Original Article

Cardiopulmonary resuscitation skills in some Nigerian secondary school students

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Abstract

Background: While many countries of the world have incorporated the teaching of cardiopulmonary resuscitation (CPR) into their schools curricula, there has been little or no effort made towards this in Nigeria. The aim of this study was to find out whether exposure of some Nigerian secondary school children to the conventional CPR would result in significant change in their CPR skills immediately after the training.

Methods: It was a quasi-experimental study design carried out in 2012 with participants drawn from both private and public secondary schools in Obio / Akpor Local Government Area in Port Harcourt City, Rivers State, Nigeria. The initial cohort (stage I) involved 400 participants from senior secondary school 1 and 2 (SS1) and SS2) when their baseline CPR skills were assessed and immediately after the CPR training (stage II) when the participants dropped to 347 [189 (54.5%) females; 158 (45.5%) males]. They were exposed to both class room teachings and the practical hands-on sessions using manikins in line with the American Heart Association (AHA) guidelines. The data was analyzed using ANOVA and *t*-test.

Results: Although the participants had virtually no CPR skills at the beginning, they gained very substantially immediately after the training which was found statistically significant ($P < 0.05$). They showed much enthusiasm in the training with high percentage of them indicating willingness not only to provide bystander CPR to their relatives but to strangers and trauma victims. Over 98% of them wanted CPR to be formally taught in Nigerian secondary schools.

Conclusions: The CPR skills of the Nigerian students improved statistically with many ready to offer bystander CPR. It was recommended that CPR training programme should be incorporated into the curriculum of secondary school education in Nigeria.

Keywords: Cardiopulmonary resuscitation, Nigeria, secondary school students, skills

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Introduction

Reports indicate that out-of-hospital cardiac arrest (OHCA) remains on the increase in many parts of the world.[1-4] Although the teaching of cardiopulmonary resuscitation (CPR) skills among secondary school students is internationally encouraged and many advanced countries of the world have complied, the case is different in Nigeria. In 1961, Norway became the first country to teach CPR to schoolchildren, followed 6 years later by Czechoslovakia.[5] Since then, CPR training has been offered sporadically to students in

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Scandinavia, Great Britain, Canada, the United States, and other countries.[6]

The Austrian Red Cross has started lifesaving first aid training for children as young as eight.[6] CPR skills are taught as an optional component of New Zealand school curriculum, in both primary and secondary schools. The American Academy of Pediatrics has opined that schools play an important role in providing students with basic emergency lifesaving skills as part of the school health education program. It has been reported that training of school children will make it possible to train 20% of any population in CPR, as the minimum standard recommended by the American Heart Association (AHA).[7]

In fact, the International Liaison Committee on Resuscitation strongly recommended that instruction in CPR should be incorporated as a standard part of the school curriculum.[8] This will act as part of their preparation for response to medical emergencies both in the school and at home. It is believed that on a long-term basis, children trained in CPR will contribute significantly to the number of adults trained in any community. It is expected that this will have a direct benefit of increasing the number of people trained to perform CPR, thereby increasing the likelihood that a victim of OHCA will promptly receive CPR. In addition, students are likely to train family members and share materials used in school-based program at home, which can further increase the program's yield in terms of the total number of members of the community trained per unit of class time expended.[9,10] Accordingly, many countries have initiated CPR programs for school children or have conducted research works to support the justification of CPR in schools.[11-16]

The only published related reports among secondary school students in Nigeria were on their awareness of CPR,[17] attitude to CPR,[18] and knowledge.[19]

In an attempt to stimulate interest and encourage the possible future introduction of the teaching of CPR in Nigerian schools, this study aimed at assessing the change in CPR skills among a group of Nigerian secondary school students in a prospective cohort experimental study in the city of Port Harcourt, Nigeria. It was hypothesized that the level of CPR skills of Nigerian students would not statistically change immediately following their exposure to the conventional CPR skills training.

Materials and Methods

Research design

This study adopted the quasi-experimental design, which is very suitable for it because quasi-experiment is an empirical study used to estimate the causal impact of an intervention on its target population.

Population of the study

The population for the study was drawn from all the 76 private and 17 public senior secondary schools in Obio/Akpor Local Government Area of Rivers State in 2012. The students in SS1 and SS2 were the respondents to the questionnaires. There were altogether 6400 SS1 and SS2 students in the Obio/Akpor Local Government, while 4000 were from public schools and 2400 were from private schools. These figures were given by the Director of Schools Board at the Obio/Akpor Local Government Secretariat, Port Harcourt, Nigeria.

Permission for the study

Permission for the study was obtained by the authors from the Rivers State Ministry of Education, as well as from all the authorities of the secondary schools that participated in the study. In addition, each participating student was given a consent form to sign along with his/her parent(s).

Sample and sampling techniques

The final sample size comprised 347 (189 [54.5%] females; 158 [45.5%] males) SS1 and SS2 students of the total SS1 and SS2 students from the public and private schools in Obio/Akpor Local Government Area of Rivers State. Two public and two private schools were purposively selected and 100 students were selected in each school to get the initial study cohort (fifty from SS1 and fifty from SS2). Due to some copies of the questionnaires that were discarded as a result of mistakes made by some of the students and some incomplete data, the final study immediately after the training dropped to the 347 participants.

Instrumentation

The modified CPR lecture on power points, CPR skills steps on power points, manikin for skills practice, and skills evaluation guide were used. The power point was used to deliver CPR lecture and CPR skills steps. The manikin was used to demonstrate, train, and evaluate CPR skills acquired by the selected students. Every participant was given a disposable face shield which each of them used during the hands-on sessions. At intervals, the manikins were cleaned using cotton wool and methylated spirit. The skills evaluation guide was used to evaluate the level of the hand-on skills acquired.

Method of data collection

The researcher met and obtained consent from the principals of the selected secondary schools, all the schools were visited on their appointment days for the data collection. The selected students were informed about the nature and purpose of the study on the training day. The data were

collected as follows: Stage 1 (pretraining, i.e. before training on CPR skills) when each of them was shown a manikin and was asked to carry out CPR on it with the assumption that it was a "person that just collapsed suddenly" and Stage 2 (training and immediate post-training): Teaching, practical demonstrations, and hands-on trainings were carried out for 135 min using power points, modified AHA "Be The Beat" Video clips, Rap songs on CPR, and manikin followed by 100 min of group practical hands-on sessions using group participatory approach on the manikins. In line with the AHA guidelines for CPR and emergency cardiovascular care,[2] the skills evaluation guide form was used to score their skill performance by the principal researcher (AOO), who is an AHA-certified CPR instructor.

Data analysis

In addition to descriptive statistics, the data collated on the pre- and post-training skills of the students were analyzed using ANOVA and *t*-test to test the null hypothesis at $P < 0.05$ level of significance.

Results

Table 1 shows that pretest mean on skills was 1.000. The selected students had no previous exposure to the practical skills steps, the chest compression (CC) skills. Similarly, the rescue breath skills had never been attempted by any of the selected students before the training. However, immediately after the training, posttest mean score was 7.92. The participants were able to perform both CC and rescue breath satisfactorily, with a mean gain of 6.92 (92.0%).

Table 2 shows the *t*-test analysis of the difference in the level of CPR skills among the selected secondary school students before and immediately after the training. From this table, the calculated *t*-value for pre- and post-skills was 125.96. This value is greater than the *t*-critical table value of 1.96 at 0.05 significance level. The null hypothesis of no significant difference is, therefore, rejected, showing that there is a significant difference between the level of skills before training and immediately after the training.

Table 1: Pre- and post-test of cardiopulmonary resuscitation skills among the selected secondary school students

Variables	*n*	Pretest ($\bar{x}$)	Posttest ($\bar{x}$)	Gain ($\bar{x}$)	Percentage of gain
Skills	322	1.00±7.92	7.92±0.97	6.92	92.0

As shown in Table 3, 96.5% of the participants were willing to teach other the CPR after the training while 66.3% would not mind giving mouth-to-mouth ventilation (MMV) to even a stranger in need of CPR. Over 89.6% would give CPR to trauma victims and 95.4% indicated willingness to be useful bystanders in case any of their relatives becomes a victim needing CPR. Over 98.3% of the participants were of the opinion that CPR should be formally taught in Nigerian secondary schools.

Figures 1-3 are some of the pictures taken during the study.

Test of the null hypothesis

The null hypothesis stated that there would be no statistically significant difference in the level of CPR skills among the selected secondary school students before and immediately after the training.

Discussion

CCs and rescue breathing are psychomotor skills that are best learned through practice.[17] The level of proficiency in performing CPR skills gained from training is directly related to the amount of time provided for skills practice during training.[20] Studies that have assessed CPR skills among trainees in programs that do not offer psychomotor skills practice sessions ("cognitive-only" CPR training) have consistently shown that trainees do not, on average, achieve an acceptable standard level of proficiency.[20,21] These authors believe that to

Figure 1: A cardiopulmonary resuscitation teaching session before the hands-on session

Table 2: Paired *t*-test analysis of the difference in the level of skills among the selected secondary school students (pre- and post-test)

Paired sample	*n*	$\bar{x}$	SD	df	*t*-calculated	*t*-critical	*P* (two-tailed)	Decision
Pre- and post-skills	322	6.91	0.97	321	125.96	1.96	0.000	Rejected

Significant at $P<0.05$. SD: Standard deviation

Figure 2: A cardiopulmonary resuscitation hands-on session during the training in a Nigerian secondary school

Figure 3: A cardiopulmonary resuscitation hands-on session during the training in another Nigerian secondary school

Table 3: Responses of the participants to postcardiopulmonary resuscitation training questions

Post-training questions	Responses, *n* (%)		
	Yes	No	Unanswered
I would like to teach others CPR	335 (96.5)	9 (2.5)	3 (0.9)
I would perform mouth-to-mouth ventilation on strangers	230 (66.3)	117 (33.7)	-
I would perform CPR on a trauma victim, if needed	311 (89.6)	35 (10)	-
I would perform CPR on relative, if needed	331 (95.4)	16 (4.6)	-
CPR should be formally taught in schools in Nigeria	341 (98.3)	5 (1.4)	-

CPR: Cardiopulmonary resuscitation

optimize skills performance, psychomotor skills practice is an essential component of CPR training programs.

Similarly, to address the question of how much the length of a CPR training program can be reduced without ruining its effectiveness, a study by Nishiyama *et al.*[22] compared compression-only CPR and the conventional CPR. They found that the shortened compression-only CPR training program appeared to help the general public retain CPR skills better than the conventional CPR training program. Our study being the first of such training program among Nigerian secondary school students, involved the conventional CPR training program for a baseline data that could serve as a springboard for further related research activities in Nigeria.

In this Nigerian study, the selected students were found to have no skills exposure whatsoever concerning CPR before the training, but after the training, they performed reasonably well in the "hands-on skills," which is in agreement with the similar work of Meissner *et al.*[23] In that study, before the training, 29.5% of the students performed CCs as compared to 99.2% post-training ($P < 0.05$). Hence, it was concluded that training in high school is highly effective considering the minimal amount of previous knowledge the students possessed. Similarly, it can be concluded in the present Nigerian study that the training was highly effective as their performance was positively impacted where the pretraining CPR skills was virtually zero and post-training gain in CPR skills of 92.0% ($P < 0.05$). The authors observed that the use of power points and demonstrations on the screen which the participants watched before hand-on sessions must have helped in impacting the CPR knowledge on them because they found it interesting and easy to follow.

In a similar prospective cohort study involving Danish high school students, the improvement in the participants' self-assessed BLS skills to carry out emergency CPR as a bystander improved from about 33% to 90% after 45 min of CPR training.[24] Although self-assessed, this improvement is comparable to the present Nigerian study except that their baseline self-assessed CPR skills was higher than that observed in our present study. This difference in baseline CPR skills between the students in Denmark and Nigerian can be explained by the fact that the Danish students had received CPR training previously while their Nigerian counterparts had never had such exposure before this present study. In Pakistan, it has been shown that children can learn and perform basic life support skills with reasonable accuracy and can retain these skills for longer periods after CPR training, and the training has been recommended for children after sixth grade in the country.[13]

In a longitudinal study by Miró *et al.*[25] involving a 5-year experience of providing training in basic CPR for students in Spanish obligatory secondary school education, the trainers applied the CPR program developed for secondary schools. At the end of that study, about 58% of learning was achieved

immediately after the PROCES, following a multivariate analysis. In fact, a systemic review by Plant and Taylor[26] on how best to teach CPR in school children has shown that CPR training delivered in various ways is successful in a wide age range of children. In Oslo (Norway), Utstein data from OHCAs showed that survival after OHCAs was increased after improving weak links in their local chain of survival, quality of advanced life support, and postresuscitation care.

Concerning the participants' willingness to give chest compressions (CC) with mouth-to-mouth ventilation (MMV) to strangers, this Nigerian study recorded that 66.3% were willing and 89.6% were ready to perform CPR on trauma victims while a report from Japan[14] reported 15–30%, despite the fact that many of the participants had received CPR training previously. However, both the Japanese study[14] and this Nigerian study have a common finding of having a higher percentage of participants willing to give CPR to their relatives.

Limitations of the study included the inability of the authors to procure a manikin for each participant. Therefore, the participants were in groups of ten per manikin and had to have the hands-on one after another. In addition, virtually, all the schools where the study took place did not have power supply. The researchers had to carry generator on each day of the study with an assistant attending to the generator. This contributed in making the study more expensive.

Conclusions

The present Nigerian school-based study has shown that the students were able to significantly improve their CPR skills comparable to their counterparts in the developed parts of the world where CPR training has been incorporated in their school curricula or where studies on CPR training had been carried out.

The participants showed much interest and enthusiasm in the CPR training program which have reflected in the marked CPR skills gain from the study and the high percentage of them desiring to have the program formally taught in Nigerian secondary schools, as well as those willing to carry out the conventional CPR on OHCA cases including strangers and trauma victims.

Recommendations

In line with the previous recommendations,[18,19] we recommend the following:

- There is a need for more similar CPR skills training studies to be carried out in more secondary schools in other parts of Nigeria
- The incorporation of CPR skills training programs into Nigerian school system should be given serious attention by the Federal Ministry of Education, in line with the global trend in preparation for better management of the expected increase in OHCA cases due to growing modernization.

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Conflicts of interest

There are no conflicts of interest.

References

1. Rea TD, Eisenberg MS, Becker LJ, Murray JA, Hearne T. Temporal trends in sudden cardiac arrest: A 25-year emergency medical services perspective. Circulation 2003;107:2780-5.
2. Field JM, Hazinski MF, Sayre MR, Chameides L, Schexnayder SM, Hemphill R, *et al.* Part 1: Executive summary: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation 2010;122(18 Suppl 3):S640-56.
3. Lloyd-Jones D, Adams R, Carnethon M, De Simone G, Ferguson TB, Flegal K, *et al.* Heart disease and stroke statistics-2009 update: A report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Circulation 2009;119:480-6.
4. Nolan JP, Soar J, Zideman DA, Biarent D, Bossaert LL, Deakin C, *et al.* European resuscitation council guidelines for resuscitation 2010 section 1. Executive summary. Resuscitation 2010;81:1219-76.
5. Reder S, Quan L. Cardiopulmonary resuscitation training in Washington state public high schools. Resuscitation 2003;56:283-8.
6. Uray T, Lunzer A, Ochsenhofer A, Thanikkel L, Zingerle R, Lillie P, *et al.* Feasibility of life-supporting first-aid (LSFA) training as a mandatory subject in primary schools. Resuscitation 2003;59:211-20.
7. Connolly M, Toner P, Connolly D, McCluskey DR. The 'ABC for life' programme – Teaching basic life support in schools. Resuscitation 2007;72:270-9.
8. 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.
9. Lorem T, Palm A, Wik L. Impact of a self-instruction CPR kit on 7th graders' and adults' skills and CPR performance. Resuscitation 2008;79:103-8.
10. Lotfi K, White L, Rea T, Cobb L, Copass M, Yin L, *et al.* Cardiac arrest in schools. Circulation 2007;116:1374-9.
11. Lund-Kordahl I, Olasveengen TM, Lorem T, Samdal M, Wik L, Sunde K. Improving outcome after out-of-hospital cardiac arrest by strengthening weak links of the local Chain of Survival; quality of advanced life support and post-resuscitation care. Resuscitation 2010;81:422-6.
12. Kang KH, Yang HJ, Lee G, Youn ST, Yim J, Im JS, *et al.* Predictors of cardiopulmonary resuscitation education for layperson. J Korean Soc Emerg Med 2006;17:539-44.
13. Naqvi S, Siddiqi R, Hussain SA, Batool H, Arshad H. School children training for basic life support. J Coll Physicians Surg Pak 2011;21:611-5.
14. Taniguchi T, Sato K, Fujita T, Okajima M, Takamura M. Attitudes to bystander cardiopulmonary resuscitation in Japan in 2010. Circ J 2012;76:1130-5.
15. Lee BC, Lee MJ, Shin SJ, Ryoo HW, Kim JK, Park JB, *et al*. The current status of cardiopulmonary resuscitation training for school. J Korean Soc Emerg Med 2012;23:470-8.
16. Hamasu S, Morimoto T, Kuramoto N, Horiguchi M, Iwami T, Nishiyama C, *et al.* Effects of BLS training on factors associated with attitude toward CPR

in college students. Resuscitation 2009;80:359-64.
17. Onyeaso AO. Awareness of cardiopulmonary resuscitation among secondary school students in Port Harcourt, Nigeria. J Educ Dev Areas 2014;22:137-42.
18. Onyeaso AO, Imogie AO. Attitude towards cardiopulmonary resuscitation among some secondary school students in Rivers State, Nigeria. Br J Educ 2014;2:37-43.
19. Onyeaso AO, Achalu EI. Knowledge of cardiopulmonary resuscitation among some secondary school students in Nigeria. J Educ Pract 2014;5:180-3.
20. Monsieurs KG, Vogels C, Bossaert LL, Meert P, Manganas A, Tsiknakis M, *et al.* Learning effect of a novel interactive basic life support CD: The JUST system. Resuscitation 2004;62:159-65.
21. Teague G, Riley RH. Online resuscitation training. Does it improve high school students' ability to perform cardiopulmonary resuscitation in a simulated environment? Resuscitation 2006;71:352-7.
22. Nishiyama C, Iwami T, Kitamura T, Ando M, Sakamoto T, Marukawa S, *et al.* Long-term retention of cardiopulmonary resuscitation skills after shortened chest compression-only training and conventional training: A randomized controlled trial. Acad Emerg Med 2014;21:47-54.
23. Meissner TM, Kloppe C, Hanefeld C. Basic life support skills of high school students before and after cardiopulmonary resuscitation training: A longitudinal investigation. Scand J Trauma Resusc Emerg Med 2012;20:31.
24. Aaberg AM, Larsen CE, Rasmussen BS, Hansen CM, Larsen JM. Basic life support knowledge, self-reported skills and fears in Danish high school students and effect of a single 45-min training session run by junior doctors; a prospective cohort study. Scand J Trauma Resusc Emerg Med 2014;22:24.
25. Miró O, Diaz N, Diaz JE, Escalada FX, Perez-Puejo FJ, Sanchez M. Cardiopulmonary resuscitation program for secondary schools (PROCES): Conclusions after 5 years. Resuscitation 2012;83:e116-7.
26. Plant N, Taylor K. How best to teach CPR to schoolchildren: A systematic review. Resuscitation 2013;84:415-21.