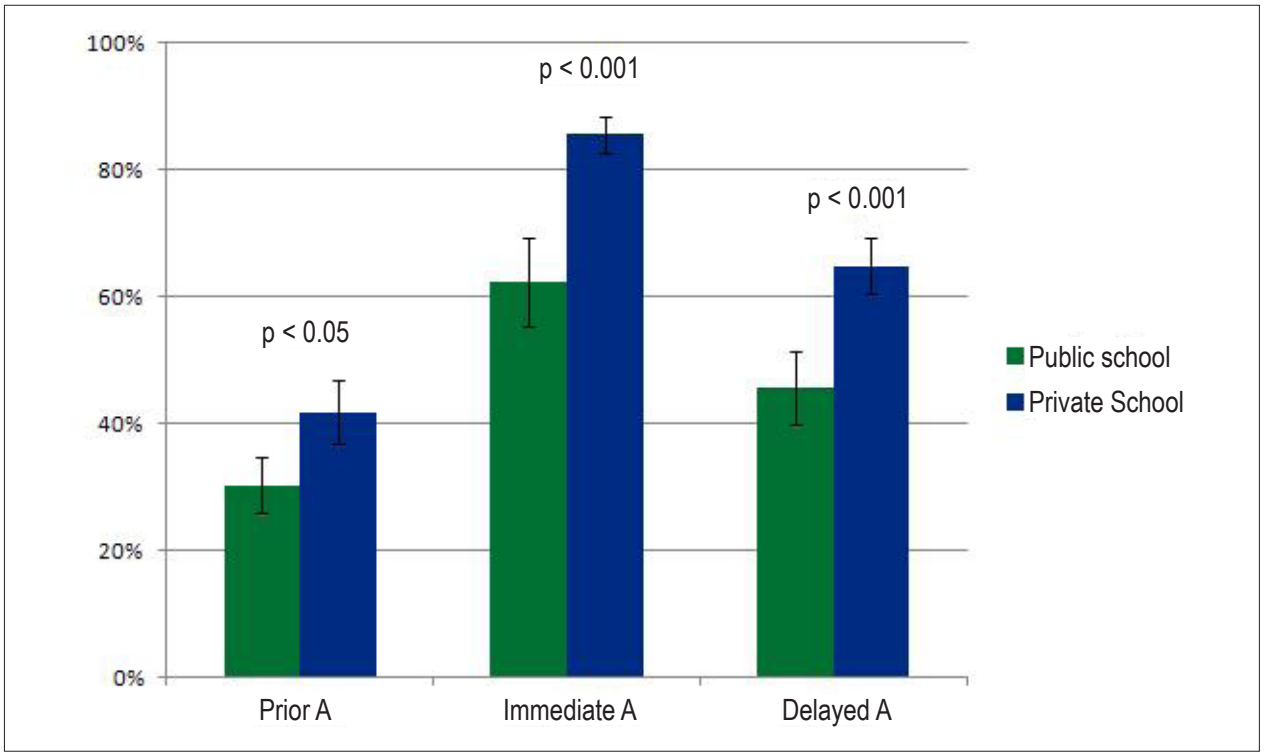

Figure 3 – *Comparison of means of correct answers with 95% confidence intervals in the prior, immediate and late evaluations among students from public and private schools.*

Table 3 – Odds ratio (OR) between the private and public schools with their respective 95% confidence intervals (95% CI) for the fifteen questions in the prior, immediate and delayed evaluations

Questions	Prior Evaluation		Immediate Evaluation		Delayed Evaluation	
	OR (95%CI)	p	OR (95%CI)	p	OR (95%CI)	p
1	2.10 (0.71 to 6.22)	0.28	1.00 (0.36 to 2.75)	1.00	3.76 (1.04 to 13.7)	0.07
2	1.64 (0.53 to 5.12)	0.57	1.64 (0.53 to 5.12)	0.57	1.00 (0.34 to 2.93)	1.00
3	0.35 (0.10 to 1.16)	0.14	8.11 (1.61 to 40.8)	0.010	1.00 (0.36 to 2.76)	1.00
4	0.14 (0.02 to 1.23)	0.10	1.30 (0.31 to 5.40)	1.0	7.86 (1.96 to 31.7)	0.003
5	2.36 (0.63 to 8.92)	0.33	36.0 (8.10 to 160)	0.0001	3.50 (1.11 to 11.0)	0.05
6	2.51 (0.83 to 7.64)	0.17	50.1 (5.97 to 420)	0.0001	53.6 (3.00 to 957)	< 0.001
7	3.06 (0.97 to 9.66)	0.09	2.07 (0.18 to 24.2)	1.00	0.38 (0.13 to 1.09)	0.12
8	2.29 (0.80 to 6.50)	0.19	7.00 (1.38 to 35.5)	0.02	4.03 (1.37 to 11.9)	0.012
9	1.16 (0.40 to 3.35)	1.00	2.67 (0.92 to 7.70)	0.11	1.96 (0.70 to 5.48)	0.30
10	2.33 (0.81 to 6.73)	0.19	10.5 (1.23 to 90.7)	0.03	5.23 (1.66 to 16.5)	0.007
11	1.31 (0.47 to 3.60)	0.80	7.25 (0.82 to 64.5)	0.10	12.3 (2.46 to 60.9)	< 0.001
12	0.86 (0.29 to 2.55)	1.00	1.96 (0.70 to 5.48)	0.30	0.55 (0.18 to 1.62)	0.41
13	18.3 (3.67 to 91.2)	< 0.001	7.00 (1.38 to 35.5)	0.02	4.30 (1.41 to 13.1)	0.02
14	1.71 (0.62 to 4.77)	0.44	4.46 (0.47 to 42.5)	0.35	2.67 (0.84 to 8.46)	0.16
15	2.19 (0.72 to 6.70)	0.27	23.0 (1.26 to 420)	0.005	10.4 (0.53 to 201)	0.12
Total	1.66 (1.26 to 2.18)	< 0.001	3.56 (2.57 to 4.93)	0.0001	2.21 (1.69 to 2.89)	< 0.001

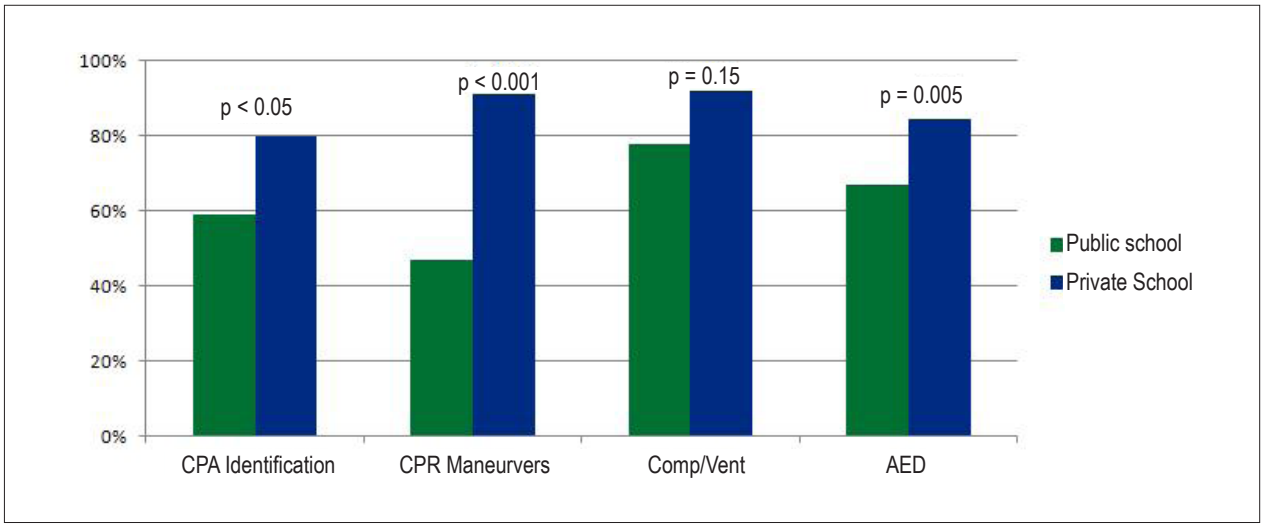

Figure 4 – *Rates of correct answers of grouped questions given by students from public and private schools at the immediate evaluation.*

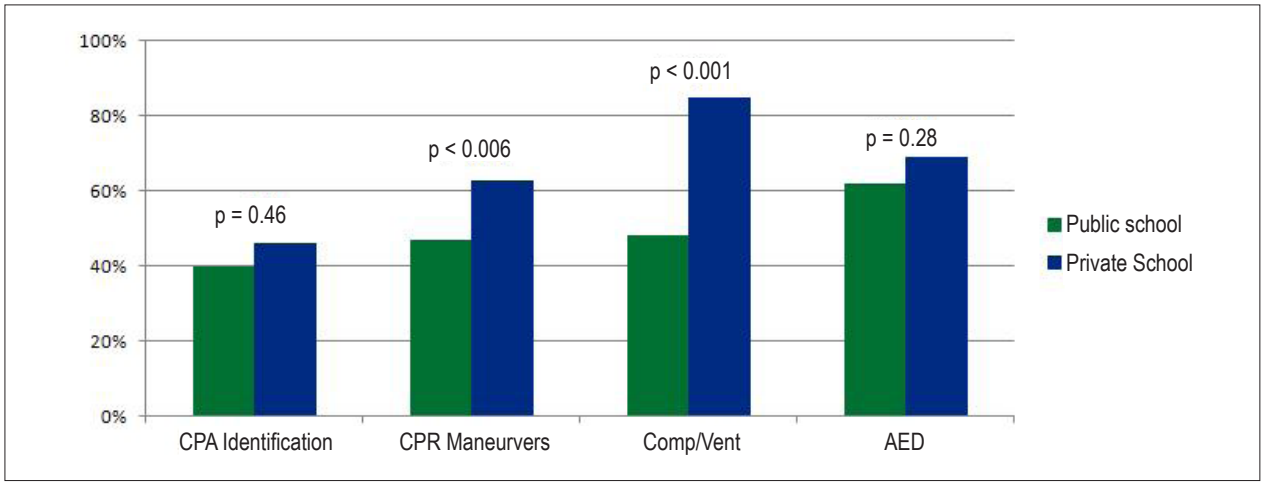

Figure 5 – *Rates of correct answers of grouped questions given by students from public and private schools six months after training.*

the characteristics of the instructors, participants and their proportions, quality of theoretical and practical training and the evaluation results at the end of course[16]. Basic skills, such as asking for help, chest compression and ventilation, decrease three to six months after the training; however, these data are based on heterogeneous studies regarding the course's duration and design, characteristics of instructors and participants and frequency of participants' involvement in real resuscitations[15,16]. Berden et al[17], evaluating a group of nurses in noncardiac units, concluded that training every six months was enough to maintain satisfactory CPR skills. Woollard et al[18], training laymen from a UK airport, observed that the interval in CPR and AED training should not exceed seven months. Moreover, Riegel et al[19], studying lay volunteers, observed a satisfactory degree of retention in CPR and AED, even after 17 months of initial training.

In this study, in relation to general knowledge about CPR, it was observed that the percentage of correct responses in the immediate and late evaluations were significantly higher in the private school group in relation to the public school one; however, in relation to the AED management, public school students showed no significant differences when compared to the private school students in the late evaluation, or significant decrease in learning when assessed six months after the training. Apparently, the learning process with the AED is easier and the skills persist for a longer period than the CPR maneuvers[19,20].

This inequality of results unfavorable to the public school may be justified by a number of factors, such as lack of attention or motivation, less access to information, less qualified teachers, lower income, lower maternal education and availability of quality laboratories[13,21] and is in agreement

with the assessments of the Brazilian Education Development Index (IDEB) and ENEM results, which have successively shown throughout the country a superior performance of private schools students when compared to public school ones[12]. According to the indicators produced by the National System of Basic Education Assessment (SAEB), 96% of students in the senior year of high school with difficulties in reading and interpreting texts of different literary genres are enrolled in public schools, while 76 % of students with reading skills of more complex argumentative texts study in private schools[20].

The insistence in incorporating the teaching of CPR in the school curriculum is based on the fact that children and adolescents trained in CPR are likely to discuss the training with siblings, friends and other family members, raising awareness about BLS and the demand for traditional training courses, which will result in the increase in the number of adults trained in CPR in the community[22]. The sooner they are trained, the better is the retention rate in formal courses[22], and even elementary school students already have sufficient cognitive skills to correctly apply the AED[23].

However, there are potential barriers for the introduction of a training program in schools[24], particularly those involving cost and time availability in the curriculum; additionally, many students and lay people are not willing to provide care due to fear of infection, shock, legal consequences and risk of harming the victim[25]. Moreover, the use of AEDs is hindered by the availability of trained staff and lack of familiarity and responsibility with the device[26]. In the U.S., in 2000, a Federal Law was passed in order to reduce such barriers against the placement and use of AEDs in public areas. Since that time, these devices are already available in many public places such as airports, malls, gyms and public offices[5]. In Brazil, there is no specific legislation requiring the installation of AEDs in public and private environments.

Some studies that compared the standard theoretical-practical training in BLS with theoretical courses only using videos showed conflicting results[27,28]. Thus, we chose to use in this study a theoretical-practical approach, performed by medical students who showed to be qualified, motivated, willing to devote time to scientific projects, and who had already successfully participated in several studies on the teaching of CPR[29-31].

Limitations

This study did not use a practical test as an evaluation tool. Although the written test should not replace the practical test on an individual assessment, it can be a viable alternative as a tool to estimate and compare the efficacy of psychomotor skills, especially in collective training programs[32,33]. The theoretical evaluation used in this study, although based on multiple-choice questions prepared by the AHA, has not been validated in previous studies. And finally, the fact that students showed a satisfactory acquisition of knowledge during the course does not necessarily indicate a good performance of psychomotor skills during CPR in the real world[32].

Conclusions

To the best of our knowledge, this is the first study that identified and directly compared the stages of prior, immediate and delayed knowledge after the theoretical and practical instruction on CPR and AED, among high school students from public and private schools. We observed that students from both schools had inadequate prior knowledge about BLS, but after theoretical and practical training, the students, particularly those from the private school, showed considerable increase in this knowledge with satisfactory persistence of such information, even after six months of training. However, considering the importance of the subject, the universal presence of schools in adolescents' lives and the inevitable decline in the levels of learning, we suggest a definitive incorporation of the BLS teaching as a compulsory subject in the curriculum of public and private high schools in the country.

Acknowledgements

We thank Professors Roohelmann Pontes Silva, from Escola Estadual Moreira e Silva and Ernesto Stadler and João Thomaz Neto, from Colégio Contato Maceió, for supporting this project, as well as the students of the participating schools for their commitment to establish new knowledge. We are also grateful to Professor Maria Aparecida Silva and Dr. Fabiana Yulita for the correction and review of the manuscript.

Author contributions

Conception and design of the research: Fernandes JMG, Leite ALS, Auto BSD, Rivera IR, Mendonça MA; Acquisition of data: Leite ALS, Auto BSD; Analysis and interpretation of the data and Writing of the manuscript: Fernandes JMG, Leite ALS, Auto BSD, Lima JEG; Statistical analysis: Fernandes JMG; Critical revision of the manuscript for intellectual content: Fernandes JMG, Rivera IR, Mendonça MA.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any thesis or dissertation work.

References

1. Nichol G, Thomas E, Callaway CW, Hedges J, Powell JL, Aufderheide TP,et al; Resuscitation Outcomes Consortium Investigators. Regional variation in out-of-hospital cardiac arrest incidence and outcome. JAMA. 2008;300(12):1423-31.Erratum in JAMA. 2008;300(15):1763.
2. Gonzalez MM, Timerman S, de Oliveira RG, Polastri TF, Dallan LA, Araújo S, et al. I diretriz de ressuscitação cardiopulmonar e cuidados cardiovasculares de emergência da sociedade brasileira de cardiologia: resumo executivo. Arq Bras Cardiol. 2013;100(2):105-13.
3. Hazinski MF, Markenson D, Neish S, Gerardi M, Hootman J, Nichol G,et al; American Heart Association; American Academy of Pediatrics; American College of Emergency Physicians; American National Red Cross; National Association of School Nurses; National Association of State EMS Directors; National Association of EMS Physicians; National Association of Emergency Medical Technicians; Program for School Preparedness and Planning; National Center for Disaster Preparedness; Columbia University Mailman School of Public Health Response to cardiac arrest and selected life-threatening medical emergencies: the medical emergency response plan for schools: a statement for healthcare providers, policymakers, school administrators, and community leaders. Circulation. 2004;109(2):278-91.
4. Chamberlain DA, Hazinski MF; European Resuscitation Council; American Heart Association; Heart and Stroke Foundation of Canada; Resuscitation Council of Southern Africa; Australia and New Zealand Resuscitation Council; Consejo Latino-Americano de Resusucitación. Education in resuscitation: an ILCOR symposium: Utstein Abbey: Stavanger, Norway: June 22-24, 2001.Circulation.2003;108(20):2575-94.
5. Cave DM, Aufderheide TP, Beeson J, Ellison A, Gregory A, Hazinski MF, et al; American Heart Association Emergency Cardiovascular Care Committee; Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation; Council on Cardiovascular Diseases in the Young; Council on Cardiovascular Nursing; Council on Clinical Cardiology, and Advocacy Coordinating Committee. Importance and implementation of training in cardiopulmonary resuscitation and automated external defibrillation in schools: a science advisory from the American Heart Association. Circulation. 2011;123(6):691-706.
6. Lind B, Stovner J. Mouth-to-mouth resuscitation in Norway. JAMA. 1963;185:933-5.
7. Miró O, Escalada X, Jiménez-Fábrega X, Díaz N, Sanclemente G, Gomez X, et al. Programa de Reanimación Cardiopulmonary Orientado a Centros de Enseñanza Secundaria (PROCES): conclusiones trás 5 años de experiência. Emergencias. 2008;20:229-36.
8. Jones I, Whitfield R, Colquhoun M, Chamberlain D, Vetter N, Newcombe R.At what age can schoolchildren provide effective chest compressions? An observational study from the Heartstart UK schools training programme. BMJ. 2007;334(7605):1201.
9. Portal Brasil. Educação: Brasil em números. [Acesso em 2013 jun 13]. Disponível em: http://www.brasil.gov.br/educacao
10. Instituto Nacional de Estudos e Pesquisas Educacionais. (INEP). Anísio Teixeira. Qualidade da educação: uma nova leitura do desempenho dos estudantes de 3ª Serie do ensino médio; 2004. [Acesso em 2013 jun 13]. Disponível em: http://www.inep.gov.br
11. Koster RW, Baubin MA, Bossaert LL, Caballero A, Cassan P, Castrén M, et al. European Resuscitation Council Guidelines for Resuscitation 2010. Section 2. Adult basic life support and use of automated external defibrillators. Resuscitation. 2010;81(10):1277-92.
12. Hazinski MF, Nolan JP, Billi JE, Böttiger BW, Bossaert L, de Caen AR, et al. Part 1: Executive summary: 2010 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations. Circulation.2010;122(16 Suppl 2):S250-75.
13. Instituto Nacional de Estudos e Pesquisas Educacionais Anisio Teixeira.. (INEP). [Acesso em 2013 jun 13]. Disponível em: http://www.inep.gov.br.
14. Parnell MM, Pearson J, Galletly DC, Larsen PD. Knowledge of and attitudes towards resuscitation in New Zealand high-school students. Emerg Med J. 2006;23(12):899-902.
15. Bhanji F, Mancini ME, Sinz E, Rodgers DL, McNeil MA, Hoadley TA, et al. Part 16: education, implementation, and teams: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2010;122(18 Suppl3):S920-33.
16. Soar J, Monsieurs KG, Ballance JH, Barelli A, Biarante D, Greif R, et al European Resuscitation Council Guidelines for Resuscitation 2010 Section 9. Principles of education in resuscitation. Resuscitation. 2010;81(10):1434-44.
17. Berden HJ, Hendrick JM, Willems FF, Pijls NH, Knape JT. How frequently should basic cardiopulmonary resuscitation training be repeated to maintain adequate skills? BMJ. 1993;306(6892):1576-77.
18. Woollard M, Whitfield R, Newcombe RG, Colquhoun M, Vetter N, Chamberlain D. Optimal refresher training intervals for AED and CPR skills: a randomised controlled trial. Resuscitation. 2006;71(2):237-47.
19. Riegel B, Nafziger SD, McBurnie MA, Powell J, Ledingham R, Selvia R, et al. How well are cardiopulmonary resuscitation and automated external defibrillator skills retained over time? Results from the Public Access Defibrillation (PAD) Trial. Acad Emerg Med. 2006;13(3):254-63.
20. Gundry JW, Comess KA, DeRook FA, Jorgenson D, Bardy GH. Comparison of naive sixth-grade children with trained professionals in the use of an automated external defibrillator. Circulation. 1999;100(16):1703-7.
21. Sampaio B, Guimarães J. Diferenças de eficiência entre ensino público e privado no Brasil. Economia Aplicada. 2009;13(1):45-68.
22. Roppolo LP, Pepe PE: Retention, retention, retention: targeting the young in CPR skills training! Crit Care. 2009;13(5):185.
23. Lawson L, March J: Automated external defibrillation by very young, untrained children. Prehosp Emerg Care. 2002;6(3):295-8.
24. Mosesso VN. AEDs in schools: lessons learned and to be learned. Resuscitation. 2013;84(4):401-2.
25. Hubble MW, Bachman M, Price R, Martin N, Huie D. Willingness of high school students to perform cardiopulmonary resuscitation and automated external defibrillation. Prehosp Emerg Care. 2003;7(2):219-24.
26. Mercer CW, Rhodes LA, Phillips JR. Automated external defibrillators in West Virginia schools. WV Med J. 2012;108(4):18-24.
27. Isbye DL, Rasmussen LS, Lippert FK, Rudolph SF, Ringsted CV. Laypersons may learn basic life support in 24min using a personal resuscitation manikin. Resuscitation. 2006;69(3):435-42.
28. Miotto HC, Camargos FR, Ribeiro CV, Goulart EM, Moreira MC. Effects of the use of theoretical versus theoretical-practical training on cardiopulmonary resuscitation. Arq Bras Cardiol. 2010;95(3):328-31.
29. Connolly M, Toner P, Connolly D, McCluskey DR. The 'ABC for life' programme Teaching basic life support in schools. Resuscitation. 2007;72(2):270-9.
30. Breckwoldt J, Beetz D, Schnitzer L, Waskow C, Arntz HR, Weimann J. Medical students teaching basic life support to school children as a required element of medical education: a randomised controlled study comparing three different approaches to fifth year medical training in emergency medicine. Resuscitation. 2007;74(1):158-65.
31. Ribeiro LG, Germano R, Menezes PL, Schmidt A, Pazin-Filho A. Medical students teaching cardiopulmonary resuscitation to middle school Brazilian students. Arq Bras Cardiol. 2013;101(4):328-35.
32. Remmen R, Scherpbier A, Denekens J, Derese A, Hermann I, Hoogenboom R, et al. Correlation of a written test of skills and a performance based test: a study in two traditional medical schools. Med Teach. 2001;23(1):29-32.
33. Kramer AW, Jansen JJ, Zuithoff P, Düsman H, Tan LH, Grol RP, et al. Predictive validity of a written knowledge test of skills for an OSCE in postgraduate training for general practice. Med Educ. 2002;36(9):812-9.