

ORIGINAL ARTICLE

Cardiopulmonary Resuscitation: Assessment of Knowledge and Skills among Healthcare Workers within Health Facilities in Sokoto Metropolis.



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Abstract

Background: Cardiopulmonary resuscitation (CPR) is a crucial life-saving intervention, aiming to restore circulation post-cardiac arrest. Proficiency in CPR demands rigorous training to optimize execution and is vital for healthcare providers. In Nigeria, a lack of comprehensive data on cardiopulmonary resuscitation proficiency among healthcare providers exists. Given the substantial impact of cardiac arrest on mortality rates, evaluating the cardiopulmonary resuscitation skills of health workers is thus paramount.

Methods: We conducted a cross-sectional survey of 280 diverse healthcare practitioners in Sokoto Metropolis using a multistage sampling technique. A pre-tested questionnaire was used to collect information on participants' sociodemographic characteristics and knowledge of CPR. The CPR skills of participants were assessed and graded using the Berden rating system. Data was analyzed using SPSS version 27. The chi-square and logistic regression were used appropriately, and the level of significance was set at $p < 0.05$ and the confidence interval at 95%.

Result: Among the 280 EHCWs, the majority were from Usmanu Danfodiyo University Teaching Hospital (59.6%), aged 20-39 (59.3%), predominantly female (66.8%), and held academic certificates or diplomas (69.5%). Notably, 69.6% of doctors demonstrated good cardiopulmonary resuscitation knowledge compared with 49.7% and 24.7% among nurses and Community Health Extension Workers respectively. The overall skill level was suboptimal (32.5%), with medical doctors exhibiting a higher average skill level (55.4%) compared to nurses (37.1%) and Community Health Extension Workers (5.5%). Significantly, participants' professions were associated with CPR knowledge, with an odds ratio of 7.955 (AOR= 7.955, 95% C. I= 2.757, 22.952, $p < 0.001$). Possession of Pediatric Basic Life Support certificates also correlated significantly with CPR knowledge, with an odds ratio of 0.005 (AOR= 0.005, 95% C. I= 0.001, 0.045, $p < 0.001$).

Conclusions: The study unveiled gaps in cardiopulmonary resuscitation skill development among health workers, accentuating deficiencies in primary and secondary healthcare facilities attributed to the lack of structured practical training and inconsistent staff development.

Keywords: Cardiopulmonary resuscitation, healthcare workers, Community health extension workers.

Introduction:

Cardiopulmonary resuscitation (CPR) is a crucial therapeutic procedure aimed at restoring circulation after cardiac arrest, involving chest compressions, airway

manoeuvres, and artificial ventilation.¹ The use of CPR is vital in hospitals, and healthcare providers often face stress and anxiety when responding to cardiac arrests. Cardiopulmonary resuscitation, synonymous with basic life

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support (BLS), requires prompt and accurate execution for positive outcomes.² Despite widespread CPR training, significant gaps persist in delivering quality medical care during cardiac arrests, emphasizing the need for optimized training methods to ensure retention of skills and knowledge.^{3,4}

Effective CPR can significantly reduce death due to cardiac arrest when administered promptly by trained healthcare professionals.^{5,6} It also, enhances survival rates and outcomes in cardiac emergencies, making it indispensable in healthcare settings.^{7,9} Thus, CPR training for healthcare professionals is critical for an immediate response, clinical proficiency, advanced skills, team coordination, stress management, legal compliance, quality improvement, and patient confidence.^{10,11} Consequently, the American Heart Association (AHA) and the European Resuscitation Council (ERC) have established CPR guidelines as the gold standard, providing a foundation for treating cardiac emergencies.¹²

Health workers, particularly those with Advanced Cardiovascular Life Support (ACLS) training, play a crucial role in improving survival rates.^{13,14} Each year, over 356,000 out-of-hospital cardiac arrests occur in the U.S., with nearly 90% being fatal, and approximately 209,000 adult in-hospital cardiac arrests happen annually.^{15,16} In North American hospitals, pediatric CPR incidence is 1.8 per 100 admissions to the pediatric intensive care unit.¹⁷ Studies in Karachi, Pakistan, and Tanzania revealed inadequate CPR knowledge among healthcare providers.^{14,18,19} In Nigeria, previous studies suggest low CPR success rates due to inadequate skills among healthcare providers.²⁰⁻²⁴ Proficiency with CPR among healthcare workers is crucial for improving survival rates during cardiac emergencies. However, data are scarce on this from northern Nigeria. Assessing CPR skills in Sokoto Metropolis could provide valuable insight into the subject from the region and will be vital to enhancing emergency response and patient outcomes. This study therefore comprehensively evaluated the knowledge and skills of CPR among healthcare workers in Sokoto Metropolis. The findings are crucial to ensure preparedness, validating the competency level of healthcare professionals and ultimately improving the emergency response and patient outcomes in the community.

Methodology

This is a cross-sectional study design that targeted eligible full-time healthcare workers within the Sokoto metropolis who volunteered to participate. Using Fischer's formula,²⁵ a sample size of 311 was calculated, accounting for a 10% non-response rate. Out of the 311 invited, 280 participated (90.03% response rate). A multi-stage sampling technique selected two local governments (Wamakko and Sokoto North), tertiary and secondary health facilities, and ten primary healthcare facilities. Participants were proportionally stratified by professional categories.

A semi-structured questionnaire was adapted from the American Heart Association Basic Life Support guidelines which covered socio-demographic data, work experience, CPR knowledge, and skill evaluation. The section on knowledge comprises 23 questions graded with "1" for correct and "0" for incorrect answers, where a score = 9 indicated good knowledge whereas a score of <9 was considered poor knowledge. For CPR skills assessment,

Participants underwent BLS skill assessment individually, simulating real-life scenarios with a Resusci Anne® manikin, graded by the Berden rating system, with scores ranging from 0 to 100; scores below 10 indicated good skills, while 11 and above suggested poor skills.^{26,27} Pre-testing of the questionnaire was done to ensure reliability and validity. Data collection was done using self-administered questionnaires

Nurses and community health extension workers holding basic certificates are categorized as having a certificate or diploma. Health workers with a first degree, including MBBS, are classified under the degree category. Those with higher degrees are further classified as either master's or PhD. Meanwhile, medical doctors undergoing residency training are classified as either registrars or senior registrars. Participants with CPR training involving in-person instruction and hands-on practice with an instructor were considered to have attended formal CPR training, while those who had self-directed learning through videos, online courses, or brief just-in-time sessions were considered to have had just CPR training

Statistical analysis was performed using SPSS version 29.0, with a significance level set at $P < 0.05$. Data were presented as frequency and percentages; variables that are normally distributed were presented as mean \pm standard deviation from the mean. Also, logistic regression was used to determine factors associated with the knowledge and skills of CPR.

Ethical approvals were obtained from the Sokoto State Ministry of Health and Usmanu Danfodiyo University Teaching Hospital with reference numbers SMH/1580/V. IV and UDUTH/HREC/2023/1305/VI respectively.

Results

Females comprised most participants, accounting for 66.8% (187) of the study participants. Nurse/Midwife constitute the majority (53.9%) of the participants while the remaining were Doctors (20.0%) and CHEW (Table 1). The majority (38.9%) of the participants fell within 36-84 years with a mean age of 32.59 ± 7.79 , followed by participants (26.8%) aged 20-35 years. Most of the participants (80; 28.6%) have 10 – 14 years of working experience. Of the participants, 70 (25%) are currently assigned to the General Outpatient Department while 64 (22.9%) work in the Obstetrics/Gynaecology unit. The details of other sociodemographic characteristics are presented in Table 1.

Also, 190 (67.9%) participants have had any form of CPR training with about half (50.4%) having undergone formal training (Table 2). For CPR frequency, 137 (48.9%) participants have never performed CPR, whereas 40 (14.3%) participants perform CPR weekly. In terms of survival following CPR, 48.9% reported no survival whereas 40.7% reported some survival after performing CPR. Other CPR-related characteristics are presented in Table 2.

A total of 148 (52.9%) participants had poor knowledge, while 132 (47.1%) participants had good knowledge, using mean and standard deviation. About two-thirds (69.9%) and about half (55.4) of the medical doctors had good knowledge and skills of CPR respectively whereas only 24.7% and 5.5% of CHEW had good knowledge and skills of CPR. (Figure 1).

CPR knowledge levels were significantly associated with the type of health facility, professional status, academic qualification, duty post, and formal CPR training. Respondents from UDUTH, doctors, and those in critical areas had higher knowledge. Training in BLS, ACLS, and PBLs, as well as the frequency of CPR training and patient survival outcomes, also showed significant associations ($p < 0.05$), Table 3.

Also, skill competence in CPR was significantly ($p < 0.001$) associated with hospital affiliation, age group, professional status, academic qualifications, and current

duty post. Notably, participants working in UDUTH, older age groups, medical doctors, and those with advanced academic qualifications showed higher CPR skills, Table 4. Similarly, formal CPR training was significantly associated with CPR skills competence ($p < 0.001$). Also, the duration of CPR training, possession of certificates in Basic Life Support (BLS) Advanced Cardiac Life Support (ACLS), and Paediatric Basic Life Support were all significantly associated with enhanced CPR skills competence. The frequency of CPR performance and patient survival outcomes also showed significant association with CPR skills competence among the participants with a p-value of

Table 1: Baseline Sociodemographic Data of the Participants (N=280)

Variable	Frequency (n)	Percentage (%)
Hospital		
UDUTH	167	59.6
General Hospital	40	14.3
Primary Health Care	73	26.1
Gender		
Male	93	33.2
Female	187	66.8
Age		
20 – 35	104	37.1
36 – 64	132	47.1
65 +	44	15.7
Professional Status		
Doctor	56	20.0
Nurse/Midwife	151	53.9
CHEW	73	26.1
Level of Education		
Certificate/Diploma	195	69.6
Bachelors	38	13.6
Masters	7	2.5
Resident	18	6.4
Senior Registrar	22	7.9
Work experience		
0 – 4 years	76	27.1
5 – 9 years	74	26.4
10 – 14 years	80	28.6
15 – 19 years	35	12.5
20 & above	15	5.4
Current Duty Post		
Intensive Care Unit/ Theatre	27	9.6
Accident and Emergency	28	10.0
Department		
General Outpatient Department	70	25
Medical ward	34	12.1
Surgical ward	21	7.5
Obstetrics/Gynaecology	64	22.9
Paediatric ward	20	7.1

Table 2: CPRrelated characteristics among Participants (N=280)

Variable	Frequency (n)	Percentage (%)
Formal CPR Training		
Yes	141	50.4
No	139	49.6
CPR training		
Not trained	190	67.9
< 6 months	38	13.6
6 months - 1year	34	12.1
1 year and more	18	6.4
BLS Training		
Yes	50	17.9
No	230	82.1
ACLS Training		
Yes	12	4.3
No	268	95.7
PBLs Training		
Yes	72	25.7
No	208	74.3
Duration of CPR training		
Not trained	190	67.9
0-1year	72	25.7
1year	18	6.4
Frequency of CPRs performed on patients		
Never	137	48.9
Daily	8	2.9
Weekly	40	14.3
Monthly	85	30.3
Annually	10	3.6
Patients survive the outcome of CPRs		
None survived CPR	137	48.9
Some survived CPR	114	40.7
All survived CPR	29	10.4

Basic Life Support (BLS), Advanced Cardiac Life Support (ACLS), and Paediatric Basic Life Support (PBLs).

<0.001 respectively. Furthermore, a higher proportion of participants with poor CPR knowledge exhibited poor skills competence (87.2%), while a higher proportion (54.5%) of those with good knowledge demonstrated good skills competence and this was found to be statistically significant ($p < 0.001$), Table 4.

Significant associations were observed only for professional status (AOR = 7.955, $p < 0.001$), and PBLs certification (AOR = 0.005, $p < 0.001$). Nurses showed a notable association with CPR knowledge compared with medical doctors (AOR = 7.955, $p < 0.001$). In addition, participants with PBLs certificates were likely to have good knowledge of CPR compared with those without the

Table 3: Association between sociodemographic and work -related variables and the CPR level of knowledge among participants (N=280).

Variables	Level of knowledge		Test value χ^2	P- value
	Poor n (%)	Good n (%)		
Hospital			44.510	<0.001
UDUTH	61(36.5)	106(63.5)		
General Hospital	32(80.0)	8(20.0)		
Primary Health Care	55(75.3)	18(24.7)		
Gender			1.117	0.311
Male	45(48.5)	48(51.6)		
Female	103(55.1)	84(44.9)		
Age group			0.332	0.847
20 – 29	54(51.9)	50(48.1)		
30 - 39	69(52.3)	63(47.7)		
40 and above	25(56.8)	19(43.2)		
Professional status			26.575	< 0.001
Medical Doctor	17(30.4)	39(69.6)		
Nurse/Midwife	76(50.3)	75(49.7)		
CHEW	55 (75.3)	18(24.7)		
Level of Education			53.768	< 0.001
Certificate/Diploma	127(65.11)	68(34.9)		
Bachelor/Master	20(44.4)	25(55.6)		
Residency	1(2.5)	39(97.5)		
Current Duty Post			9.210	0.002
Critical area	19(34.5)	36(65.5)		
Non-critical area	129(57.3)	96(42.7)		
Work experience group			0.805	0.370
< 10 years	109 (51.9)	101(48.1)		
= 10 years	32(45.7)	38(54.3)		
Formal training in CPR			37.364	< 0.001
Yes	49(34.8)	92(65.2)		
No	99(73.5)	40(28.8)		
BLS			9.974	0.002
Yes	18(36.0)	32(64.0)		
No	130(56.5)	100(43.5)		
ACLS			103.035	< 0.001
Yes	1(8.3)	11(91.7)		
No	147(54.9)	121(45.1)		
PBLs			24.426	< 0.001
Yes	1(8.3)	11(91.7)		
No	147(54.9)	61(29.3)		
Frequency of CPRs			67.783	< 0.001
Never	104(54.7)	86(45.3)		
< a month	26(36.1)	46(63.9)		
= a month	16(88.9)	2(11.1)		
Patient outcome of CPRs				
Never performed CPR	41(36.3)	72(63.7)		
None survived CPR	4(10.0)	36(90.0)		
Some survived CPR	88(76.5)	27(23.5)		
All survived CPR	8(66.7)	4(33.3)		

Basic Life Support (BLS), Advanced Cardiac Life Support (ACLS), and Paediatric Basic Life Support (PBLs), Critical area (Accident and Emergency Unit, Emergency Paediatric Unit, Gynaecology Emergency Unit, Labour room), $\chi^2 =$ Chi-square, $p < 0.05$.

certificate, Table 5. There are increased odds (43 and 38) of having good skills when participants were from UDUTH and General Hospital respectively compared to those from Primary Health Care. In addition, compared to those with a Diploma/certificate, participants with Bachelor/Master qualifications and those in the Residency program have 29%

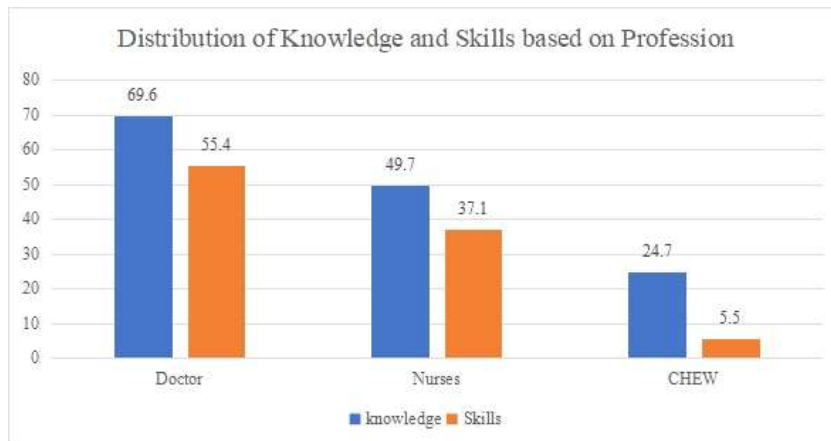


Figure 1: Proportions of various cadres of healthcare professionals with good Knowledge and Skills of CPR

Table 4: Association between Sociodemographic Characteristics and Skills Competence among Participants.

Variable	Poor n (%)	Good n (%)	χ^2	P-value
Hospital			36.134	< 0.001
UDUTH	92(55.1)	75(44.9)		
General Hospital	28(70.0)	12(30.0)		
PHC	69(94.5)	4(5.5)		
Gender			25.517	0.892
Male	62(66.7)	69(32.1)		
Female	127(67.9)	91(32.5)		
Age			25.517	< 0.001
20 – 29 years	87(83.7)	49(37.1)		
30 – 39 years	83(62.9)	25(56.8)		
=40 years	19(43.2)	91(32.5)		
Professional status			39.08	< 0.001
Medical Doctor	25(44.6)	31(55.4)		
Nurse/Midwife	95(62.9)	56(37.1)		
CHEW	69(94.5)	4(5.5)		
Level of Education			53.768	< 0.001
Diploma/Cert	127(65.1)	68(34.9)		
Bachelor/MSc	20(44.4)	25(55.6)		
Residency	1(2.5)	39(97.5)		
Years of work experience			0.624	0.734
<10 years	76(50.7)	74(49.3)		
10-19 years	61(55.5)	49(44.5)		
=20 years	11(55.0)	9(45.0)		
Current Duty Post			9.210	0.002
Critical area	19(34.5)	36(65.5)		
Non-critical area	129(57.3)	96(42.7)		
Knowledge score			55.325	< 0.001
Poor	129 (87.2)	19(12.8)		
Good	60(45.5)	72(54.5)		

Critical area (Accident and Emergency Unit, Emergency Paediatric Unit, Gynaecology Emergency Unit, Labour room), χ^2 = chi-square, p < 0.05.

Table 5: Factors associated with the level of CPR knowledge among participants using Multiple Logistic Regression (N=280)

Variable	Adjusted Odds Ratio	95% CI		P- value
		Lower Bound	Upper Bound	
Professional status				
CHEW (Ref)	1.00			
Medical Doctor	7.955	2.757	22.952	< 0.001
Nurse/midwife	1.292	0.591	1.426	0.520
Current Duty Post				
Critical area (Ref)	1.00			
Non-critical area	0.625	0.274	1.426	0.264
BLS training certificate				
No (Ref)	1.00			
Yes	0.907	0.247	3.322	0.882
Paediatric basic life support				
No (Ref)	1.00			
Yes	0.005	0.001	0.045	< 0.001
Patient survival				
None survive (Ref)	1.00			
Some survive	3.159	0.247	3.322	0.055
All survive	2.602	0.785	9.025	0.116

Confidence Interval (CI), Reference (REF), p< 0.05.

Table 6: Factors associated with the Level of CPR Skills Competence among Participants using Multiple Logistic Regression (N=280)

Variable	Adjusted Odds Ratio	95% CI for Odds Ratio		P- value
		Lower Bound	Upper Bound	
Hospital				
Primary health care (Ref)	1.00			
General Hospital	38.28	4.61	317.65	0.004
UDUTH	45.136	5.944	345.749	< 0.001
Level of Education				
Diploma/Certificate (Ref)	1.00			
Bachelor/Master	0.298	0.122	0.728	0.008
Residency	0.035	0.009	0.136	< 0.001
Current Duty Post				
Non-critical area (Ref)	1.00			
Critical area	1.796	0.885	3.643	0.105
BLS training certificate				
No (Ref)	1.00			
Yes	4.078	1.539	10.810	0.009
ACLS				
No (Ref)	1.00			
Yes	62.459	2.872	1358.190	0.009

Critical area (Accident and Emergency Unit, Emergency Paediatric Unit, Gynaecology Emergency Unit, Labour room), Confidence Interval (CI), Reference (REF), p< 0.05.

and 3.5% increased odds of respectively of possessing better CPR skills competence. Also, possession of BLS and ACLS certificates influenced CPR skills competence with an odd of 4 and 62 respectively, Table 6.

Discussion

This cross-sectional study aimed to assess the

levels of knowledge and skills in cardiopulmonary resuscitation (CPR) among health workers in Sokoto Metropolis. Utilizing internationally recognized guidelines, the study employed a validated questionnaire from the American Heart Association to comprehensively examine CPR proficiency among healthcare providers in Nigeria.^{28,30}

This approach enhances the reliability and

comparability of findings, contributing valuable insights to the global discourse on healthcare practices.^{31,32}

The study highlights a gender disparity in Northern Nigeria's health sector, with women gravitating towards nursing due to perceptions of lower demand compared to medicine. This trend is influenced by cultural and societal pressures which discourage women from pursuing the medical profession, while men dominate medical roles.^{33,34} This may partly be the reason for the existing gender imbalances, particularly in maternal and reproductive health services. Recommendations include enhancing educational opportunities for women, implementing gender quotas, and fostering positive gender norms to create a more inclusive healthcare workforce.^{7,35}

Despite about half of the participants undergoing formal CPR training, a significant majority lacked certification in Basic Life Support (BLS), Advanced Cardiovascular Life Support (ACLS), or Paediatric Basic Life Support (PBLs). In addition, the current study noted that possession of PBLs certification was strongly associated with CPR knowledge, while ACLS and BLS certification predicts good CPR skills. This agrees with other studies which associated the knowledge of CPR with the acquisition of a CPR certificate. Thus emphasizes the importance of specialized training in the acquisition of knowledge and skills of CPR.^{36,37} This highlighted a prevalent challenge in healthcare facilities across Sub-Saharan Africa, emphasizing the need for certification and training to enhance the overall preparedness of healthcare professionals.^{27,38}

Examining CPR knowledge among health workers in tertiary healthcare centres revealed a notable discrepancy compared to counterparts in secondary or primary healthcare settings. Tertiary health facility workers demonstrated superior CPR knowledge, aligning with findings from other studies from other countries including Nigeria.³⁹⁻⁴¹ The study emphasized the crucial role of health workers in influencing CPR knowledge, with medical doctors exhibiting a higher level compared to counterparts in other countries.⁴²⁻⁴⁵ This may be because medical training (undergraduate and postgraduate) is well structured and organized with clinical exposure, emergency postings and formal CPR training incorporated.^{44,46} Collectively, these factors could explain the doctors' superior CPR knowledge over other healthcare workers.^{47,48}

Contrary to expectations, Community Health Extension Workers (CHEWs), who serve as the primary contact in primary healthcare, demonstrated the least knowledge of CPR. This highlights the necessity of incorporating thorough CPR training into both undergraduate education and the continuing professional development of health workers and nurses.^{34,49,50} Although doctors showed relatively strong CPR knowledge, the overall knowledge among health workers was below average. This is largely attributed to poor CPR knowledge among other health workers, particularly CHEWs, underscoring a critical public health issue that needs immediate attention.^{27,38}

This study revealed an overall suboptimal CPR skill level among health workers, with medical doctors displaying just above average skills, surpassing nurses and CHEWs. The CHEWs also ranked the least in terms of CPR skills and this could be correlated with their poor CPR

knowledge. This underscored the critical need for targeted interventions to enhance both CPR knowledge and skills among health workers. In addition, factors such as professional status, academic qualification, and possession of specific CPR certifications. This agrees with previous studies that suggested that possession of PBLs certification, formal CPR training, and academic qualification influences CPR proficiency, with senior doctors showing more knowledge and skills of CPR indicating its impact on knowledge acquisition.^{44,51}

Conclusion:

Cardiopulmonary Resuscitation stands as a vital therapeutic intervention for restoring circulation post-cardiac arrest. However, despite its crucial role in healthcare, significant gaps persist in both knowledge and skills among healthcare providers, especially among community health extension workers in the current study. Although this study could not measure the CPR knowledge and skills retention among health workers, it however underscores the urgent need for structured CPR training programs and continuous professional development initiatives to bridge these gaps, ultimately improving emergency response and patient outcomes.

Conflict of interest: No conflict of interest was declared.

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