Original Article

Impact of Basic Life Support Training on the Knowledge of Cardiopulmonary Resuscitation among Final-year Medical Students

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Abstract

Background: Effective and prompt intervention following an episode of cardiac arrest increases survival probability. This underscores the need for basic life support (BLS) training among first-line health-care workers. This study assesses the impact of BLS training among final-year medical students in a Nigerian institution. **Materials and Methods:** Pre- and Post-BLS training questionnaires aimed at assessing knowledge of cardiopulmonary resuscitation (CPR) were administered to 72 final-year medical students. Response to 20 questions were scored (total score 20), collated, and analyzed. Knowledge was graded as good if total score was 15 and above and poor if total score was <15. **Results:** The lowest score pre-BLS training was 6 and the highest score was 16, with a mean of 10.68 ± 2.24. The lowest score post-BLS training was 13 and the highest score was 19, with a mean of 16.8 ± 1.52. Good knowledge of BLS was demonstrated in 8.3% and 88.9% of students pre- and post-BLS training, respectively. **Conclusion:** The knowledge base about CPR of final-year medical students in Nigeria is low but was remarkably improved with a focused BLS training.

Keywords: Basic life support, cardiopulmonary resuscitation, knowledge, medical students

Introduction

Basic life support (BLS) involves a series of initial attempts to restore respiratory and/or circulatory functions in a person whose breathing and/or circulation stopped signifying respiratory or cardiac arrest.[1] Following cardiac arrest, the victim becomes unresponsive and this is associated with significant morbidity if necessary corrective measures are not instituted promptly and effectively. Globally, the incidence of sudden cardiac arrest (SCA) varies from 28.3 in 100,000 persons per year in Asia, to 54.6 in 100,000 persons per year in North America,[2] and from 28 to 244 in 100,000 persons per year with an average of 84 in 100,000 persons per year within Europe.[3] Survival rate from SCA is generally low across nations and continents of the world[4,5] and particularly in developing countries.

The American Heart Association (AHA) recommends five key steps in the basic chain of survival which include recognition of cardiac arrest, activation of an emergency response system, cardiopulmonary resuscitation (CPR), use of automated external defibrillator (AED), and transport to a hospital. The most important step in the sequence of BLS is effective CPR.[6] Modern CPR was officially accepted in 1960 when mouth to mouth resuscitation was combined with chest compressions by William Kouwenhoven and Guy Knickerbocker, who were electrical engineers, and James Jude, a physician and surgeon. Their work marked the beginning of modern CPR and was published in the Journal of the American Medical Association.[7,8]

In 1962, direct current monophasic waveform defibrillation was described;[8] in 1966, the first guidelines for CPR were

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developed by AHA. The International Liaison Committee on Resuscitation (ILCOR) was founded in 1992 to promote international collaboration with a goal of endorsing evidence-based resuscitation science that can be adopted by regional councils to formulate resuscitation guidelines.[9]

BLS skill consisting of maintenance of the airway while supporting circulation remains one of the most effective tools with potential to save lives. A quick response following cardiac arrest forestalls unwanted consequences such as brain hypoxia. There should be early recognition and activation of an emergency response system, immediate high-quality CPR, rapid defibrillation, basic and advanced emergency medical services, and postarrest care. CPR and the use of AEDs are core training components during basic life-support (BLS) provider training and the provider must demonstrate the skills and cognitive knowledge to provide CPR effectively. The AHA and the ILCOR included BLS in their guidelines in 2000.[10]

Survival rates significantly improve when prompt high-quality cardiopulmonary resuscitation (CPR) is performed. The effect of BLS training on the attitudes and knowledge of health-care workers to performing resuscitation has been studied by Källestedt *et al*.[11] Their results showed that health-care workers particularly nurses had improvements in their attitudes to performing CPR and knowledge of CPR after training.

The importance of knowledge of BLS cannot be over emphasized among health workers more so for potential first-line doctors. This study seeks to assess the impact of BLS training on medical students who are about to graduate.

Materials and Methods

This study was conducted among 72 medical students undergoing anaesthesia rotation that had previously no formal training on BLS and are in their final year of study at Bayero University Kano. Following Institutional Ethical Committee approval, all consenting students had a pretest conducted using a questionnaire developed for this purpose, the 20 item questionnaire was developed from the AHA 2015 guideline. The study questionnaire which was pretested and validated among medical interns at Aminu Kano Teaching Hospital, Kano, consisted of demographic variables like age and sex and a second part consisting of items which highlight the respondent's knowledge of BLS.

Over a three months period, the students had turns of BLS training comprising of lectures, video simulations and practical hands on experiences. Lectures included an overview of cardiac arrest lasting for 15 min, adult BLS which combines structured videos and hand practice for 150 min, and practical demonstration of team work dynamics for 15 min. Paediatric BLS (45 min), defibrillation (15 min), and management of choking and respiratory failure (15 min) were also included. All hands-on demonstrations of chest compressions on manikins (adult and paediatric) were performed. The BLS instructors included a consultant, 2 senior registrars, and a critical care nurse. A posttest questionnaire was then given to the respondents and the 2 questionnaires analyzed.

Data obtained were analyzed using Statistical Package for the Social Sciences (SPSS) version 16.0 for window statistical software. Summary statistics was done using means, standard deviations, frequencies, and percentages, and the results presented in the form of frequency tables and charts. Each correct response was assessed as carrying 1 mark while an incorrect response carried 0 marks. The knowledge score was graded as good if the respondent scored 15 points and above and poor if score was <15. Student's *t*-test was used for analysis of continuous variables and Chi-test for categorical variables. $P < 0.05$ was regarded as significant.

Results

This study had 72 respondents participating; Table 1 shows their demographic variables; and the mean age of the participants was 25.93 ± 1.92 years. There were 44 males (61.1%) and 28 females (38.9%).

Only 6 students (8.3%) were graded as having good knowledge of CPR before the BLS training; this improved to 64 students (88.9%) post-BLS [Figure 1].

The minimum score pre-BLS was 6 and maximum score seen was 16 with a mean score of 10.68 ± 2.24. The minimum score post-BLS was 13 with a maximum score of 19 with a mean

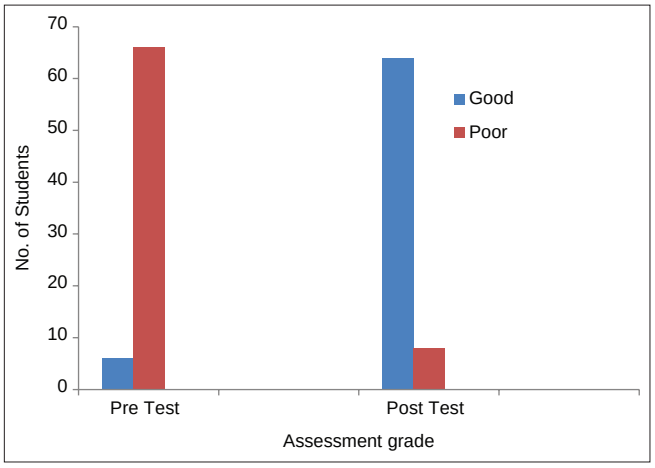

Figure 1: Comparison of assessment grades pre- and post-basic life support training

Table 1: Demographic variables of respondents

Student's demographics	Frequency (%)
Age (years)	
20-24	16 (22.2)
25-29	52 (72.2)
30-34	4 (5.6)
Sex	
Male	44 (61.1)
Female	28 (38.9)

score of 16.80 ± 1.52 [Table 2]. The difference between the posttest and pretest score was highly significant ($P = 0.0001$).

As seen in Table 3, all the respondents knew the full meaning of the abbreviation CPR pre-BLS training. There were 93.1% and 95.8% of the students who knew the components and when to conduct CPR, respectively, 44 out of 72 students (61.1%) knew what to check out for before CPR commences, and 48 students (66.7%) knew the reversible causes of cardiac arrest pretraining. Following BLS training, all respondents knew the full meaning of CPR, components of CPR, and when to carry out CPR. 67 (93.1%) students post-BLS training knew what to first check out for before commencement of CPR, 70 students (97.2%) knew the reversible causes of cardiac arrest posttraining. Table 4 depicting the knowledge of conduct of CPR shows that pretraining, only 27.8% knew the initial time taken for pulse check, 29.1% knew the correct rate for chest compression pretraining, and 22.2% and 39.1% knew the proper chest compression/ventilation ratios for adult and paediatric patients respectively. Only 10 out of 72 students (13.9%) knew at what time intervals pulse check should be carried out during CPR pretraining. Only 9 out of 72 (12.5%) knew the maximum interruption time of 10 s during CPR, and 61.1% and 61.9% of students knew when and how AED is used, respectively.

After the BLS training, 75% of students knew the time taken for initial pulse check, 97.2% knew the correct rate for chest compression, 94.4% students knew the proper chest compression/ventilation ratios for adult and paediatric patients, and 50 out of 72 (69.4%) respondents knew at what time intervals pulse checks should be carried out. There were 65 (90.3%) respondents who knew the maximum time for interruptions during CPR, and 69.4% and 88.9% of respondents knew when and how AED is used, respectively.

Table 2: Average scores pre- and postbasic life support training

	Mean (20) SD	*P*
Pre-BLS mark	10.68	0.0001
Post-BLS mark	16.80	

SD: Standard deviation, BLS: Basic life support

Discussion

The results from this study show a significant increase in score grades post-BLS training with an average score of 16.80 out of 20 when compared to scores seen pretraining (10.68) with a $P = 0.0001$. Scores were graded as good in only 6.9%

Table 3: Medical students' general knowledge on cardiopulmonary resuscitation

Parameters assessed	Pre-BLS assessment (%)		Post-BLS assessment (%)	
	Right	Wrong	Right	Wrong
Meaning of the abbreviation CPR	72 (100)	0	72 (100)	0
Meaning of the abbreviation CAB	52 (72.2)	20 (27.8)	70 (97.2)	2 (2.8)
What are the components of CPR	67 (93.1)	5 (6.9)	72 (100)	0
What is the best time to administer CPR	69 (95.8)	3 (4.2)	72 (100)	0
On whom is CPR performed	66 (91.7)	6 (8.3)	70 (97.2)	2 (2.8)
What is the first step taken during BLS	0	72 (100)	15 (20.8)	57 (79.2)
What should be checked before commencing CC	44 (61.1)	28 (38.9)	67 (93.1)	5 (6.9)
What rules guide CC during CPR	45 (62.5)	27 (37.5)	56 (77.8)	16 (22.2)
Mention reversible causes of cardiac arrest	48 (66.7)	24 (33.3)	70 (97.2)	2 (2.8)

CCs: Chest compressions, BLS: Basic life support, CPR: Cardiopulmonary resuscitation, CAB: CCs, airway, and breathing

Table 4: Medical students' knowledge on basic life support conduct

Parameters assessed	Pre-BLS assessment (%)		Post-BLS assessment (%)	
	Right	Wrong	Right	Wrong
How much time is taken for initial pulse check	20 (27.8)	52 (72.2)	54 (75)	18 (25)
How are the rescuer hands placed on the chest for effective CC	27 (37.5)	45 (62.5)	46 (63.9)	26 (36.1)
What is the proper rate of CC during CPR	21 (29.1)	51 (70.9)	70 (97.2)	2 (2.8)
What airway maneuver techniques are employed during CPR	50 (69.4)	22 (30.6)	68 (94.4)	4 (5.6)
CC/ventilation ratio in 1 rescuer adult CPR is	16 (22.2)	56 (77.8)	68 (94.4)	4 (5.6)
CC/ventilation ratio in a 2 rescuer paediatric CPR is	26 (39.1)	46 (61.9)	68 (94.4)	4 (5.6)
A reliable indicator of effective rescuer breath is	33 (45.8)	39 (54.2)	45 (62.5)	27 (37.5)
At what intervals are periodic pulse check done during BLS	10 (13.9)	62 (86.1)	50 (69.4)	22 (30.6)
What is the maximum interruption time during CPR	9 (12.5)	63 (87.5)	65 (90.3)	7 (9.7)
When is AED used	44 (61.1)	28 (38.9)	50 (69.4)	22 (30.6)
How is AED used	46 (61.9)	26 (39.1)	64 (88.9)	8 (11.1)

BLS: Basic life support, CPR: Cardiopulmonary resuscitation, CC: Chest compression, AED: Automated external defibrillator

of respondents pre-BLS training, this increased to 88.9% following BLS training. This suggests a poor knowledge of BLS among final-year medical students prior to BLS training. Our findings were similar to that seen in a study by Afzalimoghaddam *et al*.,[12] they compared the knowledge and skills of BLS among 90 medical students pre- and post-BLS training in an emergency department and found that mean scores increased significantly from results obtained during their pretest where 35.89% of respondents had good marks to as high as 78.9% following BLS training. In a similar study among Nigerian dental students by Owojuyigbe *et al*.,[8] 68 dental students had pre- and post-BLS training assessment conducted with a questionnaire. Their mean pretest and posttest scores (standard deviation) were (4.7 ± 1.47) and (8.04 ± 1.47), respectively; the difference was statistically significant ($P < 0.01$, their study similarly saw a marked improvement in knowledge of the respondents with 88.2% of them having a posttest score >7 out of 10.

Respondents in this present study before BLS training showed poor knowledge of life saving measures during the conduct of BLS with only 27.8% knowing how much time is taken for initial pulse check, 12.5% knew the maximum interruption time during CPR, and 13.9% knew at what intervals periodic pulse checks are done; these improved to 75%, 80.3%, and 69.4%, respectively, following training. These results are similar to that seen by Chaudhary *et al*.;[13] they demonstrated poor knowledge by participants regarding appropriate actions to be taken during resuscitation including chest compression technique, chest compression rate, and chest compression/ventilation ratio pre-BLS training; and these are essential for the provision of high-quality CPR. It is essential to promptly recognize the need for activation of BLS sequence by initially checking for patients' responsiveness, none of the respondents knew the initial step to take pre-BLS training, and this improved to only 20.8% post-BLS training with a majority of respondents calling for help as a first step during the conduct of BLS, thus emphasizing the need for retraining of health workers.

Patient survival is linked to the promptness of BLS offered and quality of CPR. When rescuers compress at an inadequate depth, survival-to-discharge rates after out-of-hospital arrest have been reported to reduce by 30%.[14] Similarly, when rescuers compress too slowly, return of spontaneous circulation after in-hospital cardiac arrest falls from 72% to 42%.[15] High-quality CPR is the primary component in influencing survival from cardiac arrest, and high-quality CPR performance metric include a chest compression rate of 100–120/min, a compression depth of at least 2 inches or at least a third of AP dimension of chest in infants and children, and no excessive ventilation.[14]\ These are essential for effective resuscitation and to avoid unwanted consequences of cardiac arrest like irreversible brain injury from brain hypoxia.

The improvement in knowledge seen in our study post-BLS training suggests that provision of BLS training during the course of medical school ensures retention of resuscitation skills. Ibrahim *et al*.[16] in their study on knowledge attitude and practice of CPR among clinical students in Nigeria reported a poor knowledge base and suggested that BLS training should start from the first year of medical training with hands on simulation training inclusive; they recommended that this should be reinforced in all successive classes. Pande *et al*.[17] also recommended the incorporation of BLS training into medical curriculum in the first year with reinforcement of the skill every year.

This study was carried out among medical students who are about to end medical training, and thus become among the first-line doctors who attend to emergencies and other life threatening situations. Results from this study emphasize the need for the incorporation of BLS training in medical school curriculums.

Conclusion

We conclude that the knowledge of BLS among final-year medical students is inadequate and there is a significant improvement in their knowledge after undergoing a standard BLS training.

Recommendation

We reemphasize the importance of the incorporation of BLS training in the medical school curriculum, and a BLS certificate should be compulsory for all doctors before commencement internship.

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Conflicts of interest

There are no conflicts of interest.

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