Original Research Article

Factors Associated with Basic Life Support Knowledge among Resource-Limited Hospital Nurses: A Cross-Sectional Study in North-Western Nigeria

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Abstract: *Background*: Basic life support (BLS) is a component of life-saving intervention for cardiac arrest patients. In addition to factors related to sociodemographic, and work characteristics, the level of BLS knowledge and skills nurses possess is a critical determinant of whether cardiac arrest patients in the care of nurses can survive. *Objective*: To assess the BLS knowledge level and its associated factors among resource-limited hospital nurses in north-western Nigeria. *Methodology*: A cross-sectional study of 470 nurses conducted in seven referral hospitals in north-western Nigeria between May and July 2021. A stratified simple random sampling done based on the population size of nurses in each of the selected wards. A self-administered questionnaire was used to collect data. *Results*: Out of 470 nurses, 53.4% had poor BLS knowledge scores. Variables such as age, current place of work, and duration of training with p<0.25 were investigated further in multiple logistic regression. Only nurses with more than 5-year BLS/CPR training duration were 1.907 times more likely to have good BLS/CPR knowledge than those who were not trained (AOR = 1.907, 95% CI: 1.016, 3.577, p = 0.044). *Conclusions*: Only one factor shows significance association, with the majority of nurses' revealing poor BLS/CPR knowledge which remains a public health concern, especially in a limited resource setting. Implication is that nurses are unable to provide good BLS in the event of a cardiac arrest emergency. Further study is needed on a larger scale to assess other factors for an effective survival outcome among cardiac arrest victims.

Keywords: Cardiac Resuscitation, Knowledge, Training, Nurses.

1.0 INTRODUCTION

A cardiac arrest is a life-threatening medical or surgical emergency (Nolan *et al*., 2019) . It is a major global health issue, especially in low-income countries, and may be related to a lack of adequate medical facilities and resources *(Mersha et al*., 2020; van Nieuwenhuizen *et al*., 2019). In 2017 an estimated 17 million people die from cardiovascular diseases yearly, or 32% of all deaths worldwide (Mensah, 2019). Data on mortality from cardiovascular disease (CVD) in Sub-Saharan Africa showed that CVD was responsible for approximately one million deaths (Roth *et al*., 2020). Furthermore, the prevalence of heart failure, hypertension, and stroke in Nigeria has increased over the last 20 years, and these illnesses remain among the top causes of sudden cardiac mortality (Ike and Onyema 2020; Mbakwem *et al*., 2023; Sani *et al*., 2020). Nurses spend a lot of time with patients because of the nature of their job, and they are frequently the first responders to cardiac emergencies in hospitals; the nurses are the ones who administer CPR first. As a result, whether individually or as part of a quick response team, their role in providing quality care is crucial (Dermer *et al*., 2023). Patients resuscitated by nurses trained in advanced cardiac life support (ACLS) had a fourfold higher survival rate than nurses without ACLS training (37.5% versus 10.3%) (Anderson *et al*., 2019). Several studies have revealed disparities in CPR knowledge and skill levels among healthcare professionals, such as nurses. For instance, even in advanced countries, it is not unusual for healthcare providers working in similar or the same organizations to have varying levels of knowledge and skill (Munezero *et al*., 2018a). Unfortunately, evidences have shown that CPR training programmes do not always yield the desired results, resulting in a considerable drop in knowledge and skills a few months following CPR/BLS training (Necho *et al*., 2024).

Data on nurses' CPR knowledge and skills are scarce, if not nonexistent, in many African institutions, including Nigeria. The few studies on CPR knowledge and skill levels among nurses published in Nigeria were uneven, with the majority indicating poor skills and knowledge. Some of the studies in Nigerian revealed that 43.9% of public health nurses in Calabar, Nigeria, were unaware of CPR (Onyeaso and Onyeaso 2019). Similarly, research in a semi-urban setting in northern Nigeria found that nurses and doctors had a poor mean CPR knowledge score of 21.2±18.6 (Aliyu *et al.*, 2019). Although only one study among nurses reported a 74.9% good CPR knowledge level, 56.3% had a negative attitude toward CPR (Okwuikpo and Amere 2020). There have also been reports of other associated factors that affect CPR knowledge levels. Two studies among Ethiopian nurses revealed a significant association between both age and academic qualification and the level of CPR knowledge among the nurses (p<0.05) (Mersha *et al.*, 2020). In Iran, nurses working solely in the emergency department revealed a significant inverse relationship between staff age and poor CPR knowledge retention (r = -0.09, p = 0.009) (Papi, Hakim, and Bahrami 2020). Similarly, studies in Brazil and Egypt reported that nurses' work experience, such as the length of time since graduation, is linked with nurses' lower theoretical knowledge level (p<0.05) (Zayed & Saied 2020).

For better results or outcomes following cardiac arrest training, healthcare providers must periodically be able to refresh their current CPR knowledge and skills (Oermann *et al.*, 2020). Besides, these medical professionals must be able to apply their newly gained knowledge and skills in real-life situations by performing high-quality CPR (Roel and Bjørk 2020). No doubt, the Consensus on Science and Treatment Recommendations (CoSTR) of the International Liaison Committee on Resuscitation (ILCOR) has adopted 5-year revised CPR guidelines, considered the "gold standard," to address gaps in CPR knowledge (Necho *et al.*, 2024). Indeed, there is a global issue with health workers' lack of knowledge and skills regarding CPR and management techniques for cardiac arrest, particularly in nations with limited resources like Nigeria. Therefore, this study aimed to add to the existing literature regarding the CPR knowledge level among nurses in northwest Nigeria and its contributing factors.

2.0 MATERIALS AND METHODS

2.1. Study Design, Settings, and Participants
A cross-sectional study to assess factors associated with CPR knowledge level in seven selected north-western hospitals zone of Nigeria. The study was carried out between May and July 2021 among 470 nurses working in Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, and Zamfara states. North-western Nigeria is one of Nigeria's geopolitical zones. It is the ancestral homeland of the Hausa people. According to the National Bureau of Statistics reported that north-western Nigeria had a population of around 35,786,944 people (36 million), accounting for 32.5% of Nigeria's total population of 149 million (National Bureau of Statistics Nigeria 2018). The north-west and north-east zones had the lowest concentration of tertiary health facilities when compared to other zones such as south-west and south-south zones (Makinde *et al.*, 2018).

2.2 Data Collection Instruments
The quantitative data collection tool for healthcare providers was adapted from the AHA BLS. A semi-structured questionnaire with 25 closed-ended multiple-choice questions (MCQs) with only four options (A to D) was used (Kayadelen and Durukan 2021). It was divided into two sections: the first contained the participants' sociodemographic information as well as a profile of their work experience, and the second assessed their knowledge of CPR. The content validity of the questionnaire was performed by experts from the faculty of medicine and health science, while 15 participants filled out and returned a form designed for the face validity used during the pilot study, with a total of 93.3% agreeing that all the questions were satisfactory.

2.3 Sample Size Determination and Sampling Procedure
Sample size was calculated based on the sample size formula between the two mean scores (Lachenbruch, Lwanga, and Lemeshow 1991), and the mean SD score of CPR knowledge among faculty members (6.40±2.439) and other lecturers (5.70±1.913), 95% confidence level, 80% power, 70% response rate, and 1.3 design effect, the final sample size was 567, with 81 nurses recruited from each hospital was adopted by (Alotaibi *et al.*, 2016). However, only 470 nurses were able to fill and returned completed questionnaire. A stratified simple random selection method was used to choose eligible nurses from the various wards/units of the identified referral hospitals. The hospital wards were numbered from 1 to N based on a ward/unit duty roster list of all registered nurses at the HOD nursing office in each of the seven referral hospitals. Each stratum (ward/unit) was allocated a computer-generated random number, with the size according to the staff makeup. Inclusion criteria include being a registered nurse with the Nigerian Nursing Council, willing to participate and have a written consent as well as be able to read and write in English. While the exclusion criteria are not willing to participate in the study at any stage.

2.4 Data Processing and Analysis
Data was analyzed using SPSS version 27.0. Kolmogorov-Smirnov normality test was used to evaluate the normality of data. Median and interquartile range (IQR) were presented because of not normally distributed data. Chi square and fisher exact test were used to determine association between the group variables with categorical data. Simple

logistic regression was done to determine each factor associated with the level of knowledge. Those factors with less than p<0.25 were further tested with multiple logistic regression to determine the factors associated with level of knowledge. P-value of (p=0.05) was considered significant. Model checking was done using Variable selection method: Forward likelihood ratio; Classification percentage=55.7%, Hosmer and Lemeshow test (p=0.999), cox snell = 1.3%, Nagelkerke's pseudo–R Square=1.8%; Onminus test (χ2=6.216, p=0.045).

2.5 Ethical Approval and Consent to Participants
Ethical approval was obtained from both X - Universiti with (registration number xxx-2020-185) and each of the selected hospitals. Informed written consent was obtained from each of the participants.

3.0 RESULTS
3.1 Sociodemographic Characteristics and Work Experience of Nurses
Table 1 show that the overall number of nurses in the study was 470, with an 82.9% response rate. Women account for over two-thirds of those who took part (66.8%). Eighty-six percent of the nurses who took part were between the ages of 20 and 49. Those with an RN or RN/RM certificate accounted for 66.6% of the total, making them the most common. Medical centers accounted for 39.8%, while teaching hospitals accounted for 60%.

Table1: Distribution of Sociodemographic data among participants in seven hospitals (N=470)

Variable	Frequency (n)	Percentage (%)
Hospitals group		
Medical centers	187	39.8
Teaching hospitals	283	60.2
Gender		
Male	156	33.2
Female	314	66.8
Age group		
20 – 49	405	86.2
50 and above	65	13.8
Professional Status		
Registered Nurse	236	50.2
Registered Nurse and Midwife	212	45.1
Registered Nurse/Others	22	4.7
Academic qualification group		
Diploma in Nursing	175	37.2
Diploma in Nursing/Midwifery	138	29.4
Bachelors/Masters/PhD in Nursing	157	33.4

Table 2 shows that 45.3% had work experience ranging from 11 to 20 years. In addition, 37.2% worked in critical areas, while the remaining 62.8% were in non-critical areas. Furthermore, only 38.7% of the nurses had received any formal CPR training, with only 22.8% having less than one year, 10.2% from one year to five years, and 5.7% from five years or more, leaving the remaining 61.3% untrained. 51.9 % of those who took part in this study had never done CPR on a patient, while 33.3 % had performed it.

Table 2: Work-related characteristics among participants in seven hospitals (N=470)

Variable	Frequency (n)	Percentage (%)
Work experience group		
1 – 10 years	152	32.3
11 – 30 years	293	62.3
31 & above	25	5.3
Current area of assignment Grouping		
Critical care areas	175	37.2
Non-critical care areas	295	62.8
Formal CPR Training		
Yes	182	38.7
No	288	61.3
Basic life support (BLS) Training		
Yes	102	21.7
No	368	78.3

Variable	Frequency (n)	Percentage (%)
Advance cardiac life support (ACLS) Training		
Yes	34	7.2
No	436	92.8
Paediatric basic life support (PBLS) Training		
Yes	46	9.8
No	424	90.2
Duration of CPR training group		
Not trained	288	61.3
0 month – 5years	155	33.0
5years and above	27	5.7
Frequency of CPRs performed on patients' group		
Never	244	51.9
Yes	226	48.1
Patients survive the outcome of CPRs		
None survived CPR	329	70.0
Some survived CPR	107	22.8
All survived CPR	34	7.2

3.2 The Level of Knowledge among Nurses

Table 3 shows the spread of both total scores among all the nurses in the study as well as correct answers to the CPR knowledge items. The nurses most correctly answered question 14 (procedures to check for a victim's breathing, 72.3%), question one (knowing the purpose of CPR, 70.0%), question 19 (operation of an AED, 56.6%), and question 23 (important qualities of high-quality CPR, 53.0%). While those who did poorly are on question seven (What action are you supposed to take when more rescuers arrive? Then question 22 (how can one tell if ventilation is reaching the victim? 74.6%), and lastly, on question three (an action a rescuer can take to potentially reduce the risk of gastric inflation? 73.8%) A total of 53.4% had poor knowledge, while 46.6% of the participants had good knowledge.

Table 3: Distribution of response on each knowledge questions among participants in seven hospitals (N=470)

Knowledge question	Correct n(%)	Incorrect n(%)
1. The goal of CPR is to keep the following things going: heartbeat until respirations are restored; respirations until the heartbeat is returned; consciousness until the heartbeat is restored;	329(70.0%)	141(30.0%)
2. The patient who collapsed will not respond to your call, which is your best next action	181(38.5%)	289(61.5%)
3. What action can rescuers take to possibly reduce the risk of gastric inflation?	123(26.2%)	347(73.8%)
4. The correct sequence of steps for the CPR is as follows: Chest compressions, airway and breathing?	165(35.1%)	305(64.9%)
5. If an injury to the cervical spine is suspected, which method of opening the airway should be used?	208(44.3%)	262(55.7%)
6. How long do you want to evaluate pulse before deciding the victim needs compression?	230(48.9%)	240(51.1%)
7. What action are you supposed to take when more rescuers arrive?	73(15.5%)	397(84.5%)
8. How often do rescuers switch roles when performing 2 CPR rescuers?	155(33.0%)	315(67.0%)
9. Rescue breathing should be performed: When the victim has a pulse but no spontaneous breathing; One breath every five to six seconds on adult victims; One breath every three to five seconds on child and infant victim; All of the above	205(43.6%)	265(56.4%)
10. Where are you supposed to put your hands on the victim's chest when you're doing chest compression?	201(42.8%)	269(57.2%)
11. Which artery is usually used to feel the pulse of an adult victim	184(39.1%)	286(60.9%)
12. The 2015 American Heart Association Guidelines set the rate of compression per minute as?	181(38.5%)	289(61.5%)
13. How do you know when to start the compression?	161(34.3%)	309(65.7%)
14. What are the three steps to check for a victim's breathing?	340(72.3%)	130(27.7%)
15. You are at your grandmother's house. Your grandmother is unresponsive and has stopped breathing. You are giving her mouth-to-mouth breathing. Which of the following statements is the best explanation for the positive effects of rescue breaths?	252(53.6%)	218(46.4%)
16. The basic life support steps for adults are as follows:	195(41.5%)	275(58.5%)

Knowledge question	Correct n(%)	Incorrect n(%)
17. What is the compression-to-ventilation ratio for one CPR rescuer for victims of all ages?	210(44.7%)	260(55.3%)
18. What action are you supposed to take when the AED analyzes the rhythm?	128(27.2%)	342(72.8%)
19. The appropriate steps for the operation of the AED are:	266(56.6%)	204(43.4%)
20. Which step is one of the universal step for operating an AED?	140(29.8%)	330(70.2%)
21. The correct compression depth for an adult patient is as follows:	210(44.7%)	260(55.3%)
22. How can you tell if the ventilation is going to the victim?	111(23.6%)	359(76.4%)
23. The critical characteristics of the high-quality CPR include the following?	249(53.0%)	221(47.0%)
24. When performing Basic Life Support for adults, children or infants, the first step in the CPR sequence is to:	130(27.7%)	340(72.3%)
25. Which of the following choices best describes the method used to hold the mask in place while delivering ventilations via a bag valve mask?	180(38.3%)	290(61.7%)
Total knowledge score [Median (IQR)]	10± (4)	
Poor knowledge (<10)	250	53.4%
Good knowledge (≥11)	220	46.6%

3.3 Factors Associated with the Level of CPR Knowledge among Nurses Using Multiple Logistics Regression (N=470)

Table 4 reveals the results of simple logistic regression that reported age of participants (p=0.148), current field of work (p=0.176), and duration of training group (p=0.044) as variables with p<0.25 which were investigated further in multiple logistic regression. The result revealed that only one variable was associated to CPR knowledge level. Nurses with more than five years of CPR training were 1.907 times more likely to have higher CPR knowledge than those who had not (AOR=1.907, 95% CI: 1.016, 3.577, p=0.044).

Table 4: Factors associated with the level of CPR knowledge among participants using simple and multiple logistic regression (N=470)

Variables	Level of knowledge		Test value χ^2 (df)	P- value
	Poor n (%)	Good n (%)		
Age group				
20 - 49	210(51.9%)	195(48.1%)	2.111[a]	0.146
50 and above	40(61.5%)	25(38.5%)		
Current area of assignment group				
Critical care areas	86(49.1%)	89(50.9%)	1.836[a]	0.175
Non-critical care areas	164(55.6%)	131(44.4%)		
Duration of CPR training group				
Not trained	151(53.4%)	132(46.6%)	6.192[a]	0.045*
<5years	81(58.3%)	58(41.7%)		
>5years	18(37.5%)	30(62.5%)		

*variables with p <0.05, a= chi square test value

Table 5:

Variable	Adjusted Coefficient	Standard Error	Adjusted Odds Ratio	95% Cl for Odds Ratio		P- value
				Lower Bound	Upper Bound	
Duration of training group						
Not train	Ref					
< 5 years	-0.200	0.209	0.819	0.544	1.234	0.340
> 5 years	0.645	0.321	1.907	1.016	3.577	0.044*
Intercept	-0.134	0.119				

*variables with p <0.05, Confidence Interval (CI), Reference (REF), Variable selection method: Forward likelihood ratio; Classification percentage=55.7%, Hosmer and Lemeshow test (p=0.999), cox snell = 1.3%, Nagelkerke's pseudo R Square=1.8%; Onminus test (χ^2=6.216, p=0.045).

4.0 DISCUSSION

This cross-sectional study had an 82.9% response rate, implying that it had enough power to identify statistically significant effects. Nurses are frequently the first to notice a cardiac arrest victim, so they play a critical role in the care of

in-hospital cardiac arrest (Navalpotro-Pascual, Blanco-Blanco, and Torre-Puente 2019). Since improper CPR administration can result in broken ribs, inadequate lung inflation, and poor cardiac output, all of which can result in brain damage or patient death from cardiac arrest (Fariduddin and Siau 2021; Manono, Mustisya, and Chakaya 2021; Moreira, Neto, and Freitas 2019). A nurse should become knowledgeable and skilled in performing effective CPR in the case of an emergency because CPR knowledge and competent skills are essential ingredients for preventing and reviving a collapsed patient.

In this study, 53.4% of nurses reported inadequate CPR knowledge levels as compared to other studies from places like Kano, Nigeria (98%) (Aliyu *et al*., 2019), Ethiopia (61.4%) (Kelkay *et al*., 2018), Peru (59.0%] (Aranzábal-Alegría *et al*., 2017); and Egypt (68.3%) (Mohammed *et al*., 2020) that had all reported higher percentages of inadequate knowledge levels. The reason may not be unconnected with the heterogeneity associated with design, population, sample size, or settings. For instance, in the Egypt study it was among junior medical students, while studies in Kano and Peru were multicenter among different healthcare providers. Even though the Ethiopian study was among nurses only, it was not a multicenter design, as in this current study.

Furthermore, studies conducted in other countries, such as Tanzania (50.0%) (Kaihula *et al*., 2018), Botswana (48.0%) (Rajeswaran *et al*., 2018), and Ethiopia (35.1%) (Mersha *et al.*, 2020), were found to have lower percentages of knowledge levels as compared to the current study findings. Some possible reasons might be that in the Tanzanian study it was not multicenter study couple with also a smaller sample size. In these studies, 80% was used as the pass mark to determine CPR knowledge level, rather than 50%. Botswana and Ethiopia were multicenter but with smaller sample sizes. Further large-scale studies may be needed to include the remaining five geographical zone so as to compare the differences of knowledge level of nurses across the zone in Nigeria.

Among sociodemographic and work-related factors, only one had an association with nurses' CPR knowledge level in this study. The result revealed that nurses who had received more than five years of training were more likely to be knowledgeable about CPR than those who had not. One possible explanation for this finding might be associated with the pattern of knowledge decay following training. After an initial steep reduction, participants' knowledge plateaus; although in some studies the precise duration of the knowledge plateau is unknown, it may be low or high depending on the participant's characteristics (Kelkay *et al*., 2018; Mersha *et al.*, 2020). Findings from this study show a higher knowledge level among participants with more than five years of training duration and an acceptable knowledge level compared to those with less than five years of training or who do not train. Another reason may be due to the discrepancy in training duration between participants. Guteta *et al*., revealed that participants with more than five years of CPR training were more likely to have witnessed, practiced, and attempted CPR than those who were not trained or had fewer than five years of experience (Guteta 2022). As seen in this study, only 5.7% of those surveyed had more than five years of CPR training, 33.0% had one to five years of training, and the remaining 61.3% had no CPR training. It is suggested that other large-scale studies should be done across all the geographical zone in Nigeria.

No doubt, the high proportion of nurses with poor CPR knowledge seen in this study is a public health issue. According to Queenet *et al*., the lack of knowledge among Nigerian nurses may be due to the lack of a structured CPR training scheme at undergraduate medical schools (Queenet Kalu 2018). Other resuscitation literature studies, both within and outside Nigeria, also demonstrated a rapid drop in CPR knowledge levels a few months after training (Ike and Onyema 2020; Mersha *et al.*, 2020; Munezero *et al.*, 2018b; Zayed & Saied 2020). Of course, there is a link between a lack of CPR knowledge and a lower chance of survival in cardiac arrest patients, according to numerous studies (Matthew Riggs Lua Saylany, Peter Leggat 2019; Panchal *et al*., 2020; Subdistrict *et al*., 2020; Waelveerakup 2019). Indeed, frequent resuscitation training improves the quality of the nurses' CPR knowledge and performance. Therefore, nurses must participate in periodic cardiac resuscitation retraining to achieve a better resuscitation outcome (Reckrey *et al*., 2021).

4.1 Limitation of This Study
This study has its own limitations. First, the study is cross-sectional that only looked at CPR knowledge of nurses in only one out of six geographical zone in Nigeria. Thus, lack generality capacity to include all nurses in Nigeria. Second, CPR is a step-by-step procedure, which if not performed correctly may result in a bad outcome. As a result, participants might be practicing a wrong step, however because of the MCQ options provided in the questions these participants may chose the correct options resulting to what might be called social desirability bias among respondents in answering the CPR knowledge questions. Finally, the study did not include individual testing of CPR skills aspect among the nurses, and thus, the findings may not be generalized due to this deficiency among all the participating nurses in the north-western Nigeria.

5.0 CONCLUSION
According to this study, the researcher can safely conclude that nurses have poor CPR knowledge level, which is consistent with other resuscitation literature. And that only the timing of CPR instruction was related to the participants'

CPR knowledge level. All other factors have no meaningful relationship. As a result, future research on a large scale is needed to include skills so as find other factors that might be associated with the CPR competencies. Because the nurses' role is vital in caring for patients, it is the nurses' obligation to manage patients when an emergency occurs when the physician is not there; therefore, CPR/BLS knowledge and skill should be an essential role of the nurses to accomplish this objective.

REFERENCES

- Aliyu, I. (2019). "Practice of Cardiopulmonary Resuscitation among Health Care Providers in a Tertiary Health Centre in a Semi-Urban Setting." *Journal of Acute Disease*, *8*(4), 160.
- Alotaibi, O., Alamri, F., Almufleh, L., & Alsougi, W. (2016). Basic life support: Knowledge and attitude among dental students and Staff in the College of Dentistry, King Saud University. *The Saudi Journal for Dental Research*, *7*(1), 51-56.
- Anderson, R., Sebaldt, A., Lin, Y., & Cheng, A. (2019). Optimal training frequency for acquisition and retention of high-quality CPR skills: a randomized trial. *Resuscitation*, *135*, 153-161.
- Dermer, J., James, S., Palmer, C., Christensen, M., & Craft, J. (2023). Factors affecting ward nurses' basic life support experiences: An integrative literature review. *International Journal of Nursing Practice*, *29*(5), e13120.
- Fariduddina, M. N., & Siau, C. S. (2021). Knowledge, attitude and perceptions towards basic life support training among student teachers in a Malaysian University. *The European Journal of Social & Behavioural Sciences*.
- Guteta, M. (2022). Factors affecting cardiopulmonary resuscitation practice among nurses in Mizan Tepi university teaching hospital, Tepi general hospital, and Gebretsadik Shawo hospital, Southwest Ethiopia. *Open Access Emergency Medicine*, 165-175.
- Ihunanya, O. M., Oke Michael, R. N., Babcock, B. N. S. C., Amere, L. T., & RPHN, B. (2020). Knowledge, attitude and practice of cardiopulmonary resuscitation among nurses in Babcock University Teaching Hospital in Ilishan-Remo, Ogun State, Nigeria. *International Journal of Caring Sciences*, *13*(3), 1773-1782.
- Ike, S. O., & Onyema, C. T. (2020). Cardiovascular diseases in Nigeria: What has happened in the past 20 years?. *Nigerian Journal of Cardiology*, *17*(1), 21-26.
- Kaihula, W. T., Sawe, H. R., Runyon, M. S., & Murray, B. L. (2018). Assessment of cardiopulmonary resuscitation knowledge and skills among healthcare providers at an urban tertiary referral hospital in Tanzania. *BMC health services research*, *18*, 1-8.
- Kalu, Q. D., Oboko, O. O., Stephen, O., & Nwaogburu, K. N. (2018). Witnessed cardiac arrest by Nigerian health workers; improving the outcomes. *Global Journal of Anesthesiology*, *5*(1), 7-12.
- Kayadelen, C. L., Kayadelen, A. N., & Durukan, P. (2021). Factors influencing paramedics' and emergency medical technicians' level of knowledge about the 2015 basic life support guidelines. *BMC Emergency Medicine*, *21*, 1-7.
- Kelkay, M. M., Kassa, H., Birhanu, Z., & Amsalu, S. (2018). A cross sectional study on knowledge, practice and associated factors towards basic life support among nurses working in amhara region referral hospitals, northwest Ethiopia, 2016. *Hos Pal Med Int Jnl*, *2*(2), 123-130.
- Lachenbruch, P. A. (1991). Sample size determination in health studies: a practical manual. *Journal of the American Statistical Association*, *86*(416), 1149-1150.
- Makinde, O. A., Sule, A., Ayankogbe, O., & Boone, D. (2018). Distribution of health facilities in Nigeria: implications and options for universal health coverage. *The International journal of health planning and management*, *33*(4), e1179-e1192.
- Manono, B. K., & MA, C. J. (2021). Assessment of knowledge and skills of cardiopulmonary resuscitation among health workers at Nakuru County Referral Hospital. *Int J Community.. Med Public Health*, *8*, 3224-30.
- Mbakwem, A. C., Amadi, C. E., Ajuluchukwu, J. N., & Kushimo, O. A. (2023). Trends and outcomes of cardiovascular disease admissions in Lagos, Nigeria: a 16-year review. *Cardiovascular Journal of Africa*, *34*(3), 140-148.
- Mersha, A. T., Egzi, A. H. K. G., Tawuye, H. Y., & Endalew, N. S. (2020). Factors associated with knowledge and attitude towards adult cardiopulmonary resuscitation among healthcare professionals at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia: an institutional-based cross-sectional study. *BMJ open*, *10*(9), e037416.
- Mohammed, Z., Arafa, A., Saleh, Y., Dardir, M., Taha, A., Shaban, H., ... & Hirshon, J. M. (2020). Knowledge of and attitudes towards cardiopulmonary resuscitation among junior doctors and medical students in Upper Egypt: cross-sectional study. *International journal of emergency medicine*, *13*, 1-8.
- Munezero, J. B. T., Atuhaire, C., Groves, S., & Cumber, S. N. (2018). Assessment of nurses knowledge and skills following cardiopulmonary resuscitation training at Mbarara Regional Referral Hospital, Uganda. *Pan African Medical Journal*, *30*(1).
- National Bureau of Statistics Nigeria, NBSN. 2018. "Demographic Statistics Bulletin." (May): 1–26.
- Navalpotro-Pascual, S., Blanco-Blanco, Á., & Torre-Puente, J. C. (2019). Experience of emergency healthcare professionals in cardiopulmonary resuscitation and its relationship with self-efficacy: A qualitative approach. *Enfermería Clínica (English Edition)*, *29*(3), 155-169.

- Necho, W. (2024). "Health Professionals ' Knowledge and Practice on Basic Life Support and Its Predicting Factors in Ethiopia : Systematic Review And." 6: 1–19. http://dx.doi.org/10.1371/journal.pone.0297430.
- Nolan, J. P., Ornato, J. P., Parr, M. J. A., Perkins, G. D., & Soar, J. (2019). Resuscitation highlights in 2018. *Resuscitation*, *135*, 168-175.
- Novaes Neto, E. M., & Freitas, K. S. (2019). Factors Associated to the Knowledge of Cardiac Arrest by Health Professionals. *International Journal of Cardiovascular Sciences*, *33*, 167-174.
- Oermann, M. H., Krusmark, M. A., Kardong-Edgren, S., Jastrzembski, T. S., & Gluck, K. A. (2020). Training interval in cardiopulmonary resuscitation. *Plos one*, *15*(1), e0226786.
- Onyeaso, A. O., & Onyeaso, C. O. (2019). Cardiopulmonary Resuscitation Knowledge in a Nigerian University Students after a Conventional and Hands-Only CPR Training Programmes. *Journal of Health Science*, *9*(1), 6-11.
- Panchal, A. R., Norton, G., Gibbons, E., Buehler, J., & Kurz, M. C. (2020). Low dose-high frequency, case based psychomotor CPR training improves compression fraction for patients with in-hospital cardiac arrest. *Resuscitation*, *146*, 26-31.
- Papi, M., Hakim, A., & Bahrami, H. (2020). Relationship between knowledge and skill for basic life support in personnel of emergency medical services, Islamic Republic of Iran. *Eastern Mediterranean Health Journal*, *26*(10), 1193-1199.
- Rajeswaran, L., Cox, M., Moeng, S., & Tsima, B. M. (2018). Assessment of nurses' cardiopulmonary resuscitation knowledge and skills within three district hospitals in Botswana. *African Journal of Primary Health Care and Family Medicine*, *10*(1), 1-6.
- Riggs, M., Franklin, R., & Saylany, L. (2019). Associations between cardiopulmonary resuscitation (CPR) knowledge, self-efficacy, training history and willingness to perform CPR and CPR psychomotor skills: a systematic review. *Resuscitation*, *138*, 259-272.
- Roel, S., & Bjørk, I. T. (2020). Comparing nursing student competence in CPR before and after a pedagogical intervention. *Nursing research and practice*, *2020*(1), 7459084.
- Roth, G. A. (2020). "Global Burden of Cardiovascular Diseases and Risk Factors, 1990-2019: Update From the GBD 2019 Study." *Journal of the American College of Cardiology, 76*(25), 2982–3021.
- Sani, M. U., Ogah, O. S., Scholtz, W., Nel, G., Fourie, J. M., & Scarlatescu, O. (2020). PASCAR and WHF Cardiovascular Diseases Scorecard project. *Cardiovascular Journal of Africa*, *31*(4), s19-s26.
- Subdistrict, C., Bang, P., Phra, N., & Si, A. (2020). "Effect of The Resuscitation Training Program on Knowledge and Skills and Perceived Self-Efficacy of Resuscitation Village Health Volunteers in Khlong และการร ๊ บร ๏ ๊ สมรรถนะแห ๏ งตนของอาสาสม ๊ ครสาธารณส ๏ ขประจ ▢ ำหม ๏๏ บ ๊ าน ต ▢ ำบลคลองจ ๎ ก อ ▢ ำเภอบาง." 21(3): 283–93.
- Thapa, S. B., Kakar, T. S., Mayer, C., & Khanal, D. (2021). Clinical outcomes of in-hospital cardiac arrest in COVID-19. *JAMA Internal Medicine*, *181*(2), 279-281.
- van Nieuwenhuizen, B. P., Oving, I., Kunst, A. E., Daams, J., Blom, M. T., Tan, H. L., & van Valkengoed, I. G. (2019). Socio-economic differences in incidence, bystander cardiopulmonary resuscitation and survival from out-of-hospital cardiac arrest: a systematic review. *Resuscitation*, *141*, 44-62.
- Waelveerakup, W. (2019). Effects of basic life support training program on knowledge, perceived self-efficacy, and basic life support performance of village health volunteers. *Interdisciplinary Research Review*, *14*(5), 25-30.
- Zayed & Saied. (2020). "*Knowledge among Nursing Professionals." 44*(1), 455–69.