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## The Influence of Knowledge Level on Adherence to American Heart Association Cardiopulmonary Resuscitation Guidelines Among Nurses at Kakamega County Referral, Kenya

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### Abstract

Effective care for patients during a cardiac arrest is ensured by the provision of Cardiopulmonary Resuscitation in adherence to American Heart Association guidelines. For effective CPR to be achieved, nurses need to have the most current knowledge on CPR as per the AHA guidelines and the right skills. The objective of this study is to assess the influence of knowledge level on adherence to AHA CPR guidelines among nurses working at Kakamega County Referral Hospital, Kenya. The study adopted a descriptive research design. The target population for the study was all the nurses licensed by the Nursing Council of Kenya at Kakamega County Referral Hospital. Multi-stage cluster sampling technique was used to select a sample size of 166 nurses. A questionnaire was used in data collection. Descriptive statistics such as frequencies and percentages were carried out. A linear logistic regression was used to present the relationship between adherence to American Heart Association Cardiopulmonary Resuscitation guidelines and nurses' knowledge level. The study established that the level of American Heart Association Cardiopulmonary Resuscitation adherence was poor. Overall, nurses' knowledge level on American Heart Association Cardiopulmonary Resuscitation guidelines was low as evidenced by low number of respondents who had valid certificates. The logistic regression revealed a significant relationship between knowledge level and adherence to American Heart Association Cardiopulmonary Resuscitation guidelines. The study recommends that hospitals should establish a skills lab that is well equipped with an instructor for nurses to practice and perfect their skills in American Heart Association Cardiopulmonary Resuscitation guidelines.

**Keywords:** Adherence, Guidelines, American Heart Association, Cardiopulmonary Resuscitation, Knowledge.

### Introduction

Cardiopulmonary Resuscitation (CPR) is an emergency procedure done to patients with a cardiac arrest so as to restore circulation of oxygenated blood to the heart and the brain (Marino *et al.*, 2018). According to Marino *et al.*, (2018), CPR usually involves a rate of from 100 to 120 deep compression of the chest per minute. Artificial means may be involved where the caregiver exhales to the patient's mouth or nose a process referred to as mouth to mouth resuscitation or use a device that is able to supply air into the patient's lungs a process referred to as mechanical ventilation. The main purpose of CPR is to facilitate partial circulation of oxygenated blood to heart and brain with the objective of slowing down death of tissues and to prevent permanent damage of the brain (Geocadin *et al.*, 2019). It is therefore necessary to administer an electric shock to the patient's heart to achieve a viable rhythm of the heart as a CPR alone is not enough to restart the heart. Despite its benefits, a CPR is only advised as a last resort when a patient is unable to breathe which would lead to death. In practice of CPR, several factors influence the nurse adherence to American Heart Association (AHA) guidelines (Kleinman *et al.*, 2015).

This is driven by the fact that CPR has evolved over the last 50 years (American Heart Association, AHA, 2015). The sequence has been moved from airway, breathing, circulation to circulation, airway and breathing. Increasing compression rates to 100/min and depth of 21/2inches (5cm) for adults and allowing chest recoil. For effective CPR, one has to be conversant with the chain of survival. This involves five-links in the adult chain of survival of AHA CPR, immediate recognition of cardiac arrest & activation of the emergency response system, early CPR, rapid defibrillation, advanced life support and integrated post-cardiac arrest care.

The main parts of CPR include; chest compression, airway, breathing, and defibrillation. Chest compression involves; pushing hard and fast at a rate of 100/min but not more than 120/min, allowing chest recoil which allows blood to flow into the heart for a chest compression to make an impact. Airway opening and maintenance is achieved by use of two maneuvers; head tilt-chin lift, and jaw thrust where spinal injury is involved. Breathing is achieved by mouth to mouth breathing where no risk of infection is involved. Use of the bag-mask device is another method, by use of a thumb and index finger to form a "C" on the side of the mask pressing the edges to the face and squeezing the bag for 1 second until the chest rises. The use of a defibrillator, which is a computerized device, that is able to identify cardiac rhythms that require a shock then delivers. The defibrillation is delivered after every five cycles of compressions and breathing (30:2) respectively (AHA, 2015).

Cardiopulmonary resuscitation entails the manual combination of chest compressions, artificial ventilation, and defibrillation in order to sustain brain function until further measures are taken to restore spontaneous blood circulation and breathing in a person who is in cardiac arrest (American Heart Association, 2010). The immediate goal of CPR is to re-establish and maintain blood flow to fulfill the metabolic demands of the myocardium, brain, and other vital organs. Cardiac arrest patients are patients who are unresponsive and not breathing. Therefore, both the heart and pulmonary systems fail suddenly. Early CPR, with faster rates and deeper compressions of 5cm deep results to improved survival of the cardiac arrest victim (Wallace *et al.*, 2013). During the resuscitation, the nurse ensures compressions of adequate rate, depth, allow for full chest recoil, minimize interruptions and avoid excessive ventilations (AHA, 2015). Any cardiac arrest depends on the knowledge, skills, and equipment available for CPR competence (Qara *et al.*, 2019).

High-quality CPR results to improved outcomes, when compressions are initiated rapidly, with minimal interruptions, and with avoidance of excessive (Kilbaugh *et al.*, 2020). American Heart Association (2010) guidelines emphasize the importance of immediate compressions that lead to spontaneous circulation when given correctly. The prognosis of any cardiac arrest depends on the knowledge, skills, and equipment available for CPR competence (Qara *et al.*, 2019). Therefore, nurses ought to be fully equipped with latest guideline knowledge on CPR by AHA, skills achieved through demonstration, mentoring and retraining every 2 years. Nurses are the ones that spend most of the time with patients, admitted in the hospital, hence the ones that will notice a gasping or a collapsed patient of cardiac arrest. Due to this reason, nurses are expected to have the

knowledge of the chain of survival, and skills of executing the CPR guidelines as per AHA (2015).

### Statement of the Problem

Effective care for patients during a cardiac arrest is ensured by the provision of CPR in adherence to AHA guideline. For effective CPR to be achieved, nurses need to have the most current knowledge on CPR as per the AHA guidelines and the right skills. England has a well-established system on CPR adherence, but the study done in 2014 on adherence to CPR guidelines, the out of hospital survival rate for cardiac arrest was at 8.6% (Boriani *et al.*, 2019). Sharshar *et al.* (2014) in a survey to assess the proficiency of radiologists in CPR revealed lack of knowledge which they recommended to the health sector to as an alarming factor. In Kenya, a study by Suge (2010) on the management of acutely ill patients in Kenyatta National Hospital general wards by nurses revealed that most nurses were not conversant with CPR procedures for the acutely ill patients, where amongst the respondents 12% (50) were not conversant with CPR process. In Kakamega Referral County Hospital where there are 250 nurses, only about eight nurses (3.2%) have the updated guidelines on CPR (In-service Records, 2016). Despite not going for AHA updates on CPR, they still take care of cardiac arrest patients as per the Emergency records (2017). Therefore, the purpose of this study was to assess the influence of nurses' knowledge level on adherence to AHA CPR guidelines by the nurses working at the Kakamega County Referral Hospital.

### Objective of the Study

The objective of this study is to assess the influence of knowledge level on adherence to AHA CPR guidelines among nurses working at Kakamega County Referral Hospital, Kenya.

### Empirical Literature

#### Nurses Adherence to AHA CPR Guidelines

Nurses' adherence to AHA CPR guidelines has been debated severally. An example is a research conducted in among nurses in Turkey to assess how well they retained skills and knowledge following training. It was established that that nurses' resuscitation skills were poor and what they learnt was not retained generally (Bukiran *et al.*, 2014). Cheng *et al.*, (2018) agreed with the findings suggesting retention of AHA guidelines deteriorated within three to six months, thus the need for regular trainings to improve adherence.

An additional study conducted in North East Brazil to assess how nurses managed cardiopulmonary arrest showed that few of them were conversant with the AHA CPR protocols and maneuvers and they lacked a protocol to guide them (Barreto *et al.*, 2018). Moreover, a study conducted to review implementation of AHA guidelines in United States of America showed that some hospitals limited the role of nurses during resuscitation resulting in poor outcomes (Guetterman *et al.*, 2019).

Rajeswaran *et al.*, (2018) evaluated knowledge and skills on cardio-pulmonary resuscitation among registered nurses in Botswana and observed there was deficiency in adhering to the set guidelines and protocol thus impending management of patients who required cardio-pulmonary resuscitation. It is argued that nurses' skills and knowledge

decline significantly after six months of training necessitating frequent training and practice to retain them. A similar study based in Botswana observed that knowledge and skills were retained for the first three months after training registered nurses (Munezero *et al.*, 2018).

Adherence to AHA CPR by nurses in Tanzania was low. This was due to the fact that nurses working with cardiac arrest patients faced challenges such as lack of infrastructure, lack of access to ambulance and emergency response system, lack of pre-hospital emergency care, and no defibrillators (Monsell, 2017). In Kenya, adherence to AHA CPR guidelines among health care workers in terms of process, structure and outcome is low (Bhurji, 2014). Despite the availability of resuscitation procedures for cardiac arrest patients, approximately 45% of the procedures are wrongly conducted (Bhurji, 2014). The Health Ministry in Kenya has made efforts to provide in-service training to health care practitioners (HCPs). Despite these efforts in training the HCPs the practices of the HCPs with regard to CPR are still reported to be very poor. As a result, the ineffective or wrong practices in resuscitation have resulted to minimal survival rates for cardiac arrest patients in Kenya (Shikuku *et al.*, 2017).

## Methodology

A descriptive research design was adopted for the study. The target population for the study was all the nurses (licensed by the Nursing Council of Kenya) at Kakamega County Referral Hospital. A sample size of 166 nurses was selected using multi-stage cluster sampling technique. A questionnaire was used in data collection. Descriptive statistics such as frequencies and percentages were carried out. A linear logistic regression was used to test the hypothesis.

## Results

### Profile of the Nurses

Most of the nurses 38.1% (53) were in 21-30 years age bracket. Most nurses were women at 70.5% (98). Majority of the nurses had worked in Kakamega County Referral Hospital for 1-10 years as shown by 57.6% (80). Most of the nurses worked in the maternity department (19.4%, 27). A total of 15 departments/work units were involved in the study (see Table 1).

**Table 1:** General Profile of the Respondents

Question/Statement/variable	Frequency	Percentage	
Age	21-30 years	53	38.1
	31-40 years	34	24.5
	41-50 years	28	20.1
	>50 years	24	17.3
Gender	Male	41	29.5
	Female	98	70.5
Years of service at KCRH	1-10 years	80	57.6
	11-20 years	31	22.3
	21-30 years	17	12.2
	31 and above	11	7.9
Current Ward/Department	ICU	13	9.4
	Surgical Ward	7	5.0
	Burns Unit	5	3.6
	Paediatric Ward	12	8.6
	Orthopaedic Ward	7	5.0
	Medical Ward	15	10.8
	EYE unit	4	2.9
	Psychiatric Unit	6	4.3
	CCC	2	1.4
	Gynaecology Ward	6	4.3
	A&E	9	6.5
	MCH	9	6.5
	Theatre	7	5.0
	OPD	10	7.2
Maternity	27	19.4	
Specialty in Nursing	Specialization	23	16.5
	No specialization	116	83.5
Nursing qualifications	Enrolled Nurse	12	8.6
	KRCHN/KRN Diploma	97	69.8
	Bachelor of Science (Nursing)	29	20.9
	Master of Science (Nursing)	1	0.7
Frequency of AHA CPR/BLS	Daily	14	10.1
	Monthly	20	14.4
	Occasionally	90	64.7
	Weekly	15	10.8

Source: Field Data (2020)

### Adherence to AHA CPR Protocol

Key practice questions entailed regularity of practicing

AHA CPR, position used, the appropriate artery for checking pulse, depth of chest compressions, confirmation

of an open airway and techniques to ensure bagged oxygen does not leak out. Others included length of a single ventilation and use of an AED as summarized in table 4.6. Majority of the respondents 64.7% (90) reported they practiced AHA CPR occasionally, 61.4% (86) correctly identified supine as the appropriate CPR position, but 51.1% (71) did not know carotid artery was the most convenient for checking pulse during resuscitation. About 12.2% (17) of the respondents correctly reported 2 ½ cm as the appropriate depth of compressions during AHA CPR while a higher percentage 23.0% (32) recognized chest rise on ventilation as the surest way of determining patency of

airway during ventilations. Slightly more than a quarter of the respondents were correct to say that C-E was the appropriate technique to ensure that bagged air did not leak during AHA CPR. Additionally, 23.0 % (32) of the respondents provided ventilation (bagging) for 2 seconds as required. It was established that majority of the respondents did not use AED correctly during AHA CPR with the paltry 20.1% (28) of the respondents applying it correctly after 5 cycles of AHA CPR. However, 60.4% (84) of the respondents reported that they considered checking the patient and analyzing the rhythm as precaution vital checks before putting an AED (see Table 2).

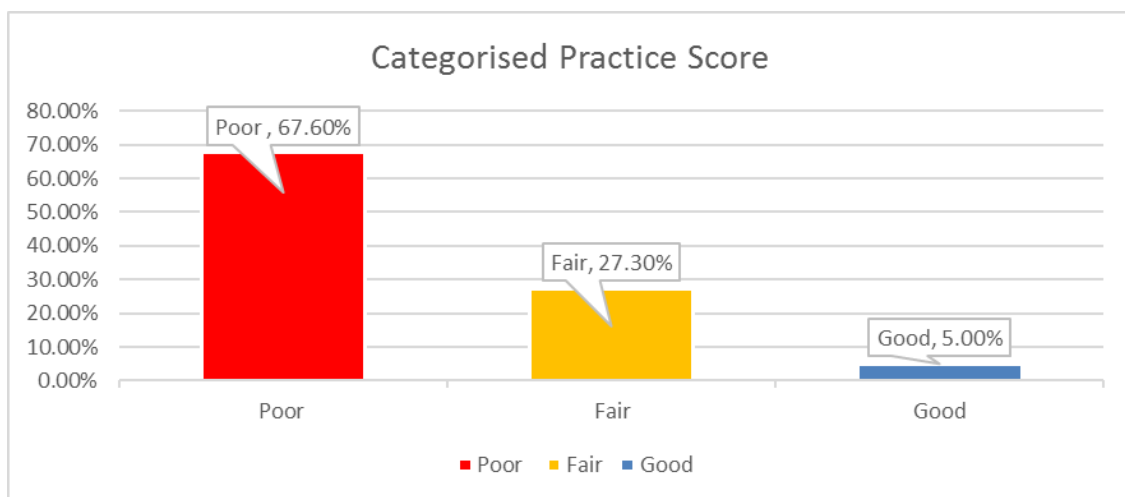
**Table 2:** Respondents’ Adherence to AHA CPR Guidelines.

Category		Frequency	Percentage
In which position do you usually put the victim for CPR? Positioning patient for CPR	Correct ( <i>Supine</i> )	86	61.4
	Wrong position Incorrect	53	37.9
Which artery do you normally use for checking the pulses in the adult victim in cardiac arrest? Checking for circulation	Correct ( <i>Carotid</i> )	68	48.9
	Others	71	51.1
How deep do you normally compress the adult chest during compressions? Depth of chest compression	Correct ( <i>2 1/2 cm</i> )	17	12.2
	Others	122	87.8
What normally informs you that the airway is clear? Assessment of airway	Correct ( <i>chest rise on ventilation</i> )	32	23.0
	Others	107	77.0
What technique do you use to ensure that oxygen being bagged won’t leak out? Ventilation technique	Correct ( <i>C-E Technique</i> )	29	20.9
	Others	110	79.1
Time taken during ventilation technique	Correct ( <b>2 seconds</b> )	32	23.0
	Others	107	77.0
At what point during AHA CPR do you use the AED? Use of AED	Correct ( <b>5 cycles of AHA CPR</b> )	28	20.1
	Other responses	111	79.9
Before you put on the AED, what are some of the vital checks you normally do? Use of AED	Correct ( <i>clear the patient, analyze the rhythm</i> )	84	60.4
	Wrong response	55	39.6

Source: Field Data (2020)

Scores below 49.5% was categorized as a poor score, >49.5-74.5% as a fair score and a score above 74.5% was regarded as good practice. Only 5% (7) of the respondents

scored above 74.5%. The mean practice score was 33.81% (Standard Deviation 20.658) with a range of 100 which was categorized as overall poor practice (see Figure 1).



**Fig 1:** Categorized Overall Practice Score

**Nurses’ Knowledge on AHA CPR**

Nurses’ knowledge on various aspects of AHA CPR protocol was assessed using a series of 16 multiple choice questions. Each question was worth one mark. Key knowledge items assessed included assessment of the order of priority in adult chain of survival in case of cardiac arrest whereby only 28.1% (39) of respondents indicated

the correct answer. The most poorly performed question was the order of priority according to AHA CPR protocol whereby 87.8 % (122) of respondents did not get the correct answer while the most correctly answered question was the definition of an Automated External Defibrillator whereby 43.2% (60) gave the correct definition. The mean knowledge score was 31.41% (Standard

Deviation=19.657), with a minimum of 0.0% and a maximum of 100.0% as illustrated in table 4. Overall, majority (85.6% 119) of respondents scored less than 50%

indicating very low level of knowledge on AHA CPR protocol (see Table 3).

**Table 3:** Knowledge of AHA CPR Protocol

Question/Statement		Frequency	Percentage
Order of priority in CPR	correct	39	28.1
	Incorrect	100	71.9
What are the main parts in order of priority, of CPR in cardiac arrest?	Gave a correct answer	17	12.2
	Incorrect	122	87.8
Ratio of chest compressions to ventilations during adult CPR?	Gave a correct answer	53	38.1
	Gave a wrong response incorrect	86	61.9
Critical concepts when giving AHA Chest compressions	Gave a correct answer	38	27.3
	Gave a wrong response	101	72.7
What are some of the foundational facts of teamwork during CPR? This is a concept - merge with four	Gave a correct answer ( <i>Loud count, continuous communication, switch roles to avoid straining, switch roles during AED analyzing</i> )	40	28.8
	Gave a wrong response	99	71.2
Definition of automated External defibrillator	Gave a correct answer ( <i>Computerized device that identifies shockable rhythms and delivers a shock during cardiac arrest</i> )	60	43.2
	Gave a wrong response	79	56.8
rhythms requiring defibrillation	Gave a correct answer ( <i>Ventricular fibrillation, pulse less ventricular tachycardia &amp; supraventricular tachycardia</i> )	40	28.8
	Gave a wrong response	99	71.2
After how many cycles of AHA CPR do you reassess the victim for defibrillation?	Gave a correct answer (5)	35	25.2
	Gave a wrong response	104	74.8

Source: Field Data (2020)

**Logistic Regression**

A linear logistic regression was conducted to test the hypothesis. The overall knowledge score and overall attitude score was used. It was revealed that there was a statistically significant positive relationship between knowledge score and adherence to AHA CPR guidelines (p value 0.001) at 95% confidence interval (see Table 4). Therefore, the null hypothesis of no relationship between knowledge and adherence to AHA CPR guidelines was rejected.

**Table 4:** Logistic Regression Results.

Variable	Beta	Sig.	95% confidence interval	
			Lower	Upper
Knowledge score	0.855	0.001	0.806	0.990

Source: Field Data (2020)

**Discussion**

Among the factors investigated included nurses' knowledge, practice and attitude. Regular AHA CPR training is essential for quality delivery of resuscitation skills (AHA, 2015; Munezero *et al.*, 2018). In regard to knowledge, the current study established that only 30.2% (42) of the respondents had received AHA CPR training signifying that only a small fraction of nurses had attained training. Further verification of AHA CPR training revealed that only a quarter of the respondents had valid AHA CPR certificate. Similar findings of low acquisition of AHA CPR certificates was made by Bhurji (2014) as well as Shikuku *et al.*, (2017) who argued that the low level of acquiring AHA CPR certificate has a negative implication on the knowledge and application of AHA CPR protocol as evidenced by a mean score of 31.41% on knowledge assessment questions in the current research. Low level of training on CPR protocol is not a peculiar finding in Kenya considering Bhurji (2014) arrived at similar findings. Besides, it is noted that over 85% of the respondents in the current study scored less than 50% on

knowledge assessment signifying low level of understanding the required and specific algorithm in provision of cardio-pulmonary resuscitation as prescribed by American Heart Association. Although Nursing Council of Kenya (2006) observes that nursing students are required to graduate with all the requisite skills, Cheng *et al.*, (2018) advises that nurses ought to be trained and retrained for AHA CPR irrespective of their work experience and training level as a measure to improve their performance in resuscitation skills.

The key knowledge assessment areas included the assessment of the order of priority in adult chain of survival during cardiac arrest. Cheng *et al.*, (2018) concluded that there exists knowledge gap regarding resuscitations and the current research had a similar finding. It was established that about a quarter of the respondents understood the correct priority steps in chain of survival. The performance got worse when the question on the priority chain of command was tailored to specific AHA CPR protocol whereby more than three quarters of the respondents proved not knowledgeable. The basic knowledge assessment such as definition of an Automated External defibrillator was the most highly performed area although nearly half of the respondents got it correct (43.2%). Clearly it was evident that respondents performed poorly on knowledge assessment, a phenomenon that can be partly explained by low attendance and lack of first time or regular attendance of AHA CPR trainings.

In regard to nurses' skills, respondents were scored based on their verbal responses about certain activities and measures that they undertake during a given scenario. It was established that the mean practice score was 33.81% indicating a very poor practice score similar to the findings on knowledge score. Only five respondents out of 139 had a score rated above average (good) signifying that AHA CPR practice was very low in the hospital but at least there were a small number of respondents who could be used to train and empower the rest of the nursing workforce.

Positioning patient in supine position during CPR requires very basic experience in resuscitation. However, only 61.4 % of respondents reported that they used supine position thus creating doubts whether the rest of the respondents had participated in resuscitation or they did not understand the question. However, it signifies the level of poor knowledge and practice of AHA CPR protocol in the study area.

More than half of the respondents 71 (51-1%) could not identify the appropriate artery for checking pulses, a finding that further confirmed the level of poor AHA CPR practice. Other aspects of AHA CPR that had a worse performance included identification of the depth of chest compressions during resuscitation whereby less than a quarter of the respondents recognized that chest rise was an appropriate way of determining airway patency and a similar fraction of respondents provided ventilation for 2 seconds as required. The worst performed was the practice on the depth of chest compressions whereby 1/8 of the respondents practiced 2 ½ centimeters as required by AHA CPR guidelines. Analysis of research findings adduced further evidence of poor practice after establishing that more than three quarters of the respondents (79.9%) could not apply Automated External defibrillator after 5 cycles as required by HA guidelines. Bowman's (2013) reported that there was a challenge in use and maintenance of automated external defibrillators despite huge donations made to East Africa.

### Conclusion and Recommendations

The study established that the level of AHA CPR adherence was poor. The respondents were assessed on level on knowledge regarding AHA CPR guidelines, and from the study approximately one seventh of the respondents scored more than 50% on the knowledge level questions. The score on knowledge level questions was alarming since majority of the respondents could not provide answers to simple questions such as the artery to be used to assess the pulse rate during a cardiac arrest. Overall, the knowledge level was low; this was evidenced by low number of respondents who had valid AHA CPR certificates. Only in two out of fifteen departments in the hospital had records of respondents who had attended the AHA CPR retraining hence demonstrating the low knowledge level. The logistic regression revealed a significant relationship between knowledge level and adherence to AHA CPR guidelines.

Based on the findings the study recommends that hospitals should establish a skills lab that is well equipped with an instructor for nurses to practice and perfect their skills in AHA CPR guidelines. The policy makers in Ministry of Health and the relevant hospitals' management team should come up with programs on retraining of nurses in AHA CPR Guidelines every 2 years as recommended in AHA CPR Guidelines with reinforcements provided when necessary.

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