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ORIGINAL ARTICLE

An evaluation of basic life support training among medical students in Southwest Nigeria: A web-based study

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ABSTRACT

Background: Basic Life Support (BLS) is considered a lifesaving measure and sound knowledge is expected among health professionals. Studies conducted among medical doctors and students in many developing countries show deficiencies in knowledge and practice of essential BLS skills. This study assessed the awareness, knowledge, perception, practice, accessibility and barriers to BLS training amongst medical students in South-Western Nigeria, exposing skill gaps and training challenges to inform appropriate solutions.

Methods: This was a cross-sectional descriptive e-survey involving 2nd – 6th year medical students enrolled in 12 regional medical schools. Overall, 553 responses were received over a 3-month period from November 2020 to January 2021 and analyzed using IBM-SPSS 26.

Results: Of the 553 respondents, 79.2% were aware of BLS however only 160 (29%) respondents had good knowledge of BLS principles. Increasing age, higher level of study, prior BLS training and being enrolled in College of Medicine, University of Lagos (CMUL) were significantly associated with a higher knowledge score ($p<0.05$). Majority (99.5%) considered BLS training necessary however, only 51.3% had prior training. Increased level of study correlated with prior BLS training ($p<0.05$) alongside higher BLS uptake by respondents from CMUL (26.7%) and College of Medicine, University of Ibadan (20.9%) compared to respondents from other schools ($p<0.05$). Only 35.4% had ever done Cardiopulmonary Resuscitation. Most respondents reported no confidence in performing BLS (67.1%) or in using an Automated External Defibrillator (85.7%). Unavailability of training opportunities in state (35%), town (42%) and cost (27%) were major barriers to BLS training identified.

Conclusion: Despite a high level of awareness of BLS training, knowledge of BLS principles and its practice is poor among Nigerian medical students, reflecting a need to integrate stand-alone/structured BLS trainings into the medical curriculum to increase participation and accessibility by medical students.

African Relevance

- As medical students are being trained to become future clinicians, it is important that they have adequate knowledge and practice of Basic Life Support for use in emergency situations.
- Adequate knowledge and proper practice of BLS can minimize mortalities associated with cardiac emergencies.
- Private organizations should be encouraged to contribute to improving the uptake of BLS training by providing certified, affordable and accessible BLS trainings and refresher courses to interested medical students and the general populace.
- This study highlights the need for the integration of BLS as a standard training in the medical curriculum across all medical schools in Nigeria and other African countries.

Introduction

Basic Life Support (BLS) has been described as the foundation for saving lives post cardiac arrest. It is the recognition of sudden cardiac arrest followed by activation of emergency response system, early Cardiopulmonary Resuscitation (CPR) and rapid defibrillation using an Automated External Defibrillator [1].

Cardiac Arrest, a potentially life-threatening emergency with poor survival rates, is a sudden and unexpected cessation of blood circulation following failure of the heart to pump effectively [2]. Out-of-hospital cardiac arrest is a leading cause of mortality with about 0.5–1 death/1000 population annually. The figures are likely worse in a developing nation like Nigeria with increasing incidence of cardiovascular disease and limited healthcare resources [3].

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Adequate knowledge of lifesaving measures is vital to ensure that individuals can deliver necessary assistance in emergencies. In the United States (US), BLS training course has been suggested for all health care providers since 1966, particularly those involved in resuscitation [4].

Studies done among medical students in developed countries revealed that about 84% of Japanese final year medical students could not perform standard CPR and Polish medical students had high estimations of their ability to perform CPR which did not correlate with their knowledge and skills. This informed the opinion of the need to improve the art and knowledge of CPR with refresher courses in both theory and skills at least annually for medical students [5–7].

Organizations like the International Liaison Committee on Resuscitation, the European Parliament and the World Health Organization recommend that CPR training be included in secondary school curriculum to increase BLS uptake. This has proved effective in several schools across Europe and USA, however, we are unaware of such program for students at any level of education in Nigeria as BLS training remains the exclusive preserve of medical trainees, health professionals and paramedics [3].

Medical schools in many advanced countries provide BLS training and refresher courses as an integral part of the medical school curriculum due to scientifically proven benefits on survival outcomes, however, in Nigeria, the BLS training is not a standard component of the national curriculum [8].

Also, there are very few studies conducted on BLS knowledge amongst medical students and almost none assessing the perceptions, barriers to the training and practices of medical students as regards BLS training in Nigeria. Therefore, this study aimed to contribute to existing data on the knowledge, perceptions, barriers to training and practices of medical students in Southwestern Nigeria on BLS skills and training by highlighting the knowledge and skill gaps of medical students in South-Western Nigeria on basic life support and revealing barriers faced by these students in accessing BLS training.

Methods

Study design

This study was a descriptive, cross-sectional online survey of medical students in the South – West region of Nigeria.

Setting

The South-West region of Nigeria consists of six states: Ekiti, Lagos, Ogun, Ondo, Osun and Oyo states. It has an estimated population of 34.6 million people and is home to two of Nigeria's three largest cities, Lagos and Ibadan. Of the 44 government-approved medical schools and colleges in Nigeria, 12 are located in this region [9–11].

They are as follows:

- College of Medicine and Health Sciences, Afe Babalola University, Ekiti State (ABUAD).
- College of Health Sciences, Ladoke Akintola University of Technology, Oyo State (LAUTECH).
- College of Health Sciences, Olabisi Onabanjo University, Ogun State (OOU).
- School of Medicine, Babcock University, Ogun State (BABCOCK).
- College of Medicine, University of Ibadan, Oyo State (COMUI).
- College of Medicine, Lagos State University, Lagos State (LASUTH).
- College of Health Sciences, University of Osun, Osun State (UNIOSUN).
- College of Health Sciences, Obafemi Awolowo University, Ile-Ife, Osun State (OAU).
- Faculty of Clinical Sciences, University of Medical Sciences, Ondo State (UNIMED).
- College of Medicine, Ekiti State University, Ekiti State (EKSU).
- College of Health Sciences, Bowen University, Osun State (BOWEN).
- College of Medicine, University of Lagos, Lagos State (CMUL).

Participants

Students in the 2nd (200 level) to 6th year (600 level), enrolled in Southwestern medical schools were eligible for the study. Exchange students and those unwilling to participate were excluded from the study. In each school, an invitation containing the title, aim of the project, and link to the questionnaire was sent to the student body platforms on WhatsApp, Telegram and Twitter. All responses were recorded for the time period of the study which ran between November 2020 and January 2021.

Study tool

Data collection was via a Google form containing a structured, self-administered questionnaire created from previous similar studies(3,12,13) comprising sections which assessed the respondents' sociodemographic characteristics, awareness, perception, knowledge, practice, accessibility and barriers to BLS trainings.

Study size

The sample size was determined using Cochran's formula, $n = z^2pq/d^2$, where n = sample size when target population is over 10,000, p was set at 0.5 (50%) for maximum variability. The sample size calculated was 384 [14].

However, the target population in this study was estimated to be less than 10,000, calculated from the Medical and Dental Council of Nigeria approved quota of students for each school which ranged between 50 and 180 per class depending on the school and hence our sample size was corrected with the formula nf = n / 1 + (n / N) and the minimum sample size was calculated as 336 respondents.[10] An additional 30% was added to the minimum sample size to make up for contingencies such as non-response.

$$N = 336 + (0.3 * 336) = 436.8 \sim 437 \text{ respondents}$$

Data analysis

Collected data was cleaned, coded, and analysed using the Statistical Package for Social Sciences (SPSS) version 26 Software. Frequencies and proportions of descriptive statistics on knowledge, perception, practice and barriers to training on BLS were presented on tables and charts. One-way ANOVA was used to determine the association between demographic, institutional characteristics, awareness and mean knowledge scores. Relationship between qualitative variables was determined using bivariate and multivariate analysis such that $p < 0.05$ was considered statistically significant.

Ethical approval

Informed consent was obtained online from participants and approval was obtained from the Health Research and Ethics Committee (HREC NO: ADM/DCST/HREC/APP/4146) of the Lagos University Teaching Hospital. Use of personal identifiers were avoided and confidentiality was maintained for all participants.

Results

Sociodemographic characteristics of respondents

Overall, 553 responses were received and analyzed. Table 1 shows the study characteristics of the sample. The mean age of respondents was 22.2 ± 2.9 years while the modal age range was 21–25 years. Male

Table 1
Study sample characteristics (*N*=553).

Characteristic	Frequency (%)	Mean Knowledge score ± SD	*P* - value	Awareness	*P*-value
Sex					
Female	303 (54.8)	8.6 ± 3.0	ref	235 (77.6)	Ref
Male	243 (43.9)	8.6 ± 2.9	1.000	199 (81.9)	0.345
Prefer not to say	7 (1.3)	6.0 ± 3.0	0.150	5 (78.8)	0.897
Current Institution					
University A	55 (9.9)	7.5 ± 2.6	ref	38 (69.1)	Ref
University B	17 (3.1)	7.4 ± 2.9	1.000	16 (94.1)	0.344
University C	32 (5.8)	7.7 ± 2.8	1.000	24 (75.0)	1.000
University D	77 (13.9)	10.6 ± 2.4	<0.001*	72 (93.5)	0.008*
University E	77 (13.9)	9.2 ± 2.2	0.149	69 (89.6)	0.061
University F	38 (6.9)	7.3 ± 3.2	1.000	24 (63.2)	1.000
University G	65 (11.8)	8.6 ± 3.6	0.865	45 (69.2)	1.000
University H	52 (9.4)	8.1 ± 2.8	0.999	37 (71.2)	1.000
University I	51 (9.2)	8.3 ± 2.7	0.988	44 (86.3)	0.376
University J	63 (11.4)	8.0 ± 2.8	0.999	51 (81.0)	0.828
University K	15 (2.7)	8.4 ± 2.4	0.998	13 (86.7)	0.880
University L	11 (2.0)	6.2 ± 1.5	0.994	6 (54.5)	0.987
Current Level of Study					
200	90 (16.3)	6.4 ± 2.6	Ref	46 (51.1)	Ref
300	94 (17.0)	8.0 ± 2.9	0.131	70 (74.5)	<0.001*
400	142 (25.7)	8.0 ± 2.8	0.009*	110 (77.5)	<0.001*
500	128 (23.1)	9.2 ± 2.7	<0.001*	117 (91.4)	<0.001*
600	99 (17.9)	10.4 ± 2.5	<0.001*	96 (97.0)	<0.001*

* Significant values.

to female ratio was 1.2:1. Highest proportion of respondents were from Universities D (13.9%) and E (13.9%). Highest number of respondents were in 400 level (25.7%) and 500 level (23.1%).

Awareness of BLS

Of the 553 respondents, most (79.2%) had heard of BLS; school (61.0%), digital media (13.0%) and social media (8.7%) were the highest sources of first information. Among respondents that were aware of BLS, 274 (62.6%) respondents had seen BLS being performed and only 225 (51.3%) respondents had had any form of BLS training (Fig. 1).

Chi-square analysis showed a statistically significant association ($p<0.05$) between level of training, institution and awareness of BLS. Most (73.7%) respondents who had heard of BLS were in 400–600 level which are higher levels of study. Greater than 80% of respondents from Universities B, D, E, I, J and K were aware of BLS compared to Universities A, C, F, G, H ad L which had awareness levels less than 80%.

There was also a statistically significant association ($p<0.05$) between academic class and direct observation of Basic Life Support as students in 600 level (81.8%) were more likely to have seen BLS being done compared to students in 200 level (17.8%).

Knowledge of BLS principles

In total, 439 responses were analyzed and the mean knowledge score was 8.6 ± 3 [range 2–15]. Only 29% of respondents had good knowledge; 34.7% had fair knowledge and 15.3% had poor knowledge of BLS principles. Of those with good knowledge scores, 36.5% were from University D followed by 16.5% from University E.

Multifactor ANOVA of study characteristics with knowledge score demonstrated statistically significant ($p<0.05$) relationships of age, level

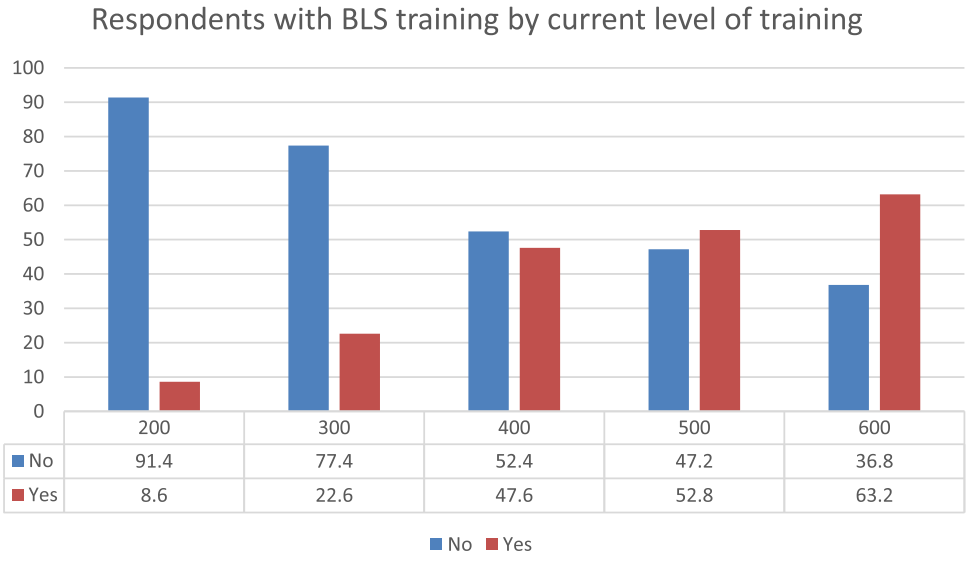

Fig. 1. BLS training by level of study (*N*=553).

Table 2
Knowledge of BLS (*N*=439).

Characteristics	Correct (%)	Incorrect (%)	Don't Know
BLS stands for	437 (99.5)	2 (0.5)	-
Picture of an AED	419 (95.4)	20 (4.6)	-
When to start CPR	287 (65.4)	132 (30.1)	20 (4.6)
Placement of hands when performing CPR in adults	266 (60.6)	119 (27.1)	54 (12.3)
Where can BLS be done	401 (91.3)	20 (4.6)	18 (4.1)
BLS steps for adults	125 (28.5)	209 (47.6)	105 (23.9)
Compression: ventilation ratio for adults	221 (50.3)	73 (16.6)	145 (33.0)
Compression: ventilation ratio for children	96 (21.9)	147 (33.5)	196 (44.6)
Next step if unwilling to perform mouth-mouth CPR	272 (62.0)	54 (12.3)	113 (25.7)
Frequency of role switching in two-rescuer CPR	71 (16.2)	176 (40.1)	192 (43.7)
Correct steps in operating an AED	172 (39.2)	111 (25.3)	156 (35.5)
Signs of airway obstruction	305 (69.5)	86 (19.6)	48 (10.9)
First aid for a choking child	307 (70.0)	63 (14.4)	69 (15.7)
Next step if patient is not breathing but has a pulse	188 (42.8)	142 (32.3)	109 (24.8)
What is unimportant in delivering breaths	186 (42.4)	115 (26.2)	138 (31.4)

of study, current institution and prior BLS training with knowledge score (Table 1). Increasing age and increasing level of study correlated with an increase in knowledge score. University D had the highest mean knowledge score (10.6 ± 2.4) and University L (6.2 ± 1.5) had the lowest mean score. Respondents that had received prior BLS training had a much higher mean score (10.2 ± 2.5) compared to those without (6.8 ± 2.4).

After controlling for level of study, there remained a significant difference in mean knowledge scores between institutions [$F_{([11],426)} = 4.098$, $p = 0.001$] and prior BLS training [$t(14.619) = 437$, $p < 0.001$]. University D had higher mean knowledge scores (9.9) compared to University A (7.3), B (7.1), C (7.7) and J (8.0). There were no significant differences in scores between the other institutions. Respondents that had received prior BLS training had significantly higher scores (10.0) compared to those without training (7.1).

Table 2 further describes the results of the knowledge of BLS principles. Most respondents knew the full meaning of BLS (99.5%), could correctly identify an AED (95.4%) and knew where BLS could be performed (91.3%). Less respondents were aware of when to start CPR (65.4%), placement of the hands when performing CPR in adults (60.6%), compression-ventilation ratios for adults (50.3%), or correct steps for BLS in adults (28.5%). Only 62% responded that the next step if unwilling to do mouth-to-mouth ventilation was to carry out compression-only CPR. Knowledge of BLS for children was particularly poor as only 21.9% knew the compression–ventilation ratios for children.

Perception and practice of BLS training

Overall, 553 responses were analyzed of which most (82.4%) respondents reported a willingness to resuscitate victims however, most respondents had never performed CPR before, neither on a patient (83.2%) nor on a mannequin (64.6%). Majority reported no confidence in performing BLS (67.1%) or in using an AED (85.7%). Among eyewitnesses to a traumatic event, 73% of respondents had never attempted to resuscitate victims.

Nearly all respondents (98.9%) felt it was necessary to receive BLS training in medical school and 85.4% of respondents were willing to pay for this training if necessary. Almost all respondents (98%) were willing to perform BLS in any setting and 97.5% were willing to use an AED. Also, 96.2% agreed that BLS training was not restricted to medical doctors.

About half (51.3%) of respondents (*n*=553) had undergone BLS training and 4.4% of those were in 200 level, 11.6% in 300 level, 24.4% in 400 level, 27.1% in 500 level and 32.4% in 600 level ($p<0.05$). Fig. 1 further shows the proportion of respondents per level who had undergone training. BLS training was also noted to vary by institution as higher proportions of respondents who had received training were from Universities D (26.7%) and E (20.9%) compared to the other institutions which ranged from 0.9% in University L to 10.2% in University J ($p<0.05$). Most (96.4%) had received training during medical school and majority had in-person training (77.8%). In addition, 94.7% of respondents who had received training felt that a retraining would be necessary.

The influence of knowledge on perception and practice

Respondents that had good knowledge scores were more likely to have good practice scores (71.8%) compared to those who had poor knowledge (14.9%) however this was not statistically significant.

Accessibility and barriers to training

More than half of respondents (67.3%) were unsure of availability of BLS training in their location and 85% of respondents were unaware of how often it was offered. Similarly, 78% of respondents were unaware of the cost of BLS training in their location.

A large proportion of respondents cited unavailability in town (42%) or state (35%) as reasons for not participating in BLS training. Lack of time and cost of training was cited by a fewer number of respondents, 22% and 27% respectively. Only 2.5% felt comfortable with the teaching covered in their school curriculum (Fig. 2).

Discussion

This study showed that about 4 in every 5 participants (79.2%) had heard about BLS, similar to findings from studies done among medical students in other developing countries such as India and Pakistan where majority, 377 (84.6%) and 243 (81%) respondents respectively, had heard about BLS training [13,15].

About half (51%) of respondents in this study, most of whom were in the clinical years (4^{th} – 6^{th} year), had undergone BLS training. In keeping with other studies, there was a significant increase in knowledge scores with increasing level of study which can be attributed to the higher likelihood of having undergone BLS training [16].

There is a large disparity in proportions of students that had undergone BLS trainings across institutions and University D which had the highest proportion (77.9%) demonstrated significantly higher knowledge scores. Including BLS training as a graduation requirement might help standardize competencies across medical schools and motivate all students to attain BLS training.

Majority of the respondents (65%) were able to recognize when to start CPR but demonstrated poor knowledge of BLS protocol with only 28.5% of respondents correctly identifying the BLS steps. Only 0.5% of respondents answered all questions correctly compared to 10% of medical students in the UK where 80% (*n*=2999) of students had completed

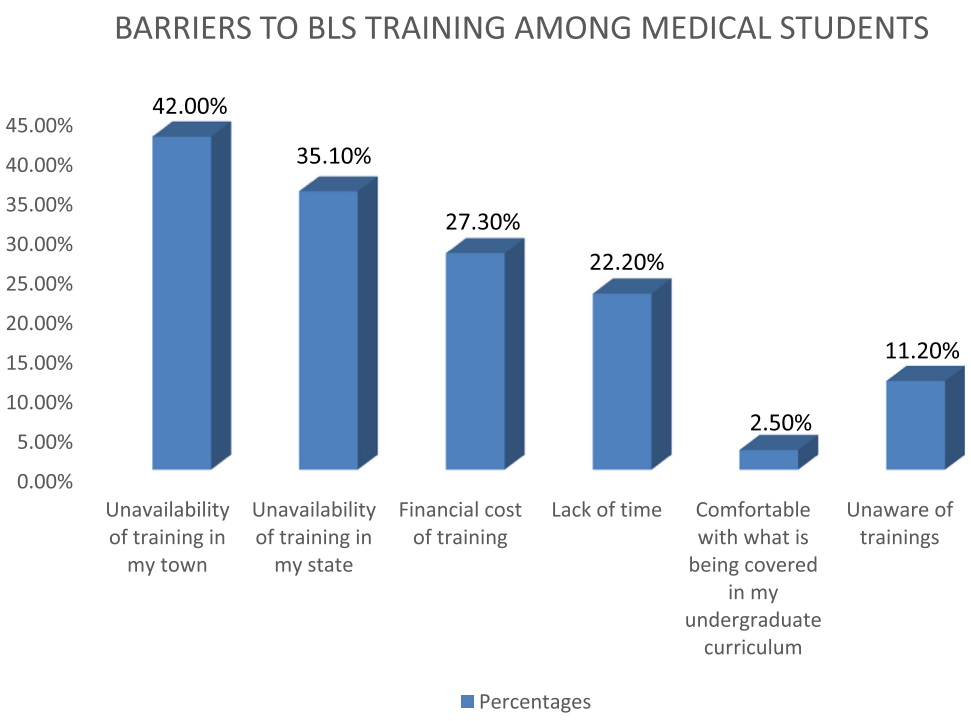

Fig. 2. Barriers to BLS training among medical students (*N*=553).

BLS as part of their undergraduate training [17]. The mean knowledge scores of 2.6/5 among medical students in the UK was similar to our findings of 8.6/15 and to findings in Saudi Arabia of 7.8/14, highlighting fair but inadequate knowledge of BLS principles among students [17,18].

As an essential lifesaving skill, members of the healthcare team such as medical students should demonstrate adequate knowledge by greater than average scores. Although subpar, this study population demonstrates better knowledge than medical students in University of Port Harcourt, South–South region of Nigeria where only 25.4% (*n*=177) students scored greater than 50% in a survey examining knowledge of CPR [7]. This major gap in knowledge should be taken into account in the development of the medical school curriculum in the coming years (Table 3).

Medical students very well recognize the importance of BLS and 99% agreed that incorporating the training into medical school is necessary. Majority (94%) of students also felt that periodic refresher courses would be necessary. Previous studies have also demonstrated a positive correlation between the number of courses taken and increased knowledge scores [17,19].

Majority (85.4%) of respondents were willing to pay for the training and the major reason cited for having not done the training was unavailability (42%). Only 24.4% of students were aware of where they could obtain BLS training. A study in Nigeria showed that there are only 1.5 courses available per 10 million population in Nigeria [12]. This highlights an opportunity for independent and accredited bodies to take stand-alone BLS trainings to medical students in a bid to supplement the medical school curriculum and improve BLS knowledge and skills amongst medical students.

Although 82.4% indicated a willingness to perform resuscitation on a live patient if the opportunity presents, only about 24% had ever attempted to do so after witnessing an event. The predominant reasons given were fear of inflicting further harm (62.2%), anxiety and lack of confidence (59.2%). Only one-third of respondents' self-reported confidence in performing CPR and 64.6% had never even attempted CPR on a mannequin. In Saudi Arabia, only 32.4% (*n*=1261) responded in an emergency and the significant determinant of response was having had formal BLS training [20]. Formal BLS training and retraining will increase confidence, knowledge and skills that can translate to improved rates of by-stander CPR and improved survival from cardiac arrests.

Despite continued efforts to reduce cardiovascular risk factors in the general population, immediate bystander CPR remains one of the strongest predictors of survival following cardiac arrest. It is therefore prudent that knowledge and practice of lifesaving measures such as BLS is promoted at all levels of medical training [21].

This study assessed factual knowledge of BLS principles and therefore cannot determine the ability or skills of students in delivery of BLS. However, Brown et al demonstrated that accurate knowledge of CPR guidelines is associated with increased odds of correct performance. Subsequent studies may evaluate BLS skills delivery by medical students in a real or simulated environment [22].

Table 3
Relationship between knowledge, perception and practice scores (*N*=439).

Characteristic (*n*= 439)	Good knowledge (%)	Fair knowledge (%)	Poor knowledge (%)	*p*-value
Perception				
Good	85 (100.0)	193 (100)	160 (99.4)	0.881
Poor	0 (0)	0 (0)	1 (0.6)	
Practice				
Good	61 (71.8)	62 (32.1)	24 (14.9)	0.653
Poor	24 (28.2)	131 (67.9)	136 (84.5)	

Conclusion

This study showed that although most respondents had heard about BLS, only a few of them had good knowledge about the principles of resuscitation and this was influenced by increasing level of study, the enrolled institution and having had prior BLS training.

This study also highlighted that the high levels of awareness of BLS among medical students is not matched by adequate knowledge and practice of BLS.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. It is recommended to the Federal Ministries of Health and Education that BLS training which is an important life-saving skill be included in the welcome package for second year medical students with refresher training biannually.
2. It is recommended that States Ministries of Health encourage the springing up of independent BLS training sites by certified trainers especially in locations without any available training programs.
3. It is recommended that the Medical Education Committees of medical schools' revamp currently existing resuscitative trainings in the medical curriculum to include a more robust and hands-on training experience with enough equipment to meet the learning needs of students.
4. It is recommended that private health organizations offering BLS trainings perform more vigorous awareness of their services and also expand to areas with no available training. It is also advised that these services be made more affordable to suit the financial capacity of average medical students.
5. It is recommended that medical students be proactive about the learning of standard life-saving skills, obtain certifications and receive refresher trainings while in medical school.

Dissemination of Results

Results of this research were disseminated informally to members of the Medical Education Committee of College of Medicine, University of Lagos and also to a private organization providing AHA certified emergency competency trainings.

Authors' Contribution

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: OS contributed 25%; IF 25%; AA 15%; AB 15%; AO and PA contributed 10% each. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of Competing Interest

The authors declared no conflicts of interests.

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