Original Article

Theoretical Knowledge of Greek Healthcare and Non-Healthcare Professionals on Basic Life Support

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Abstract

Introduction: The incidence of cardiac arrest remains high and therefore Cardio-Pulmonary Resuscitation (CPR) training of health professionals has been widely implemented. The role of citizen bystanders in the out-of-hospital setting has been widely acknowledged.
Aim: The evaluation of the theoretical knowledge of healthcare and non-healthcare professionals on BLS and use of AED (Automated External Defibrillator).
Methods: 324 health professionals and 141 non-health professionals, trained in 42 BLS courses conducted in 2015, completed an anonymous questionnaire before and after their training. Questionnaire's Cronbach's alpha coefficient was 0.70. We used Student's t-test and one-way ANOVA to evaluate mean differences.
Results: The mean age of the participants was 39.6 ± 9.7 years. 70.3% (N=327) were women and 69.7% (N=324) healthcare professionals. Only 15.5% (N=72) of participants were trained in CPR in the last 6 months period. Men, higher education graduates, and health professionals had higher mean knowledge prior to training. Physicians and registered nurses performed significantly higher scores before and after the course (p=0,045 and p=0,034, respectively). Participants with previous BLS training self rated their knowledge as better (p=0,001). The mean knowledge score revealed a significant increase post training (p = 0.05) and greater increase in non-health professionals (p = 0.05) and women (p = 0.007).
Conclusion: Findings indicate that CPR courses improve knowledge and performance of both health professionals and non-health care professionals. Individuals with more training experience self-assess higher their knowledge than their actual knowledge as assessed through knowledge tests. Future studies should focus on strategies for improving knowledge and skills' retention in trainees with different educational and professional background.

Keywords: basic life support, resuscitation, cardiac arrest, bystander, health professional

Introduction

Even though a cardiac arrest has been characterized as a dramatic event, during last decades it has been proven that successful resuscitation is possible. Nowadays, is widely acknowledged that CPR and defibrillation when provided rapidly and are adequately supported by

high quality post-resuscitation care, the possibility of good physical and neurological recovery is higher (Committee on the Treatment of Cardiac Arrest, 2015; Xanthos et al, 2012).

Favorable outcomes are best achieved by early resuscitation and bystanders' attitudes at the Initial minutes of a cardiac arrest are vital to the patient's survival (Bukiran et al, 2014; Bradley & Rea, 2011). Nevertheless, basic life support (BLS) training and perceptions concerning CPR vary widely among countries or even between different groups in the same country (Kanstad et al, 2011).

The incidence of cardiac arrest remains high globally and the training of health professionals in CPR has been identified as a core skill. Additionally, the role of citizen bystanders in the out-of-hospital setting has been acknowledged. For example, every day in United States a mean of 1,600 individuals face a cardiac arrest and similar are the rates among European countries. According to literacy, cardiac arrest stands as the third cause of death in the United States with approximately 395,000 incidents of cardiac arrest in community settings and 200,000 in hospital settings in 2013. Moreover, the survival rates remain low and a wide diversity in survival rates is noted, indicating that it stands as a sustained public health problem, especially among minorities and those with lower socioeconomic status (Horsted et al., 2007; Merchant et al., 2011; Taniguchi et al., 2012; Daya et al., 2015; Committee on the Treatment of Cardiac Arrest, 2015).

Early enactment of resuscitation care is fundamental for survival with favorable neurological and functional outcome. Thus, the provision of high quality CPR at the right time is essential. (Committee on the Treatment of Cardiac Arrest, 2015). For example, bystander CPR has been correlated with better survival rates and better quality of life for individuals who had an out-of-hospital cardiac arrest and survived (American Heart Association-CPR, 2005). Therefore, training of non-health care professionals is essential not only in order to improve survival but also to change bystander attitudes toward CPR (Hamasu et al, 2009).

Nowadays, there is a growing evidence that the CPR's outcome is related to several determinants such as early intervention, the existence of protocols, constant training, early defibrillation and quality chest compressions. In addition, successful resuscitation following cardiac arrest requires a chain of synchronized responses, often involving complex transitions between health professionals and non-health care professionals. In order to improve health outcomes across different sites of care, all possible rescuers must be trained (and retrained) to provide rapid and effective treatment for cardiac arrest (Committee on the Treatment of Cardiac Arrest, 2015).

Keeping that in mind it is essential to investigate the level of healthcare professionals' and non-health care professionals' (possible bystanders) knowledge in CPR before and after a BLS training seminar. In Greece, there is a limited number of previous studies that assessed that knowledge and the evidence data concerning bystanders' knowledge are quite limited. Characteristically in a Greek study, conducted in 42 cardiology and cardiac units (ICU), only one in three nurses (38.5%) had participated in a formal CPR program after the completion of basic education and in only 12 of the 42 units there was a formal training program in CPR (Merkouris et al., 2003).

Aim if the study

Core aim of the study was to evaluate the theoretical knowledge of health-care and non-health care professionals on BLS with use of AED. In addition, to evaluate the effect of a BLS seminar based on European Resuscitation Council Guidelines (ERC, 2010) on their knowledge in a group of healthcare professionals, teachers and local government employees working in the 6th Regional Health Authority of Greece.

Methodology

Sampling - Data Collection: This is a quasi-experimental study without a control group. In total, 600 questionnaires were distributed (400 to the health professionals and 200 to non-health professionals) during 42 BLS seminars. Each seminar had a duration of 6 hours following the 2010 ERC guidelines. These clinical seminars were conducted from February 7, 2015, to April 4, 2015. Each questionnaire was accompanied by a description of the purpose of the study and additional clarifications were provided. Anonymity, confidentiality and voluntary participation were assured. Permission from the Institutional Review Board of the Department of Nursing, University of Peloponnese was obtained. All participants were informed about the study and informed consent was obtained. They

completed the questionnaire at the beginning and after the end of the seminar.

A number of questionnaires (N=82) were excluded due to partly completion (either prior or after the course) and 53 participants did not sign consent. In total, 465 pair of questionnaires from 324 health professionals (physicians (n=15), nurses (n=175) and nurse assistants (n=134) and 141 non health professionals (teachers of secondary level of education and local government employees) working in the area of the 6th Regional Health Authority (Peloponnese, Epirus, Western Greece and Ionian Islands) were included, with an overall response rate of 77.5% (81% and 70.5% respectively). The courses were part of a project co-funded by the Greek government and the European Union in the terms of the National Strategic Reference Framework (NSFR) entitled "Resuscitators' training and their certification in Basic Cardiopulmonary Resuscitation and population updating & awareness".

Research Questionnaire: Data were collected using a two part anonymous questionnaire, originally developed by Xanthos et al (2012), and consisted of 23 items. The first part with 14 items collects data regarding demographic characteristics, working status, previous BLS training and knowledge on BLS self-assessment. The second part includes eight items used to evaluate the theoretical knowledge of BLS according to the 2010 International Liaison Committee on Resuscitation (ILCOR) recommendations. Finally, a five-point ordinal Likert scale question (not good, moderate, good, very good and excellent) was used to evaluate the BLS self-assessment knowledge (Xanthos et al, 2010). The internal reliability measured by Cronbach's alpha coefficient was 0.70.

Statistical analysis: Continuous variables were quantified and are presented as mean, standard deviation, minimum and maximum value and range while categorical variables are presented in terms of absolute (n) and relative frequencies (%). The normality assumption of the quantitative variables was evaluated by a. the mean to be double than the standard deviation, b. the mean to be equal to the average, c. the kurtosis and asymmetry coefficients, d. the Kolmorogov-Smirnov criterion and e. the probability plots. Moreover, Student's t-test and one-way ANOVA were used to evaluate the mean differences. Pearson's correlation and Spearman's correlation coefficient were used adequately. In addition McNemar's test was performed to identify correlation in the case of paired nominal data while paired samples t-test was used to identify correlation in the case of two quantitative data. A backward stepwise multivariate linear regression analysis was performed for variables that were significantly different ($p<0.2$) in the bivariate analysis. All tests of statistical significance were two-tailed and p-values <0.05 were considered statistically significant. Statistical analysis was performed using the Statistical Package for Social Sciences software (IBM SPSS v. 20.0, IBM SPSS Inc., Chicago, IL, USA).

Results

The participants' characteristics are presented in Table 1. The mean age of the sample was 39.6 ± 9.7 years, with 70.3% to be women and 69.7% healthcare professionals. Meantime from experience was 8.7 ± 9.3 years and mean time since graduation was 15.9 ± 9.8 years. University graduates were 20.2% and Technological Institute graduates were 44.7%. Only 15.5% of participants were trained in CPR in the last 6 months period and 7 years had passed since the last CPR training for all the rest. 97.8% expressed their will to be trained in CPR while 34.4% reported that they had performed CPR. In the self-evaluation question, 13.8% of the participants answered that they had not good knowledge on BLS, 34.6% had medium knowledge, 30.5% had good knowledge, 18.5% had very good, and 2.6% had excellent knowledge.Table 2 presents the bivariate correlations between demographics and their knowledge score regarding CPR before training. Men, higher education graduates, and health professionals had higher mean knowledge score without although the differences to be statistically significant. Physicians and registered nurses showed better knowledge in comparison to assistant nurses and non-healthcare professionals since they performed significantly higher scores before and after the course (p=0,045 and p=0,034, respectively). However, the participant that attended another BLS course even though they did not perform better scores, they self-rated their knowledge as better (p=0,001).

Table1. Demographic characteristics, working status, Basic Life Support training and knowledge self-assessment

CHARACTERISTICS	N	%
Gender		
Men	138	29.7
Women	327	70,3
Age (in years)	39.6[§]	9.7[‡]
Educational level		
Secondary	163	35.1
Tertiary (Technological educational institute)	208	44.7
Tertiary (University)	94	20.2
Years since graduation	15.9[§]	9.8[‡]
Health professionals		
Physicians	15	0.3
Nurses	175	37.6
Assistant Nurses	134	28.8
Non-Health Professionals	**141**	**30.3**
Years of experience	8.7[§]	9.3[‡]
CPR training the last 6 months		
No	393	84.5
Yes	72	15.5
Attendance of a BLS course in the past		
No	160	34.4
Yes	305	65.6
Years since last CPR training	7.0[§]	8.2[‡]
Wish to train in CPR		
No	10	2.2
Yes	455	97.8
Personal experience in performing CPR		
No	305	65.6
Yes	160	34.4
Self-assessment of knowledge on BLS		
Not good	64	13.8
Medium	161	34.6
Good	142	30.5
Very good	86	18.5
Excellent	12	2.6

[§] Mean value
[‡] Standard deviation

Table 2. Bivariate correlations between the demographic characteristics of the participants and their knowledge score regarding CPR before education.

Characteristic	Mean knowledge score before training (SD)	p	Mean knowledge score after training (SD)	p
Gender		0.094§		0.063§
Men	5.35 (1.77)		6.57 (1.43)	
Women	5.03 (1.89)		6.81 (1.23)	
Age (in years)	0.013†	0.778†	-0.033†	0.473†
Educational level		0.279‡		0.091‡
Secondary	4.93 (1.95)		6.60 (1.40)	
Tertiary (Technological Educational Institute)	5.17 (1.78)		6.82 (1.22)	
Tertiary (University)	5.35 (1.85)		6.81 (1.26)	
Years since graduation	0.004†	0.936†	-0.015†	0.744†
Health professionals		0.288§		0.184§
Yes	5.19 (1.84)		6.69 (1.32)	
No	4.98 (1.89)		6.86 (1.21)	
Profession		0.045‡		0.034‡
Physicians	5.33 (1.40)		6.73 (0.73)	
Nurses	5.38 (1.71)		6.82 (1.25)	
Assistant nurses	4.91 (2.03)		6.50 (1.45)	
Non-Health Professionals	4.98 (1.89)		6.86 (1.21)	
Years of experience	0.045†	0.328†	-0.009†	0.844†
CPR training the last 6 months		0.944§		0.397§
No	5.12 (1.89)		6.77 (1.24)	
Yes	5.14 (1.75)		6.63 (1.57)	
Years since last CPR training	-0.017†	0.722†	-0.011†	0.818†
Wish to train in CPR		0.415§		0.913§
No	5.60 (2.36)		6.70 (1.42)	
Yes	5.11 (1.85)		6.75 (1.29)	
Personal experience in performing CPR		0.400§		0.082§
No	5.07 (1.85)		6.82 (1.27)	
Yes	5.22 (1.86)		6.60 (1.34)	
Self-assessment of knowledge of CPR	0.070*	0.133*	-0.065*	0.162*

§ t-test † Pearson correlation ‡ Analysis of variance (ANOVA) * Spearman correlation

Table 3. Participants' answers before and after the BLS Course

Question	Period of assessment				
	before		*after*		
	Wrong answer n (%)	**Right answer** n (%)	**Wrong answer** n (%)	**Right answer** n (%)	**p[§]**
What is the correct sequence of actions during BLS application in an adult victim with one rescuer?	249 (53.5)	216 (46.5)	152 (32.7)	313 (67.3)	<0.001
How can you check the victim's responsiveness?	151 (32.5)	314 (67.5)	60 (12.9)	405 (87.1)	<0.001
What is the primary action for keeping the airway open?	101 (21.7)	364 (78.3)	30 (6.5)	435 (93.5)	<0.001
What is the compression to ventilation ratio in an adult victim with one rescuer?	90 (19.4)	375 (80.6)	10 (2.2)	455 (97.8)	<0.001
What is the compression to ventilation ratio in an adult victim with two rescuers?	199 (42.8)	266 (57.2)	58 (12.5)	407 (87.5)	<0.001
What is the hand position for chest compressions in adult resuscitation?	214 (46.0)	251 (54.0)	66 (14.2)	399 (85.8)	<0.001
How many centimeters do you have to move the chest when performing compressions in adult resuscitation?	157 (33.8)	308 (66.2)	81 (17.4)	384 (82.6)	<0.001
Which is the correct placement of the electrodes of the automatic external defibrillator	176 (37.8)	289 (62.2)	127 (27.3)	338 (72.7)	<0.001

[§] McNemar's test In all questions, there was a statistically significant increase in knowledge about CPR after the training.

After the training, the lowest percentages of correct answers were related to algorithm in basic life support with one rescuer (67.3%), the correct electrode placement of the automatic external defibrillator (72.7%) and the right depth of chest compression in adults (82.6%), while the highest rates of correct answers were given for the relation between the chest compression and rescue breaths with one rescuer (97.8%), the primary action to unblock obstructed airway (93.5%), the rhythm of chest compressions and rescue breaths with two rescuers (87.5%), control of the victim's reaction (87.1%) and the areas where chest compressions must be done in adults (85.8%).

Table 3 illustrates the results in each of the eight multiple choice questions before and after the BLS training. The mean knowledge score before training was 5.1 (SD 1.9), the average value was 5 and the minimum and maximum value were 0 and 8 respectively. The mean knowledge score after the training was 6.7 (SD 1.3), with (min 1 - max 8). The mean knowledge score showed a statistically significant increase after the training ($p = 0.05$). Concerning demographics, mean knowledge score showed a statistically significantly greater increase in non-health professionals in relation to health professionals ($p = 0.05$), and in women in relation to men ($p = 0.007$). In all questions, there was a statistically significant increase in the theoretical CPR knowledge after the training.

Discussion

The successful outcome of CPR in the hospital depends on many factors including the competence of personnel taking part in the effort to revive the victim, the suitability of the equipment in emergency situations and the efficiency of the communication system. But the most important is the quality assurance in the implementation of Cardiopulmonary Resuscitation, which increases the survival rate of cardiac arrest victims. This is one out of a limited number of studies in our country, that evaluated the level of knowledge

concerning CPR in a group of possible bystanders (volunteer trainees, non-health care professionals) and compared their level of knowledge with health professionals before and after a BLS & AED Seminar based on 2010 ERC guidelines. In general, the level of pre-course theoretical knowledge was low in both groups, and there was a statistically significant difference between health professionals with higher education and assistant nurses and non-health professionals.

A limited number of participants had attended a CPR course or completed a refresher test in the last six month. Thus, the low pretest levels of BLS theoretical knowledge may be partly explained by the fact that the majority of our study population had not recertified since their initial BLS training or had not attended a BLS course in the past. This is in accordance with a recent study with participants that attended previous BLS training courses and their pre-test scores were unsatisfactory as well (Toubasi et al, 2015). Quality of cardiopulmonary resuscitation (CPR) performed both by health professionals but also by citizen bystanders has been evaluated. A factor contributing to poor performance in CPR implementation is incorrect application of knowledge received during basic training (Parnell & Larsen, 2007). Therefore, repeated educational programs can improve attitudes toward CPR performance and the use of AEDs.

In a recent study, the number of previous BLS training courses attended was correlated with better theoretical knowledge and greater skill performance (Abolfotouh et al, 2017). That was not the case in our study, indicating that both the quality of the training and the time intervals of the systematic retraining are of high importance. In a previous study in Greece, three hundred ten school teachers' knowledge in BLS/AED was evaluated. Similarly, with our findings, the authors concluded that the seminar increases their level of knowledge concerning CPR especially in teachers with no previous attendance of a BLS course. However, they noted a rapidly knowledge and skill decline after BLS/AED course (Patsaki et al, 2012). In our case, the participants in both groups rated higher scores in theoretical knowledge after the seminar. Additionally, Bukiran et al (2014) in a similar study with 225 nurses found a significant increase in knowledge, in all subgroups, between pretest and posttest scores. However, they noted that pretest scores were significantly higher in nurses who had increased experience in the profession, previously attended a similar course, and worked in the emergency and intensive care department. (Bukiran et al, 2014). In our study registered nurses and physicians had higher pre-course knowledge scores. This can be partly explained by the fact that emergency care in our Health Care System is provided mainly by experienced personnel with adequate education and only during last decade there is an effort to train assistant health personnel in basic life support. To support this hypothesis, we refer to the results from a previous study in Greece with 82 nurses and 134 physicians. The authors concluded that nurses and physicians who had worked in high-risk areas for cardiac arrest scored significantly higher than those who worked in low-risk areas. Moreover, health professionals with participation to more than 5 resuscitation attempts in the previous year, scored significantly better (Passali et al, 2011).

Another possible explanation is that physicians and nurses are generally more motivated to attend BLS courses than assistant nurses or other healthcare professionals since they are commonly the first responders in an in-hospital cardiac arrest. Losert et al (2006) have already supported that the possibility of being the first responder can stand as an essential motivation for CPR training (Losert et al., 2006). Similarly, Kyriakou et al, in their study in a tertiary hospital in Athens found that healthcare professionals' resuscitation knowledge was positively influenced by their attendance of Basic Life Support and Advanced Life Support/Advanced Cardiac Life Support courses (Kyriakou et al, 2010).

Therefore, retention of learned knowledge and skills following BLS courses remains an important challenge since they deteriorate over time (De Regge et al., 2008; Smith et al., 2008; Spooner et al., 2007, Xanthos et al, 2012). Especially when health professionals return back to their regular duties with rare or limited incidences of cardiac arrest in their clinical practice and/or without further practice or refresh training, they lose the opportunity to learn and recall from the experience (Alinier et al., 2009). Conclusively, knowledge retention is based on the regular practice of CPR and systematic re-attendance of a BLS course at regular intervals. However, the optimal interval between the courses remains unclear and recommendations vary internationally from six months to three (Toubasi et al, 2015). Oermann et al (2011) performed a study with nursing students to determine how often one must exercise to retain the adequacy of BLS knowledge. They concluded that students that exercised regularly (at least once

a month) maintained and improved their skills, whereas, those who were trained on CPR once and were not refreshing their skills and knowledge, could poorly perform adequately CPR (Oermann et al, 2011). Therefore, is highly recommended to take measures to retain the skills and knowledge following the BLS training, such as mandatory renewal policy.

The effect of the training on participant's knowledge concerning CPR was obvious based on their higher scores as evaluated after the course. An encouraging founding is that the number of the participants that failed to respond correctly is less than previous studies. For example, in the question regarding the compression to ventilation ratio in an adult cardiac arrest victim with two rescuers the 42,8% gave a wrong answer. Xanthos et al (2012) reported an 80% failure in the same question. Keenan et al (2009) had also reported that 77.3% failed to respond correctly about compression to ventilation ratio (Keenan et al, 2009). We attribute this result to the fact that this ratio has not been modified for several years.

Moreover, there was a significant increase in the self-evaluation of knowledge before and after the course. We assume that this may have a direct effect on the attitudes of participants concerning the provision of CPR, especially in bystanders. Hamasu et al (2009) in a sample of trained students in CPR noticed that the attitude of participants changed dramatically. Those who had received some CPR training within 5 years obtained the highest mean score in comparison to those with over 5 years back training or without previous training. Moreover, as the guidelines are updated and revised from time to time, the need of refreshers training cannot be ignored to correct the poor technique and to ensure changes are addressed (Hamasu, 2009).

In our study even though the mean knowledge scores before and after the course were equal for participants who participated another BLS course in the last six months and the participants with no or older training, their self-reported knowledge was significantly higher. Similarly, Xanthos et al (2012) reported that participants with a previous personal experience and repeated training after graduation rated their knowledge better than the others. Moreover, they also found that more favorable self-assessment was not correlated with a better performance in test before or after training. We believe that the overconfidence that increased self-estimations revealed after a recent BLS course can be beneficial. Verplancke et al. (2008) discussed the effect of different determinants on the quality of BLS by hospital nurses and concluded that higher confidence was correlated with better skills performance in both chest compressions and ventilation (Verplancke et al., 2008). Therefore, systematic intervals of retraining could retain both knowledge and confidence. Abolfotouh et al (2017) concluded that previous attendance of a BLS course affects in a positive way the level of the theoretical knowledge and affects also the attitude concerning CPR provision (Abolfotouh et al, 2017). On contrary, Toubasi et al (2015) found no significant influence of previous exposure to BLS training on their achievement. However, the authors stated that the small sample size may be responsible for the non-statistically significant association (Toubasi et al, 2015).

Previous literacy supports that rescuers who had CPR training were more willing to perform CPR in cases of cardiac arrest in a variety of out of hospital settings. Current evidence supports that provision of CPR by a bystander is strongly linked to improved patient survival. Therefore, CPR training could yield better outcomes linked to a positive attitude and improved quality of CPR (Tanigawa, 2011; Committee on the Treatment of Cardiac Arrest, 2015). A refreshment BLS training session is highly recommended to guarantee trainees' preparedness in actual CPR scenarios (Toubasi et al, 2015).

We evaluated the level of knowledge concerning CPR in a group of possible bystanders (volunteer trainees, non-health care professionals) and compared their level of knowledge with health professionals. Even though there was a significant difference in the theoretical knowledge before the course, after the course their scores are equal to the health professionals. This finding is of great importance since it partly reveals the effect of such courses to the skills and knowledge to possible bystanders and furthermore that the basic algorithm of BLS can stand as an excellent training tool. The current (2015) CPR guidelines focus on high-quality BLS as were also 2010 guidelines (Koster et al., 2010; Gyllenborg et al, 2017). To improve survival of victims with cardiac arrest, it is important to increase rates of bystander CPR in the community (Perkins et al, 2015). Therefore, the focus on the performance of high-quality chest compressions with the adequate use of AED, if available, is essential, even in cases of unwilling bystanders to provide rescue breaths. Early high-

quality BLS is the key to achieve better survival rates (Xanthos et al, 2012; Gyllenborg et al, 2017). Another alternative trend is to promote self-instruction with hands-on practice. This potential seems promising since can be trained many more rescuers with reduced resource utilization (Hsieh et al, 2016). However, traditional BLS course seems to be the gold standard at the moment.

Limitations

Authors acknowledge the existence of a number of limitations. Self-reported data is vulnerable to bias, and there is a possibility a few participants to provide ‘‘expected’’ answers, although anonymity was protected. One possible limitation may also be the fact that we evaluated knowledge right after the end of the course. In addition, we did not evaluated the long-term skill retention. Finally, our sample represent only a specific region from Greece and that limits generalization.

Implications for Nursing and/or Health Policy.

- BLS courses have a direct impact on both the skills and knowledge of possible bystanders (both health and non-health professionals)
- Systematic training in basic life support is essential in order to retain the theoretical knowledge in both healthcare and non-healthcare professionals.
- The basic algorithm of BLS can stand as an excellent training tool.
- The performance of high-quality chest compressions and the use of AED, if available, is essential.
- Educators and health managers should focus on strategies for improving skills' retention in trainees with different educational and professional background.

Conclusion

Our finding supports the hypothesis that systematic educational programs and programmed recertification can improve CPR performance for both health professionals and non-health care professionals. There is evidence based that basic life support courses are associated with improvement in the performance and skills of the participants. But we need to investigate the influence of such courses on the knowledge, skills, and attitudes on different healthcare environments.

Individuals with more training experience state higher levels of self-assessment knowledge. However, this is not in accordance with their actual knowledge as evaluated through knowledge tests. Therefore, the average bystanders lack adequate knowledge in basic life support. Therefore, despite the clear need for standard BLS training for an increased number of possible rescuers, we also have to focus on the retaining of these skills over time. Future studies should focus on strategies for improving knowledge and skills' retention in trainees with different educational and professional background.

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