

Retention of Cardiopulmonary Resuscitation Skills after 15 Months of Initial Chest Compression-Only Training of Some University Students in Nigeria

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Abstract Introduction: There is sufficient information globally on the effectiveness of chest compression-only CPR in providing adequate bystander CPR for victims of out-of-hospital cardiac arrest (OHCA) but there is no single report on the retention of such skills by potential providers of bystander CPR in Nigeria. For potential bystander CPR providers to provide this useful service to victims of OHCA, they must be able to retain the skills for a reasonable period of time before re-training takes place. This study aimed at assessing the retention of CPR skills 15 months after the initial training on chest compression-only CPR in a group of Nigerian students. **Materials and Methods:** A quasi-experimental study design was used. The initial cohort were seventy but this reduced to sixty-five consisting 50 (76.92%) females and 15(23.08%) with age range of 18-31 years (mean age, 22.11+ 2.80). Their CPR skills were assessed immediately post-training 15 months ago and re-assessed at the retention stage by the same AHA-certified CPR Instructor using the same modified AHA Skills Evaluation guide. Three CPR skills domains were assessed – scene safety and call for help, chest compression and cycle / min and placement of victim in correct recovery position. The data were analysed using descriptive statistics and paired sample t-test with P-value set at $P < .05$. **Results:** The participants had impressive CPR skills retention 15 months later. Only the scene safety and call for help CPR skills domain had significant loss ($P < .001$) while the remaining skills domains did not. Generally, the retained chest compression skills of the participants had marked improvement on their immediate post-training levels but not significant ($P > .05$). **Conclusion:** Chest compression-only CPR holds promise as an adequate technique for increasing the number of potential bystander CPR providers for the general public in our environment.

Keywords Chest compression CPR technique, CPR skills Retention, University students, Nigeria

1. Introduction

The usefulness of bystander cardiopulmonary resuscitation (CPR) in the outcome of victims of out-of-hospital cardiac arrest (OHCA) has been widely documented [1-8]. Central to effective bystander CPR provision is the ability of trained bystanders to retain their CPR skills for sometime before re-training programmes. Across the globe, various researchers have reported their findings on retention of cardiopulmonary resuscitation skills by bystander CPR providers with different levels of retained skills [9-13].

In Nigeria, few reports have shown that Nigerian school

children and teachers could retain reasonable levels of their CPR skills following initial trainings [14,15]. Earlier reports from Nigeria have shown that some Nigerian University students, who are potential teachers in primary and secondary schools, displayed impressive acquisition of CPR skills [16-20], but reports on the CPR skills retention ability of such important target group in the popularization of the bystander CPR among Nigerians is very essential.

Although the quality outcomes of Hands-Only CPR trainings for bystander CPR skills are documented [21-29], there is need for more reports on the retained skills of such trainings especially in Nigeria where there is no such report so far.

Nigeria is a developing economy and is not spared of the globally increasing public health burden of out-of-hospital cardiac arrest (OHCA). In addition, the role of teachers and students in our advocacy for integration of the teaching and training in bystander into Nigerian schools' curricula is crucial.

Therefore, this study aimed at ascertaining the level of

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Published online at <http://journal.sapub.org/ajmms>

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retention of earlier acquired CPR skills through Hands-Only CPR training programme by some University students (potential teachers) in Nigeria. It was hypothesized that: (1) the retention of CPR skills by most of the students in the group would be poor. after over a year of their initial CPR training using the Hands-Only method; and (2) there would be statistically significant losses in CPR skills in all the three domains assessed.

2. Materials and Methods

2.1. Study Design

A quasi-experimental design was used.

2.2. Population of the Study

The initial cohort of seventy (70) participants was 200-Level undergraduate students in the Department of Human Kinetics and Health Education, Faculty of Education, University of Port Harcourt. The participants had CPR training using the hands-only method in March 2018. Their immediate post-training CPR skills were assessed then by the lead researcher who is an American Heart Association (AHA)-certified CPR Instructor using a modified AHA Skills Evaluation Guide as in Onyeaso and Onyeaso [29]. See Appendix below.

The same cohort that participated in the earlier study in 2018 were recalled to carry out the hands-only CPR skills in a similar simulated situation using manikins in June, 2019. Without further teaching or training in bystander CPR, they were asked to individually carry out bystander CPR for a simulated victim with out-of-hospital arrest (OHCA). Each of them was assessed by the same lead researcher who did it 15 months ago. The three CPR skills domains assessed were: scene safety and call for help (SS), chest compression (CC) and Cycle / min and correct placement of victim in recovery position (RP). The same modified AHA guideline was used by the same CPR Instructor to assess each participant.

The matching of the participants earlier immediate post-training hands-only CPR skills was easy because their matriculation numbers were written on top of each of the assessment form. In all, sixty five (65) of the original cohort of seventy (70) participated at this stage of assessing their retained CPR skills – 50 (76.92%) females and 15(23.08%)

with age range of 18-31 years (mean age, 22.11+ 2.80).

The following null hypotheses were generated and tested:

Ho1: The retention of CPR skills by most of the students in the group would be poor after over a year of their initial CPR training using the Hands-Only method; and

Ho2: There would be statistically significant losses in CPR skills in all the three domains assessed.

2.3. Determination of Poor and good CPR Skills

Score of 50% was considered acceptable (good) for each of the three domains of chest compression-only (hands-only) CPR skills while less than 50% was considered unacceptable (poor) retained CPR skills.

2.4. Data Analysis

The Statistical Package for Social Sciences (SPSS) was used to analyze the data. In addition to descriptive statistics, the data collated 15 months ago and the present data on retention were analyzed using the paired samples T-test. The P-value was set at 0.05 level of significance.

2.5. Ethics and Participants Consent

Institutional review and consent was not necessary as the programme was within the course work of the students and was completely non-invasive. In addition, the students were very enthusiastic to participate in the study because of the obvious benefit they would derive from it. In all, the participants freely gave their consent.

3. Results

Comparison of the immediate post-training CPR skills and retention by the participants after 15 months of initial hands-only CPR skills training are shown in Table 1 below. They produced the best retention in their chest compression skills where 61 (93.8%) had 60% and above, followed by Cycle / min and correct placement of victim in recovery position having 55 (84.5%). It is important to note also that hands-only CPR skill involving chest compression domain had more participants (53.8%) scoring 100% than during their immediate post-training assessment (29.1%), although double of participants had 40% which is considered unacceptable.

Table 1. Comparison of the immediate post-training CPR skills and retention of the participants

Percentage of CPR skills	POST-SS	POST-CC	POST-RP	RET-SS	RET-CC	RET-RP
0 (0%)				3(4.6%)	-	3(4.6%)
1(20%)				14(21.5%)	-	-
2 (40%)	1(1.5%)	2(3.1%)	1(1.5%)	15(23.1%)	4(6.2%)	7(10.8%)
3 (60%)	2(3.1%)	5(7.7%)	5(7.7%)	22(33.8%)	3(4.6%)	9(13.8%)
4 (80%)	43(66.2%)	39(60.0%)	44(67.7%)	11(16.9%)	23(35.4%)	19(29.2%)
5 (100%)	19(29.2%)	19(29.2%)	15(23.1%)	-----	35(53.8%)	27(41.5%)

Note: Post SS = Immediate post-training CPR scene safety skill; Post CC = Immediate post-training CPR chest compression skill; Post RB = Immediate post-training CPR rescue breath skill; Post RP = Immediate post-training CPR resting position skill; while Ret SS, Ret CC, Ret RB and Ret RP stand for the respective retention skills.

Table 2. Mean immediate post- training and retained CPR skills of the participants with their mean and percentage losses

		No	Mean	Std Dev.	Std Mean Error	Mean Loss	% Mean Loss
Pair1	Post-SS	65	4.23	.58	.07	1.87	44.21
	Ret-SS	65	2.36	1.13	.14		
Pair 2	Post CC	65	4.15	.689	.08	+0.21(Gain)	5.06 (Gain)
	Ret-CC	65	4.36	.83	.10		
Pair 3	Post-RP	65	4.12	.59	.07	0.25	6.07
	Ret-RP	65	3.87	1.31	.16		

Table 3. The Paired Sample T-Test analysis of the Post Training-and Retention CPR skills of the participants

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Post-SS- Ret- SS	1.86154	1.21033	.15012	1.56163	2.16144	12.400	64	.000
Pair2	Post-CC – Ret-CC	-.21538	.94360	.11704	-.44920	.01843	-1.840	64	.070
Pair3	Post-RP-- Ret -RP	.24615	1.43648	.17817	-.10979	.60210	1.382	64	.172

P < .001 for scene safety and call for help while the other two skills domains had P > .05

Table 2 gives the mean immediate post- training and retained CPR skills of the participants with their mean and percentage losses. The result shows gain in chest compression skill in line with the descriptive statistics in Table 1 above. In all, more participants improved on this skill than in the other two domains.

Table 3 provides the paired sample T-test analysis of the post-training and retention CPR skills of the participants with statistically significant difference found only in the scene safety and call for help CPR skills domain ($P < .001$). This confirms the acceptance of the null hypothesis 2 with respect to scene safety and call for help only while the null hypothesis is rejected in other two skills domains. This means that the participants not only had very acceptable skills retention, their losses or gains were not statistically significant for two out of the three skills domains - chest compression and cycle / min and placement of victim in correct recovery position ($P > .05$).

4. Discussion

This first Nigerian study on the retention of CPR skills after the initial chest compression-only (hands-only) CPR training has revealed statistically significant drop in the participants skills in the scene safety and call for help CPR skills domain only while the differences in their retained skills in relation to chest compression and cycle / min and placement of victim in the correct recovery position domains were not statistically significant. However, it must be noted that in all the participants actually gained in the chest compression skill 15 months after and not loss. Bobrow et al [25] reported that victims of out-of-hospital cardiac arrest who received chest compression-only bystander CPR had increased survival rates. They

concluded that among patients with out-of-hospital cardiac arrest, layperson compression-only CPR was associated with increased survival compared with conventional CPR and no bystander CPR in this setting with public endorsement of chest compression-only CPR. [25]. According to Lim et al [30], the chest compression-only group produced superior chest compression compared with their conventional counterparts.

Although Kim et al [23] reported that chest compression-only CPR did not produce as good chest compression as the conventional CPR in their retention study, it did not mean that chest compression-only CPR was not good. Moreover, their retention assessment was just after 3 months unlike our present study that assessed retention after 15 months. Iwami et al [31] concluded in their study that compression-only CPR is more effective than conventional CPR for patients in whom out-of-hospital cardiac arrest is witnessed and shocked with public-access defibrillation. They further opined that compression-only CPR is the most likely scenario in which lay rescuers can witness a sudden collapse and use public-access AEDs.

In their prospective observational study, Iwami et al [32] found out that bystander-initiated cardiac-only resuscitation and conventional CPR were similarly effective for most adult out-of-hospital cardiac arrests. Roppolo and Pepe [33] had earlier emphasized the importance of retention of CPR skills and its multiplier effect through schools. The very impressive retention of CPR skills observed in this study by potential teachers is an encouraging development because it is expected that some of these students will contribute in the teaching of this vital safety procedure in primary and secondary schools. Therefore, this finding with chest compression-only CPR holds great potential for our community where many would not want to carry out

bystander conventional CPR because of the fear of contacting diseases [34].

The only related earlier studies in Nigeria on retention of CPR skills were on conventional CPR training [14,15] and all showed satisfactory retention. With the current finding on chest compression-only CPR, it could be said that Nigerian students both at the secondary and University levels have shown satisfactory retention of CPR skills which is a promising development with regard to the future of bystander CPR training and practice in the country. In fact, a meta-analysis on chest compression-only and standard (conventional) CPR training programmes by Hupfl et al [35] led them to conclude that for adults with out-of-hospital cardiac arrest (OHCA), instructions to bystanders from emergency medical services dispatch should focus on chest-compression-only CPR.

4.1. Strengths and Limitations of the Study

Being a pioneer study on chest compression-only CPR skills retention in Nigeria, this study will serve as a baseline work in this aspect and would stimulate further related studies. However, there is need to improve on the sample size involving a larger cross-section of Nigerian lay persons.

4.2. Conclusions

- The retention of CPR skills in this study by the participants was generally very satisfactorily good without significant differences in the chest compression and cycle / min and placement of victim in correct recovery position domains except for the scene safety and call for help domain.

- Although there was no significant difference in the chest compression skills of the participants, there was gain instead of loss in their chest compression skills 15 months after the initial training.

The results suggest that chest compression-only CPR skills training technique is adequate for producing more potential bystander providers for the general public including our Nigerian environment.

4.3. Recommendations

More related studies in Nigeria involving lay persons in schools (primary, secondary and tertiary institutions) and communities from different parts of the country are encouraged so as to increase the number of potential bystander CPR providers and chest compression-only CPR offers this chance because the fear of contacting diseases is not there.

Appendix

CHEST COMPRESSION-ONLY (HANDS-ONLY) SKILLS EVALUATION FORM

Skill	Performed Steps	Obtainable Score	Obtained Score
Scene Safety & Call for help	1. Ensure safety	1	
	2. Check for response	1	
	3. Call for help	1	
	4. Check for breath warm	1	
	5. Check for breath sound & chest movement	1	
	TOTAL	5	
Compression	6. Heal of Hand	1	
	7. Centre of the chest	1	
	8. Push hard	1	
	9. Push fast	1	
	10. Chest Recoil	1	
	TOTAL	5	
Cycle/min & Recovery Position	80/min	1	
	12. Body turned left	1	
	13. Left hand below head	1	
	14. Left leg straight	1	
	15. Right leg folded backward	1	
	TOTAL	5	
	GRAND TOTAL	15	

NAME / SERIAL NUMBER -----

SEX / AGE: -----

MATRICULATION NO: -----

NAME OF SCHOOL / STATE-----

INSTRUCTOR'S REMARK: -----

DATE: -----

REFERENCES

- [1] Fairbanks RJ, Shah MN, Lerner EB, Ilangovan K, Pennington EC, Schneider SM. Epidemiology and outcomes of out-of-hospital cardiac arrest in Rochester, New York. *Resuscitation* 2007; 72:415–24.
- [2] Waalewijn RA, De Vos R, Tijssen JG, Koster RW. Survival models for out-of hospital cardiopulmonary resuscitation from the perspectives of the bystander, the first responder, and the paramedic. *Resuscitation* 2001; 51:113–22.
- [3] Nordberg P, Hollenberg J, Herlitz J, Rosenqvist M, Svensson L. Aspects on the increase in bystander CPR in Sweden and its association with outcome. *Resuscitation* 2009; 80:329–33.
- [4] Handley AJ, Koster R, Monsieurs K, Perkins GD, Davies S, Bossaert L. European Resuscitation Council guidelines for resuscitation 2005. Section 2. Adult basic life support and use of automated external defibrillators. *Resuscitation* 2005; 67: S7–23.
- [5] Nichol G, Stiell IG, Laupacis A, Pham B, De Maio V, Wells GA. A cumulative metaanalysis of the effectiveness of defibrillator-capable emergency medical services for victims of out-of-hospital cardiac arrest. *Ann Emerg Med* 1999; 34:517–25.
- [6] Eckstein M, Stratton SJ, Chan LS. Cardiac arrest resuscitation evaluation in Los Angeles: CARE-LA. *Ann Emerg Med* 2005; 45:504–9.
- [7] Cardiopulmonary resuscitation by bystanders with chest compression only (SOS-KANTO): an observational study. *Lancet* 2007; 369: 920–6 Chan PS,
- [8] Swor R, Khan I, Domeier R, Honeycutt L, Chu K, Compton S. CPR training and CPR performance: do CPR-trained bystanders perform CPR? *Acad Emerg Med* 2006; 13: 596–601.
- [9] Iserbyt P, Mols T. Retention of CPR skills and the effect of instructor expertise one year following reciprocal learning. *Acta Anaesth Belg* 2014; 65: 23-29.
- [10] Behrend T, Heineman J, Wu L, Burk C, Duong N-T, Munoz M, Pruett D, Seropian M, Dillman D. Retention of cardiopulmonary resuscitation skills in medical students utilizing a high-fidelity patient simulator. *Medical student Research Journal* 2011; 1(1): 001-004.
- [11] Einspruch EL, Lynch B, Aufderheide TP, Nichol G, Becker LB. Retention of CPR skills learned in a traditional AHA Heartsaver Course versus 30-min video self-training: A controlled randomized study. *Resuscitation* 2007; 74(3): 476-86.
- [12] Nishiyama C, Iwami T, Kitamura T, Ando M, Sakamoto T, Marukawa S, Kawamura T. Long-term Retention Cardiopulmonary Resuscitation Skills after Shortened Chest Compression-only Training and Conventional Training: A Randomized Controlled Trial. *Acad Emerg Med* 2014; 21:47-54.
- [13] Isbye DL, Meyhoff CS, Lippert FK, Rasmussen LS. Skill retention in adult and children 3 months after basic life support training using a simple personal resuscitation manikin 2007; 74(2): 296-302.
- [14] Onyeaso AO. Retention of Cardiopulmonary Resuscitation skills in Nigerian Secondary School Students. *J EducPract* 2016; 7(15): 162-168.
- [15] Onyeaso AO, Onyeaso CO. Retention of Cardiopulmonary Resuscitation Skills in a Group of Nigerian School Teachers. *Am J Med Med Sci* 2018; 8(6): 112-116.
- [16] Onyeaso AO, Onyeaso CO. Cardiopulmonary Resuscitation Skills in some Nigerian secondary school students. *Port Harcourt Med J* 2016; 10(2): 60-65.
- [17] Onyeaso AO, Onyeaso OO. Cardiopulmonary resuscitation Skills of some Nigerian Primary and Secondary School Teachers. *J Adv Med Res* 2017; 23(2): 1-8.
- [18] Onyeaso AO, Onyeaso OO. Cardiopulmonary resuscitation Skills in some Undergraduate Human Kinetics and Health Education students in a Nigerian University. *J Health Sci* 2017; 7(4): 84-90.
- [19] Onyeaso AO, Onyeaso OO. The skills of cardiopulmonary resuscitation in some professional and student teachers compared. *Asian J Med Health* 2017; 8(2): 1-9.
- [20] Onyeaso AO, Onyeaso OO. Association of age and gender with simulated Cardiopulmonary resuscitation skills performance in some Nigerian student teachers. *J Adv Med Med Res* 2017; 24(9): 1-9.
- [21] Iwami T, Kitamura T, Kihohara K, Kwamura T. Dissemination of chest compression only cardiopulmonary resuscitation and survival after out-of-hospital cardiac arrest. *Circulation* 2015; 132: 415-22.
- [22] Kate H, Magid BA, Debra H, Comilla S. Addressing Gaps in Cardiopulmonary Resuscitation Education: Training Middle School Students in Hands - Only <https://doi.org/10.1111/josh.12634>.
- [23] Kim YJ, Cho Y, Cho GC, Ji HK, Han SY, Lee JH. Retention of cardiopulmonary resuscitation skills after hands-only training versus conventional training in novices: a randomized controlled trial. *Clin Exp Emerg Med* 2017; 4(2): 88-93.
- [24] Panchal AR, Bobrow BJ, Spaite DW, Berg RA, Stolz U, Vadeboncoeur TF, Sanders AB, Kern KB, Ewy GA. Chest compression-only cardiopulmonary resuscitation performed by lay rescuers for adult out-of-hospital cardiac arrest due to non-cardiac aetiologies. *Resuscitation* 2013; 84:435-9. <http://dx.doi.org/10.1016/j.resuscitation.2012.07.038>.
- [25] Bobrow BJ, Spaite DW, Berg RA, Stolz U, Sanders AB, Kern KB, Vadeboncoeur TF, Clark LL. cardiac arrest. *JAMA* 2010; 304: 1447–54, <http://dx.doi.org/10.1001/jama.2010.1392>.
- [26] Sayre MR, Berg RA, Cave DM, et al. Hands-only (compression-only) cardiopulmonary resuscitation: a call to action for bystander response to adults who experience out-of-hospital sudden cardiac arrest: a science advisory for the public from the American Heart Association Emergency Cardiovascular Care Committee. *Circulation* 2008; 117: 2162–7.
- [27] SOS-KANTO Study Group. Cardiopulmonary resuscitation

- by bystanders with chest compression only (SOS-KANTO): an observational study. *Lancet* 2007; 369: 920–6, [http://dx.doi.org/10.1016/S0140-6736\(07\)60451-6](http://dx.doi.org/10.1016/S0140-6736(07)60451-6).28.
- [28] Japanese Circulation Society Resuscitation Science Study Group. Chest-compression-only bystander cardiopulmonary resuscitation in the 30:2 compression-to-ventilation ratio era. Nationwide observational study. *Circ J* 2013; 77: 2742–50.
- [29] Onyeaso AO, Onyeaso CO. Chest Compression-only Cardiopulmonary Resuscitation in Nigerian University Students. *Am J Med Med Sci* 2018; 8(8): 213-218.
- [30] Lim SH, Aw SJ, Cheong MA, Chew J, Ler AC, Yong LP, Chan YH, et al. A randomised control trial to compare retention rates of two cardiopulmonary resuscitation instruction methods in the novice. *Resuscitation* 2016; 103: 82-7.
- [31] Iwami T, Kitamura T, Kawamura T, Mitamura H, Nagao K, Takayama M, et al. Japanese Circulation Society Resuscitation Science Study (JCS-ReSS) Group); Chest compression-only cardiopulmonary resuscitation for out-of-hospital cardiac arrest with public-access defibrillation: a nationwide cohort study. *Circulation* 2012; 126(24): 2844-51.
- [32] Iwami T, Kawamura T, Hiraide A, et al. Effectiveness of bystander initiated cardiac-only resuscitation for patients with out-of-hospital cardiac arrest. *Circulation* 2007; 116: 2900–7.
- [33] Roppolo LP, Pepe PE. Retention, Retention, Retention targeting the young in CPR skills training! *Crit Care* 2009; 13(5): 185. doi: 10.1186/cc7997.
- [34] Onyeaso AO, Imogie AO. Attitude towards Cardiopulmonary Resuscitation among Some Secondary School Students in Rivers State, Nigeria. *Br J Educ* 2014; 2(3): 37-43.
- [35] Hupfl M, Selig HF, Nagele P. Chest-compression-only versus standard cardiopulmonary resuscitation: a meta-analysis. *Lancet* 2010; 376: 1552-1557.