

**DETERMINANTS OF IN-HOSPITAL CARDIAC ARREST SURVIVAL RATES  
OF ADULTS IN SELECTED COUNTIES IN KENYA**

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**A Thesis Submitted to the School of Medicine and Health Sciences in Partial  
Fulfillment of the Requirements for the Conferment of the Degree of Master in  
Health Systems Management of Kenya Methodist University**

**SEPTEMBER, 2024**

## DECLARATION AND RECOMMENDATION

### Declaration

I declare this thesis is my original work that has never been presented in any other university for award of any degree or diploma.

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## **DEDICATION**

I dedicate this thesis to my siblings and my parents for the foundation they started, nurturing and imparting values of hard work resilience and persistence in me. I also give my utmost gratitude to my three lovely children, my newly found friend and mentor Wangari.

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## ABSTRACT

In-hospital cardiac arrests are a significant reason for illnesses and deaths in hospitals worldwide. Roughly 1-5 patients in a group of 1000 people admitted, experience in hospital cardiac arrest around the world. This contributes to eighty percent of deaths occurring in hospitals hence low survival rates. The purpose of this study was to evaluate the determinants of in-hospital cardiac arrest for survival rates of adults in selected counties in Kenya. The specific objectives were to: Determine the influence of healthcare provider training, area of deployment within the hospital, skill mix (health care cadre), and availability of medical equipment on the survival rate of cardiac arrest among adults in Kenya. The study was guided by two theories which were cardiac pump theory and five-star theory of quality of medical services. A cross-sectional design was used on collecting data from 2,037 doctors and nurses in Machakos Level 5 Hospital, Muranga Level 5 Hospital and the Aga Khan University Hospital, Nairobi. The medical doctors were selected using inclusion and exclusion criteria resulting to 72 doctors. The study used 30% to get a sample size of 402 nurses. Nurses answered questionnaires while the doctors were interviewed and secondary data was gathered from general medical reports on CPR operations from 2022- 2023. Pilot test was done in Nairobi and Kenyatta hospitals whereby the results enabled examine reliability and as well as validity. Descriptive and inferential statistics were examined and the findings presented through tables, figures and explanations. Participants were guaranteed anonymity and confidentiality such that the interview guides and questionnaires did not require them to give personal details. The regression results indicated that the Pearson correlation coefficient of 'healthcare provider training'  $r$  was 0.495\*\* at  $\alpha < 0.002$ ; area of deployment of the healthcare provider within the hospital  $r$  was 0.117\*\* at  $\alpha < 0.000$ ; skill mix (health care cadre)  $r$  was 0.309\*\* at  $\alpha < 0.000$ ; availability of medical equipment'  $r$  was=0.412\*\* at  $\alpha < 0.000$ . Therefore, the study rejected all the null hypotheses. It was noted that the effectiveness of healthcare providers was greatly affected due to low number of staff assigned tasks at night in different units. Additionally, there was low team work effort hence resulting to work related divisions and sidelining each other during critical scenarios like assessment of the chest compressions. Further, the hospitals lacked advanced medical equipment to ensure that the IHCA's were amicably monitored and treated on time. The recommendations are that, the hospital management should enact learning and development policies that make it mandatory for various staff in different units to attend CPR training. Additionally, the hospital board should push and seek more funding from various sources so as to recruit more staff. Further on, the hospital management should provide more department bonding activities such as retreats, and office meetings, for the staff to create a working connection. Also, the hospital management should come up with unique fund-raising programs that would enable the hospitals purchase the much-required medical equipment.

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## **ABBREVIATIONS AND ACRONYMS**

|              |                                     |
|--------------|-------------------------------------|
| <b>ACLS</b>  | Advanced Cardiac Life Support       |
| <b>AED</b>   | Automated External Defibrillators   |
| <b>AKHUN</b> | Aga Khan University Hospital        |
| <b>ALSO</b>  | Advanced Life Support in Obstetrics |
| <b>ATLS</b>  | Advanced Trauma Life Support        |
| <b>BLS</b>   | Basic Life Support                  |
| <b>CA</b>    | Cardiac Arrest                      |
| <b>CB</b>    | Code Blue                           |
| <b>CAR</b>   | Cardiac Arrest Response             |
| <b>CBS</b>   | Code Blue System                    |
| <b>CCR</b>   | Cardio Cerebral Resuscitation       |
| <b>CPR</b>   | Cardiopulmonary Resuscitation       |
| <b>CPT</b>   | Cardiac Pump Theory                 |
| <b>CVD</b>   | Cardiovascular Diseases             |
| <b>EC</b>    | Emergency Center                    |
| <b>EMS</b>   | Emergency Medical Services          |
| <b>ETT</b>   | Endotracheal Tube                   |
| <b>HCP</b>   | Health Care Providers               |
| <b>ICU</b>   | Intensive Care Unit                 |
| <b>IFC</b>   | International Finance Corporation   |
| <b>IHCA</b>  | In-Hospital Cardiac Arrest          |
| <b>LMA</b>   | Laryngeal Mask Airway               |
| <b>MOH</b>   | Ministry Of Health                  |
| <b>NCD</b>   | Non-Communicable Diseases           |
| <b>OHCA</b>  | Out Of Hospital Cardiac Arrest.     |
| <b>PEA</b>   | Pulseless Electrical Activity       |
| <b>ROSC</b>  | Return Of Spontaneous Circulation   |
| <b>SCD</b>   | Sudden Cardiac Arrest               |
| <b>SDG</b>   | Sustainable Development Goals       |
| <b>TPT</b>   | Thoracic Pump Theory                |
| <b>TB</b>    | Tuberculosis                        |
| <b>VF</b>    | Ventricular Fibrillation            |
| <b>WHO</b>   | World Health Organization           |

# **CHAPTER ONE**

## **INTRODUCTION**

### **1.1 Background of the Study**

An enhanced health system is structured in a way that patients requiring medical services are able to access them, through well-equipped institutions. These institutions provide qualified and experienced medical specialists who administer medicine and therapy. For this reason, the study was anchored on the pillar of health workforce. Notably, patients are able to conquer diseases hence improving their quality of life and as well as their life-span. This gives an opportunity for the population to live a stress-free life and have the ability to contribute greatly towards achieving personal, family life and the societal goals. Considerably, the health system ensures that it provides solutions to five areas on public health which include the physical treatment, psychological, social and spiritual aspects of a patient through the help of health workforce.

It is notably agreeable that a healthy person has no pain in their body, no stress, able to practice religious activities and also able to interact with other people without restrictions. Therefore, an established health system that addresses the complete wellbeing of its population, contributes greatly towards Sustainable Development Goals [SDGs] through the health workforce (World Health Organization [WHO], 2020). The population is able to work hence earn income to reduce household poverty rates. They are able to develop healthy lifestyles which encompasses investing in agricultural activities to grow nutritious food that give the body strength. According to Yu et al. (2018), a reduction by fifty-percent

of cardiac arrest patient cases occurred when a healthy lifestyle such as eating balanced diet was maintained.

However, from time-to-time people have encountered sicknesses which has resulted to having the dire need of quality healthcare administered through direct consultation with healthcare workers. Therefore, the leadership in place dictates a lot on whether quality healthcare will be availed or not. This is because, quality healthcare requires heavy investment towards training healthcare providers, building huge capacity health facilities, buying adequate medical equipment and medicine. WHO(2023) noted that the health systems of developing nations were weak since they lacked effective, efficient safe processes that impact preventive, promotive, curative, rehabilitation and palliative health service delivery.

The health care systems have had less qualified and experienced medical practitioners who could treat heart failure conditions. Additionally, According to International Finance Corporation [IFC] (2021), there has been less funding to purchase essential medical equipment and provision of medicine particularly in African nations. This has left the citizens at a cross road, particularly when serious illnesses such as cardiac arrests take place due to their lifestyles.

According to WHO (2021), in 2019, approximately seventeen million and nine hundred thousand people died and surprisingly, thirty percent of this population was caused by cardiovascular diseases [CVDs]. In addition, from the thirty two percent that died out of CVDs, 85% of the cases were as a result of cardiac arrests which happened majorly in developing nations. Therefore, it is paramount to note that the health systems in place

dictates a lot on the kind of services offered and ability to cure cardiac arrest patients in and out of hospitals.

In-hospital cardiac arrests (IHCAs) have been a significant reason for illnesses and deaths in hospitals worldwide (Nolan et al., 2019). Roughly 1-5 patients in a group of 1000 people admitted have experienced an IHCA around the world which contributed to eighty percent of deaths occurring in hospitals (Aziz et al., 2021). The recent coronavirus disease 2019 (COVID-19) pandemic has rendered cardiac arrest patients outcomes even more unpredictable (Shao et al., 2020).

In America, Cardiac arrest patients came in third as main elements that led to high mortality in 2019-2021 and predominantly affecting men aged between 60 and 70 years (Drezner et al., 2019; Monsieurs et al, 2021). According to Andersen et al. (2019) there have been more than two hundred and ninety-thousand cases of cardiac arrests that have happened inside the hospitals annually in addition to other sudden cardiac arrests (SCA) that affected 300,000 persons. Data generated from health reports showed that 395,000 people in the rural areas are at some point affected by cardiac arrest patients (Perkins & Bracey-McDonnell, 2021). For every minute of delayed defibrillation, chances of survival following a cardiac arrest patient decreased tremendously (Ewy, 2022).

In the recent past, the average eight four people in every one hundred thousand population who have not been in the hospital, have been affected with cardiac arrest complications in in 27 European countries (Navab et al., 2019). In European countries such as Norway and Germany, first aid training involving the use of automated external devices (AEDs) was advocated, leading to over 80-95% of the public trained. The USA trained only 3% of its population annually, leaving the majority of bystanders unprepared to handle an out-of-

hospital cardiac arrest patient (Andersen, et al., 2021). Enhanced training and knowledge was suggested to translate to more lives saved (Cheng et al., 2020).

Canadian critical care research data indicated that 65% of cardiac arrest-related deaths have occurred in hospitals (Drennan et al., 2019). In-hospital mortality rates in 4 healthcare facilities in Norway were 63% for patients with Return of Spontaneous Circulation (ROSC) after a cardiac arrest complication (pulse range of fifty-four to seventy four percent) 57% for in-patient in the emergency section with a heart rate that ranges from 56% to 70%), and 50% for in-patients in the wards (range 41% to 62%).

Sudden cardiac arrest has been a threat to people worldwide, as linked to more than 1.5 million deaths globally (Bray et al., 2021). While there have been abundance of data on the morbidity and mortality rate from cardiac arrest-related complications, data from Africa was limited (Chin, 2019). There is in addition very little data on particular time that a cardiac arrest took place and its subsequent outcomes in Africa (Wachira & Tyler, 2015a). In Cameroon cardiovascular-related complications were reported to cause 288 deaths in among patients, with 27(9.4%) being sudden cardiac death. The crude incidence rate in this study was 31.3 per 100,000 person-years (Bonny et al., 2021).

Delayed response following a cardiac arrest has been shown to be a major cause of low rates of ROSC (Cheng et al, 2020). A study carried out in South Africa showed that in hospital cardiac arrest patients had poor rates of ROSC at 18% (Ocen et al., 2019). Cheng et al. (2020) further noted the impact of distance to healthcare facilities on ROSC following a cardiac arrest, with an estimated 10% increase in mortality noted for any increase in time without resuscitation (Cheng et al., 2020)

Lack of adequate data on IHCR has contributed to the poor monitoring of the situation in Kenyan hospitals (Wachira & Tyler, 2020). With loss of productive labor through cardiac arrest-related mortality, the country has been faced with a significant burden. The little data available indicating the proportion of patients with non-communicable diseases (NCDs) who suffered an in-hospital cardiac arrest pointed to the growing burden of NCDs in Kenya (Ocen et al., 2019). According to Ocen et al. (2019), cardiac arrest standards of care specifications have been implemented worldwide, with a number of amendments in the recent past. Internationally, IHCR emergency teams have become the gold standard for health centers worldwide. In spite of these however, different health outcomes were achieved depending on the healthcare facility, the patient and event characteristics.

Cardiac arrests in Kenya carried a poor prognosis, with a mere 16% of patients surviving the initial CPR and almost none surviving to discharge (Ocen et al., 2019). Prognosis has been dependent on factors such the presence of sepsis, renal failure, metastatic cancer and stroke though the consequent cardiac arrest patient outcomes could not directly be traced from those factors (Wachira & Tyler, 2020). However, the presence of inadequate data on in-hospital cardiac arrest patients in Kenya have made its management and any attempts to improve outcomes a major challenge (Ocen et al., 2019). Therefore, the study examined the survival rates of cardiac arrest patients in Kenya through safety standard protocols on CPR, Basic Life Support (BLS), Advanced Cardiac Life Support (ACLS), Advanced Life Support in Obstetrics (ALSO) and Advanced trauma life support (ATLS).

## **1.2 Statement of the Problem**

Cardiac arrest patients have been the highest source of mortality and morbidity worldwide (Czyż et al., 2022). Post-cardiac arrest patient survival rates have been low, ranging from

0-36.2%. In the USA alone, in-hospital cardiac arrests claimed over 200,000 lives, with an average survival rate of 17% (Perman et al., 2021). Although cardiovascular diseases have been on the rise in Africa, data on the incidence of cardiac arrest patients in this part of the world has been lacking (Bonny et al., 2017). The absence of this information has made improvement in the cardiac arrest patient response a challenge in many African countries (Nolan et al., 2019).

Low post-cardiac arrest patient survival rates in Kenya have thought to be due to lack of adequate emergency response equipment, low numbers of responders, lack of competence and poor team leadership in responding to IHCA (Andersen et al., 2021). The few studies that have been carried out, have focused on out-of-hospital cardiac arrest (OHCA) patients (Perman et al., 2021). Notably, limited research from Kenya has estimated a low survival rate after IHCA at between 11.1-16% and return of spontaneous circulation (ROSC) at 29.2%, actual healthcare workers' response to IHCA and the rate of ROSC following IHCA in Kenyan facilities has been undefined. This study therefore sought to assess in-hospital cardiac arrest patient prevalence, evaluate cardiac arrest patient response, review cardiac arrest patient outcomes and explore variables explaining the outcome of cardiac arrest patients in private and public healthcare facilities in a developing country such as Kenya. The findings would guide the development recommendations and sustainable solutions to improve cardiac arrest response in those facilities and in Kenya as a whole.

### **1.3 Purpose of the Study**

To evaluate the determinants of in-hospital cardiac arrest for survival rates of adults in selected counties in Kenya.

#### **1.4 Specific Objectives**

- i. To determine the influence of healthcare provider training on the survival rate of cardiac arrest among adults in selected counties in Kenya.
- ii. To assess the influence of area of deployment of the health provider within the hospital on the survival rate of cardiac arrest among adults in selected counties in Kenya.
- iii. To establish the influence of the skill mix (health care cadre) on the survival rate of cardiac arrest among adults in selected counties in Kenya.
- iv. To examine the influence of availability of medical equipment on the survival rate of cardiac arrest among adults in selected counties in Kenya.

#### **1.5 Research Hypothesis**

H<sub>0</sub>1: Healthcare provider training did not have significant influence on the survival rate of cardiac arrest adult patients in selected counties in Kenya.

H<sub>0</sub>2: Area of deployment of the health provider within the hospital did not have significant influence on the survival rate of cardiac arrest adult patients in selected counties in Kenya.

H<sub>0</sub>3: Skill mix (health care cadre) did not have significant influence on the survival rate of cardiac arrest adult patients in selected counties in Kenya.

H<sub>0</sub>4: Availability of medical equipment did not have significant influence on the survival rate of cardiac arrest adult patients in selected counties in Kenya.

## **1.6 Justification of the Study**

A study at Aga Khan University Hospital in Kenya revealed very low cardiac arrest patient survival rate of 11% (Wachira & Tyler, 2015). This made this study essential in order to find out the major causes of such poor outcomes and therefore able to recommend solutions to improve outcomes. The study would provide health managers in both private and public hospitals in Kenya with data regarding the correct interventions that must be taken in order to reduce cardiac arrest patient related mortality. The study would inform the CBS (Response team system) on their major role in salvaging cardiac arrest patients in the wards and Intensive Care Units (ICUs). This would encourage continuous training and learning in order to adhere to recent guidelines on CPR.

The study would contribute to the very little data available concerning cardiac arrest patients in Kenya. Through the results of this study the county governments, Ministry of Health, and the health managers in both public and private hospitals would better understand the challenge that cardiac arrest patients present. This would enable them to equip the emergency departments and provide financial support and regular training to staff on new CPR guidelines. This study would also improve health systems under the Ministry of Health, and emergency services systems such as St. John's Ambulance (for out of hospital response), with up-to-date information for decision making. County governments and healthcare managers in both public and private hospitals would also be beneficiaries of this study through recognition of their roles in improving health systems.

### **1.7 Significance of the Study**

There has been a lot of data from developed countries on the organization of resuscitation systems in health institutions. This information has been lacking in the developing world. This study would contribute to improved knowledge of resuscitation systems in Kenya and inform practice in the developing world. The study anticipated that the knowledge of resuscitation practice gained from this study would inform resuscitation policy in this country. Therefore, the regulators and hospital management would use the findings to make decisions on whether to deduce, improve or incorporate new policies altogether through effectively implementing CPR practices.

Additionally, the Ministry of Health and county governments would utilize the primary data collected from patient's records to improve health systems management. This is whereby they could also implement the suggested recommendations to enhance healthcare provider training and increase the availability of medical equipment in the public hospitals. This would increase the chance of survival for heart failure patients since all the manpower and medical tools are presently available.

The patients(&families) who have had a medical background of cardiac arrest patient episodes, would benefit from the study especially when they would understand the standard protocols on how CPR should be conducted and the treatment options available to them to improve the chances of survival when they experience such a condition again. This would give them confidence on the roles that medical practitioners play towards their survival rate.

The healthcare providers would also find the findings useful since they would get a chance to speak out the concerns they have been experiencing while performing the resuscitation. Therefore, this would enable them have a higher bargaining power as far as better working conditions and allowances are concerned. They would also have an opportunity to enhance awareness to the public through sharing on how to identify a cardiac arrest patient on time to avoid undergoing through CPR and access better healthcare on time.

The general public would also get a rare opportunity to access a local study that shares knowledge on where, when, how and what is needed when cardiac arrest occurs. This would act as an eye opener to people on what to do in a case where a colleague, family, child or friend experiencing the symptoms of cardiac arrest to avoid avoidable fatalities. The study would contribute new knowledge once the determinants of in-hospital survival rate of cardiac arrest among adults in Kenya are identified, measured and ascertained on how they reduce fatalities in the medical field.

### **1.8 Scope of the Study**

The study evaluated the determinants of in-hospital cardiac arrest for survival rates of adults in selected counties in Kenya. This was done in three hospitals which are Machakos Level 5 Hospital, Muranga Level 5 Hospital and the Aga Khan University Hospital in Machakos, Murang'a and Nairobi respectively. The study included healthcare providers such as doctors and nurses in medical surgical wards such as cardiology, anesthesiology, emergency and Critical Care Units CCU departments. The study gathered both quantitative and qualitative data whereby nurses answered questionnaires while the doctors were

interviewed. The study also collected secondary data from general medical reports on CPR operations for the last one year (August 2022-August 2023).

### **1.9 Limitations of the Study**

The study experienced a challenge in conducting a study on the three hospitals concurrently. This was due to the fact that they were located in three counties (Murang'a, Machakos and Nairobi). Due to the emergency nature of cardiac arrests in hospitals, some of the respondents had to abruptly stop taking part in the study to attend to an urgent cardiac arrest call.

### **1.10 Delimitations of the Study**

To counter the challenge of data collection in three counties, the researcher recruited research assistants that were instrumental in distribution and collection of questionnaires and as well as secondary data. The research assistants began by collecting data in Nairobi, followed by Murang'a and concluded by Machakos hospital. The researcher's role was to conduct interviews. On the second limitation, the research team was patient enough till the resuscitation process was over and if it took longer than expected, they left the questionnaires to come and pick them later.

### **1.11 Assumptions of the Study**

This study assumed that despite the few cases of COVID-19 pandemic, the healthcare workers were present and agreed to take part in the research. Secondly, the study assumed that at any given time if the form was administered, similar information was gathered. The study assumed that the data from the secondary form was guided by the objectives. The

form had been reviewed by the supervisor and experts in the field and thus it was deemed reliable.

## **1.12 Operational Definition of Terms**

### **Adult**

A person above the age of eighteen.

### **Availability of Equipment**

This is defined as easy access of the tools and infrastructure necessary for cardiac arrest patient response within the hospital premises such as defibrillators.

### **Chest Compressions**

They are administered by a person or a machine-driven gadget during CPR trying to reestablish unconstrained dissemination.

### **Cardiac Arrest**

Cardiac arrest happens when cardiac activity stops. This is usually noticed through absence of a pulse.

### **Cardiac Arrest Outcomes**

This is defined as return of spontaneous circulation (ROSC) after the response such as chest compressions. This will be taken as an indirect measure of survival rate or whether the patient will live or succumb following the cardiac arrest.

### **Cardiopulmonary Resuscitation [CPR]**

This is an endeavor to reestablish unconstrained dissemination by performing chest compressions, regardless of ventilation.

### **Defibrillation**

This is any attempt by a bystander to rescue a cardiac arrest patient and restore shockable rhythm through use of an AED.

**Emergency Medical Services (EMS)**

These are medical services provided by either physician, nurses, clinical officers (COs), doctors, paramedics, etc. who respond to cardiac arrest patient and give CPR.

**First Monitored Rhythm**

This is defined as the first monitored cardiac rhythm noticed once a defibrillator is linked to a person who has experienced a cardiac arrest. If the AED device can record the data, the cardiac rhythm is classified as either shockable or non-shockable.

**Health Care Provider Skills**

This relates to the capability, and knowhow competence by the healthcare provider to confidently perform CPR and defibrillation and other emergency service related to cardiac arrest patient.

**Location of Arrest**

This is defined as either ICU, ward or any area of deployment within the hospital where cardiac arrest occurred.

**Number of Responders**

This is defined as the total number of paramedics, emergency team members who attend to the patient in the event of cardiac arrest.

**Survival Rate**

This is defined as the percentage of the patients who do not die after cardiac arrest, when CPR is performed.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter contains the review of theories and studies concerning cardiac arrest. The chapter is organized into theoretical review and then introduction, in-hospital cardiac arrest, treatment and treatment outcomes, and effects of location of cardiac arrest, number of responders, healthcare provider skills and availability of equipment on cardiac arrest outcomes.

#### **2.2 Survival Rate of Cardiac Arrest Patients**

The primary outcome of CPR in several studies was quick endurance with any ROSC, characterized as the arrival of flow without even a trace of progressing chest compressions (return of satisfactory heartbeat/pulse by palpation, auscultation, Doppler, blood vessel circulatory strain waveform, or reported systolic pulse >50 mmHg) (Shao et al., 2020). The auxiliary result was 30-day endurance and neurological results at 30 days recorded by cerebral performance class (CPC) score. On normal rate, the occurrence of grown-up in-emergency clinic heart failure in the USA was 1.6/1000 in clinic affirmations with an overall survival rate of 18.4% (Nolan et al., 2014). However, incidence and cardiac arrest outcome in the USA varied within different regions.

According to Perman et al. (2021), in-hospital cardiac arrest accounted for more than 200,000 of the patients admitted in hospital, with survival rates of 0 % to 36.2% and differing from hospital to hospital. Kolte (2019), noted significant variation in cardiac arrest survival by location in the USA. These variations were attributed to patients'

conditions and features of the hospital. He further reported a significant increase in IHCA cardiac arrest survival during 2003 and 2011 and recommended that further research be carried to establish the underlying factors behind these variations, to improve IHCA outcomes (Kolte et al., 2019).

### **2.2.1 Return of Spontaneous Circulation [ROSC]**

The number of bystanders and responders mattered in enhancing the outcome of CPR. A study by Ocen et al. (2019) in Uganda found poor performance of CPR, low ROSC and lack of 24-hour emergency services as factors leading to low survival rates, and emphasized the need for quick recognition of cardiac arrest. The observation from this study was for leadership and organization within the hospital to dedicate emergency teams to address cardiac arrest to improve outcomes. A survival rate of between 11%-37% after hospital discharge was noted which was low, compared to up to 50% survival after CPR. Factors hindering improvements in IHCA were inadequate skilled health providers, limited or no arrest protocols in wards, poor recognition of cardiac arrest and lack of emergency services. Poor documentation of measures taken in different hospitals were however a limitation of the study.

Monangi et al. (2022) noted that early recognition of cardiac arrest led to prompt initiation of CPR and defibrillation, with improved outcomes. With an annual incidence of 1-5 IHCA per 1000 admissions, an incredibly low survival rate 0.42% indicated the impact of hospital and patient characteristics on outcomes. A study by Merchant et al. (2021) noted that survival rates differed across hospitals due to factors such as the availability of equipment and availability of healthcare providers trained in cardiac arrest care.

Emergency codes such as ‘code blue’ were utilized in Kenya to alert response teams of a cardiac arrest. However response team systems were faced by a number of challenges as noted by Monangi et al. (2022). This study that specifically focused on asystole reported a survival rate of 26.54% after discharge from ICU, higher than what was reported in other studies. This suggested the key role of intensive care and better management by emergency response teams in that setting. Monangi et al. (2022) noted a fall in survival rates to 11.3% when code blue teams were not involved in IHCA, signifying the importance of expertise and competence during a cardiac arrest response.

Monangi et al. (2022) argued that survival was not the best parameter to evaluate the effectiveness of response teams since other factors such as patient age and disease conditions similarly affected health outcomes. CPR was found to be more successful in patients who were under the age of 60 years, whereas survival decreased significantly in patients over the age of 80. Survival rates were highest for VT/VF and bradycardia, and lowest for asystole. The time a cardiac arrest occurred also influenced outcomes, suggesting a shortage of staff to monitor 24-hour emergency services. Survival rates were reportedly high during working hours when compared to arrests out of hours with low survival rates during evenings and ends of the week (Monangi et al., 2018). Availability of healthcare providers, patient age, and type of rhythm, equipment and trained staff significantly influenced IHCA outcomes.

Boundaries had to be drawn between primary and secondary causes of heart failure so as to administer the effective therapy like cardio-cerebral resuscitation (CCR) for key heart failure and cardiopulmonary resuscitation (CPR) for tributary heart failure (Ewy, 2022).

Factors such as bystander availability and detection, coupled with the right intervention, provision of emergency service by a response team as well as effective post-resuscitation care significantly affected survival.

### **2.3 Healthcare Provider Training and Survival Rate of Cardiac Arrest Patients**

A study by Kaihula et al. (2022) in MNH clinical departments in Tanzania found very poor knowledge of cardiac arrest care by healthcare providers, even though they had performed CPR in the past. Out of 350 HCPs only 16% scored above 50% in the written and practical test against the international minimum passing score. Poor knowledge of the performance of CPR had also been noted at a general tertiary hospital in Kenya and in other low-income countries (Wachira & Tyler, 2020). The study based in Kenya found that quick detection of warning signs of an impending cardiac arrest made it possible to provide relevant treatment and improve health outcomes. However, the management needed to implement systems that supported training, certification and monitoring of the healthcare providers' skills. This in turn supported a motivated response to curb the chances of a situation worsening.

#### **2.3.1 Basic Life Support**

Therefore, Graham et al. (2015b) noted that IHCA presented a challenge to healthcare systems; in some hospitals with low rates of cardiac arrest, specialists and other healthcare providers lacked the competence to deal with IHCAs. They further pointed out that some teaching hospitals relied on students, residents and fellows who upon completion of their training left behind new trainees who did not have the required expertise to perform IHCA

appropriately. Great teamwork, skills and competencies were required to improve the quality of IHCA which younger healthcare providers lacked (Hayes et al., 2023).

Another challenge presented was that, emergency situations were time-involving and requiring a strategic approach by both management and staff to improve the outcomes of post-resuscitation care. A study by Dufourq et al. (2021) found out that training increased perceived level of skill, competence and confidence among trainees. Surgery trainees that had advanced life support certificate for instance were more likely to respond to IHCA than their colleagues who had not undergone the training in emergency skills. This indicated that life support training not only impacted knowledge but also led to a change in behavior and perception (Dufourq et al., 2021).

### **2.3.2 Advanced Cardiac Life Support**

Lack of data on the incidence of cardiac arrests made it difficult to assess the parameters used to estimate both IHCA and OHCA. This study emphasized the need for more studies and teaching, rethinking IHCA, provision of technical equipment as well as team training to improve IHCA response. The training and learning emphasized quick identification of signs, communication, and utilization of barrier devices and use of safety devices in situations that require these. Real education not only changed the mind but changed the heart since the healthcare providers' attitudes towards provision of CPR were also transformed. The use of defibrillators was noted to improve with increased knowledge which consequently improved health outcomes following a cardiac arrest.

### **2.3.3 Heart Saver**

Emergency response teams had a responsibility to enhance learning by all HCP within the health facility in order to ensure responders were competent in performing CPR (Murakami et al., 2019). Taha et al. (2021) concluded the low rate of ROSC following IHCA pointed to the need for training and education of staff to ensure better delivery of CPR, and to enhance post-cardiac arrest care. Similarly, White (2019) called for holistic and inclusive training that took care not only of IHCA but also one that ensured that public bystanders were skilled in performing CPR, to save lives. The benefit of training was illustrated by the fact that those trained were more likely to offer CPR than those who were not. Bray et al. (2021) recommended use of advanced technology in training like through DVD kits and self-instruction videos. The study showed that much more can be done in this way to increase training rates and improve skills for better IHCA outcomes.

### **2.3.4 Defibrillation**

Ko et al. (2018), noted that training staff enabled them to easily recognize worsening states and quickly respond to cardiac arrest through CPR and defibrillation, increasing the chances of survival. Morrison et al. (2019) recommended developing a competency-based human resource policy that ensured the ability of staff to identify cardiac arrest and perform chest compression using an AED, and to put into action best policies, a thorough cardiac arrest process and a sustained quality care routine.

## **2.4 Area of Deployment of the Healthcare Provider within the Hospital and Survival Rate of Cardiac Arrest Patients**

### **2.4.1 Medical/Surgical Ward**

Perman et al. (2021) reported that many IHCA occurred in the ICU (59%). This study found that cardiac arrest outcomes improved depending on the location of the arrest, with high survival rates in monitored locations. Perman et al. (2021) further noted that improved outcomes could be explained by high healthcare provider to patient ratio, and the presence of life support machines. In contrast, a study by Drennan et al. (2019) showed that IHCA improved in in-patient wards in comparison to those in the ICU, a factor that may be attributed to the extent of a patient's illness, the quality of resuscitation and survival after IHCA.

Perman et al. (2021), however noted that quality resuscitation, the use of early cardiac catheterization and thermodynamic management significantly improved cardiac arrest outcome despite the location of the arrest. An earlier study concluded that quality vigilant consideration was necessary despite patient location, although patients in location where personalized care was given, had a higher rate of survival than inpatient ward locations. While it was not practical to place every patient in the ICU, conditions needed to be improved in inpatients wards; critically ill patients nursed in a ward setup lacked specialized care, reducing their chances of survival. This study therefore emphasized the need for early recognition of cardiac arrest and better cardiac arrest response to improve survival (Perman et al., 2021).

According to Drennan et al. (2019), living in high-rise buildings affected the cardiac arrest response for out of hospital cardiac arrests when compared with living on ground floors.

Similarly, it was necessary to study whether the placement of patients in wards at the hospitals had an impact on cardiac arrest outcomes. Perman et al. (2021) concluded that while most deaths related to cardiac arrest occurred in inpatient wards, intense monitoring and immediate detection improved the chances of survival. It was therefore, the role of hospital management to identify the most vulnerable patients and have them, cared for in a location suited for their condition and for quick resuscitation.

#### **2.4.2 Critical Care Units**

A study by Monsieurs et al. (2021) found that more CPR was performed following IHCA in monitored area of deployments such as ICU, with a higher rate of survival, compared with those on a telemetry ward. This study however found that most patients admitted to the ICU were young (64 years +/- 16) in relation to the older ones in the telemetry ward (69 years +/- 14). These younger patients had higher ROSC compared to the older ones, implying that patients' characteristics such as age significantly influenced cardiac arrest outcomes (Andersen et al., 2021).

#### **2.4.3 Emergency Unit**

Cheng et al. (2020) noted the need for emergency management services to work with all stakeholders to unify their roles and coordinate utilization of resources in bettering the outcomes of cardiac arrest. He also emphasized the need to dedicate research funds to finance equipment, staff remuneration, and for advocacy services on the impact of cardiac arrest comorbidities and mortality. A study by Perman (2021), discussed the benefit of improvements in the telemetry ward and the ICU in improving survival rates in spite of area of deployment. Further restructuring of health systems and adopting new ones that

encouraged healthcare providers were encouraged not only reduce IHCA but also better enhance outcomes.

#### **2.4.4 Consultation Areas**

Murakami et al. (2019) in a study on utilization of automated external defibrillators (AEDs) revealed that hospitals near locations such as railway stations were more likely to receive a high number of cardiac arrest cases compared to those close to sports facilities. He noted that quick action to restore ROSC such as, early defibrillation, improved neurological outcomes following a cardiac arrest.

### **2.5 Skill Mix (Health Care Cadre) and Survival Rate of Cardiac Arrest Patients**

#### **2.5.1 Response Team System Availability**

Ngunga et al. (2022) in a study on IHCA on weekends and nights suggested that healthcare provider availability during the weekend significantly affected survival; more resuscitations were performed during the day, with higher survival rates than during the night. The study identified age, gender and heart rhythm as confounding factors. The fact that fewer people survived IHCA at nights and weekends compared to daytime on weekdays suggested the role of the number of responders in successful cardiac arrest outcomes. Patients' hopes, attitudes and perception also increased with the expectation that someone was available to attend to them.

Ngunga et al. (2022) further added that organizational differences in care at nights and over the weekend also explained cardiac arrest outcomes. Further research into effective measures to improve outcomes especially during the weekends was required. According to

Graham et al. (2019b), healthcare systems were presented with a number of challenges such as the absence of a 24-hour emergency service and the lack of healthcare providers throughout in the smaller healthcare facilities. Limited human resources were therefore a major hindrance to cardiac arrest outcomes among hospitals of different tiers, particularly in developing countries.

### **2.5.2 Duty Roster of Doctors and Nurses Present**

Goto et al. (2018) established that the higher the availability of cardiac arrest responders, the higher the rate of neurological survival, and vice versa. This implied that responder actions not only mattered in the emergency response per se, but in reducing the response time for the institution of resuscitation measures, improving neurological survival. A study by Ocen et al., (2015) found that a shortage of healthcare providers in emergency wards resulted in poor recording and monitoring of essential patient characteristics. The study concluded that lack of adequate healthcare providers in emergency wards and other wards where cardiac arrests occur reduced the rate of monitoring to detect the threat of an impending cardiac arrest, worsening outcomes.

### **2.5.3 Coordination of the Responders**

According to Cheng et al. (2020) cardiac arrest outcomes to a very large extent, depended on quick diagnosis and treatment. However, Nolan et al. (2021) noted that the effectiveness of IHCA was faced by challenges in smaller facilities, including lack of human resources, competent skills availability, and 24-hour emergency services or ready responders. Hayes et al. (2023) noted that most referral hospitals in the past utilized physicians-in-training

who lacked the necessary skills and confidence to attend to a cardiac arrest. Nolan (2014) further noted that a lot of teamwork and leadership that was required to carry out successful resuscitation was lacking in many hospitals.

#### **2.5.4 Medication Management**

Chan et al. (2019) noted that when defibrillation was not done within a span of two minutes, it caused a person to die hence their survival rates were slimmed by thirty- percent. There were major gaps in Kenya related to emergency services which included substantial variability in care to create an opportunity of making changes that offered solutions for both private and public hospitals across all tiers Nolan et al., (2021). Delayed responses occurred in 2%-51% of cases across hospitals following a cardiac arrest. Contributory factors included failure to alert emergency teams; failure to provide chest compressions, defibrillation, airway management, hyperventilation, medications or vascular access; absence of administration; protocol deviation, and equipment issues (Cheng et al, 2020).

### **2.6 Availability of Medical Equipment and Survival Rate of Cardiac Arrest Patients**

#### **2.6.1 Defibrillator/AED**

In order to improve outcomes, healthcare facilities, in coordination with emergency teams, needed to not only increase CPR training but also boost the availability of key equipment such as automated external defibrillators (Lancet, 2022). Additionally, the option to link hospitals with the general public who played the role of the first responder by leveraging smartphone technology to locate the nearest automated defibrillator needed to be explore since it was expected to improve cardiac arrest outcomes and increase survival.

Chan et al. (2021) noted that therapeutic hypothermia was applied as a treatment of IHCA. However, different medications played a great role during cardiopulmonary resuscitation. Epinephrine, a-adrenergic receptor agonist provided advantages due to its effective increased peripheral vascular resistance through enabling a-receptors of the blood vessels. This enabled uniform flow blood flow from body tissues to the heart and head. However, the rise of the b- receptor caused high metabolic demand in the heart.

The use of vasopressin in CPR was questioned as it led to fringe vasoconstriction by following up on vasopressin receptors, bypassing the adrenergic framework. It took more time than epinephrine but acted in an acidic environment, unlike epinephrine (Navab et al., 2019). Atropine, although used in asystole and to stop the parasympathetic effect on the heart, lacked evidence to support its use in cardiac arrest. Amiodarone on the other hand, was used in shock refractory to defibrillation. Magnesium sulfate was used to treat ventricular tachycardia (VT) or ventricular fibrillation (VF) during CPR. However, it had been recommended as a Class Two drug by the American Heart Association (AHA) (Ocen et al., 2019).

### **2.6.2 Ambubag**

Merchant et al. (2021) suggested that the variations in cardiac arrest outcomes across hospitals implied that some facilities were better resourced than others to carry out CPR. The study found a substantial difference in adjusted survival rates between the bottom decile (8.3%, range: 0-10.7%) and the top decile (31.4%, range 28.6% -51.7%) among study hospitals. This study further found out that the variations in IHCA survival did not change significantly even after adjusting for a few predictors. This implied that availability

of equipment such as ambubags significantly influenced the cardiac arrest response and subsequent outcomes in different hospitals (Merchant et al., 2021).

### **2.6.3 Laryngoscope**

According to Morrison et al. (2019), lack of guidelines and protocols in different hospitals hampered effective and consistent results in IHCA. They further added that CPR documentation lacked uniformity and that a specific standard guide should be implemented. A study on IHCA in Kenya by Wachira and Tyler (2020) concluded that resident medical institutions ought to be urged to give patients revival administrations and gears like Laryngoscope in accordance with proof based programs.

### **2.6.4 Monitoring Equipment**

Once patients had an ROSC following CPR, post-resuscitation care played a great role in improving hemodynamic, respiratory, and neurologic outcomes while noting and addressing factors that recurred but that were controllable. Moderate hypothermia therapy was beneficial and applied in cases where cardiac arrest was due to monitoring equipment. Randomized studies followed by clinical experimental showed it to enhanced survival and preserve cerebral function.

## **2.7 Theoretical Review**

This study was guided by cardiac pump theory and the theory of planned behavior. The cardiac pump theory guided healthcare provider training and availability of medical equipment variables. Additionally, the five-star theory of quality of medical services guided the area of deployment of the healthcare provider within the hospital and skill mix

(health care cadre) variables of the study. These theories formed the basis of this study since they explicitly suggested possible causes and remedies that could be attributed to the theories.

### **2.7.1 Cardiac Pump Theory**

Cardiac Pump Theory CPT was originally developed by Babbs (1980) and later advanced by Redberg et al. (1993) and it guided healthcare provider training and availability of medical equipment variables. It basically stated that during CPR, blood was forced to flow when it was pressed between the spine and sternum by a chest compression system. This was whereby the compression caused immense pressure in the ventricles, forcing a closure of the mitral and tricuspid valves as the semilunar valves opened. Eventually the blood was supplied in the arteries and an arteriovenous pressure was created in the chest to enable the patient inhale. Further, Babbs (1980) pointed that ventilation system was needed after chest compressor was released since the available inhaled air was still insufficient for the patient to survive. According to Bobrow et al. (2008), the most vital operations of CPR were compressions of the chest and clearing of the obstruction. Literature over the years recommended an increase in ratio of chest compressions to ventilation from 5:1 to 15:2 to 30:2 during CPR. This increased ratio was found to be beneficial in both human and animal studies.

Therefore, in relation to healthcare provider training, it required a doctor or nurse who had undergone intensive training, to understand how a chest compression system works and the level of pressure needed to ensure blood flows. Notably, the training encompassed basic life support, advanced cardiac life support, heart saver and defibrillation. The health care provider with an in-depth training ensured that the patient was administered adequate

pressure that did not crush other organs as they resuscitated the heart. Notably, the consistence training and practice of CPR enabled a health provider to ensure that as they a resuscitating a patient, care was taken on the administer accurate compression rate and depth. It also needed training to understand when to apply the AED shocks, how to balance the AED with chest compressions, and when to stop, particularly when pauses were noticed. Further the pattern of doing the CPR whereby a minimum of thirty compressions were administered with two breaths was vital towards saving a patient's life.

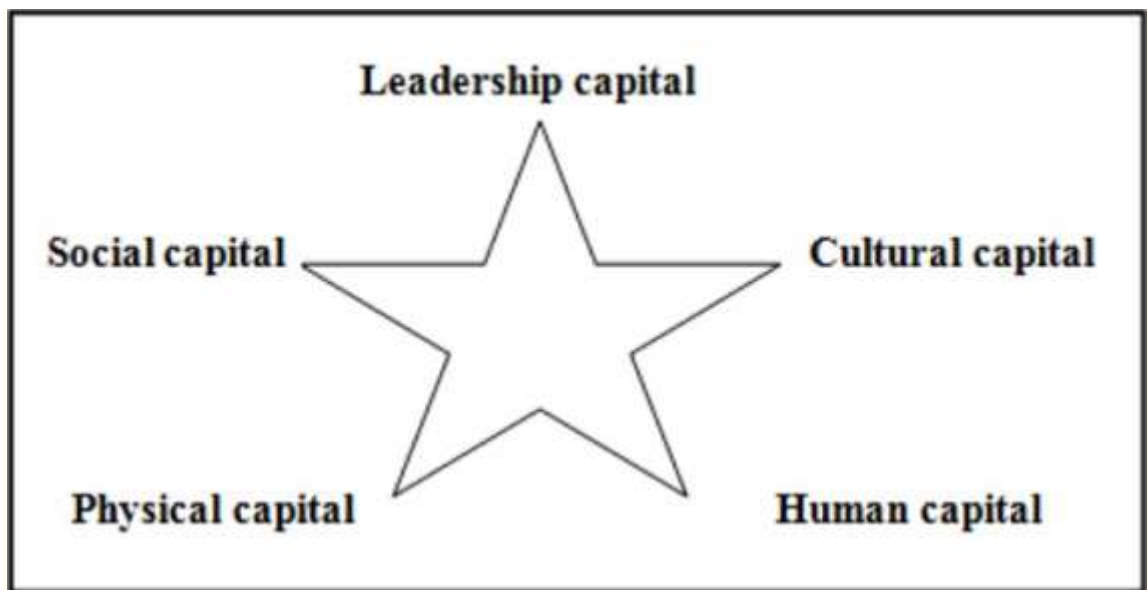
In relation to availability of medical equipment, a healthcare provider needed to have access to various key tools when conducting a CPR. The equipment needed were defibrillator/AED, ambubag, laryngoscope, and monitoring equipment. Therefore, if a health provider was able to access the apparatus, they would be able to successfully save a life and as well as ensure that they did not get infections. This was because if a health provider was not able to access a simple medical equipment such as ambubag, the oath taken to save lives could push them to use mouth to mouth contact resulting to rise of infections to both the healthcare provider and the patient. Additionally, if they could not get a laryngoscope, they resulted to using bare hands to open the patient's mouth wide so as to see if there was any obstruction in the patient's larynx, which could result to infection transmission to either the patient or the medical practitioner.

It was also important to note that when a medical practitioner was trained on the proper use of medical apparatus when conducting CPR, it became effective and reduced the chances of errors. For example, if nurse was trained on how to administer an AED, it would minimize the chances of personal electric shock and as well as not actually killing the patient in the process of saving them. Therefore, for cardiac pump theory to effectively

work, both the training and availability of medical equipment were key to ensuring the success of the process. It was therefore paramount that hospitals increase in-job training, courses and also funds to purchase enough medical equipment. The easier it was for a health provider to perform a CPR, the higher the number of lives were saved hence decline in fatalities of cardiac arrest complications.

### **2.7.2 Five-star Theory of Quality of Medical Services**

Developed by Mosadeghrad (2014) the theory was anchored on five capitals that were thought to improve health outcomes and the quality of services provided. As depicted in the figure that follows, the five capitals were leadership, social, human, and cultural capital.



#### **Physical Capital**

Physical capital referred to any asset that isn't a person and is used to make goods and services. High-quality resources were required to provide high-quality services, and healthcare organizations ought to provide their staff with the resources they need to deliver high-quality services. Quality was not free. Health care costs accounted for 5.6% of Iran's

GDP in 2012, or US\$ 118 per person. To improve the quality of healthcare services, a much higher percentage of the national GDP needed to be allocated to the system (Mosadeghrad, 2014).

### **Human Capital**

Human capital referred to the skills, knowledge, and experience an employee acquires in order to do their job well. The amount and nature of medical care suppliers impacted the nature of administrations. High-quality outcomes were only possible with high-quality providers. In order to attract and keep the best-qualified doctors who could provide the highest quality of care, healthcare managers needed to have unique strategies.

### **Social Capital**

Social capital referred to one's obligation and accountability to society and other individuals. Conveyance of top-notch medical care administrations was a corporate social obligation of an association. Patients needed to hold doctors accountable for the quality of their care. Social capital was helped by transparency of information and accountability. Administrative bodies upheld proficient responsibility in medical services through keeping a register of doctors, setting guidelines for their ceaseless preparation, requiring proceeding with proficient turn of events and giving direction on principles and morals.

### **Cultural Capital**

The mindsets, attitudes, and beliefs of physicians regarding quality had to significantly change in order to improve the quality of medical services. Collaboration and teamwork were encouraged. Providers of healthcare supported the provision of medical services that were both effective and efficient and promoted shared responsibility for patient care through effective communication, cooperation, and collaboration.

## **Leadership Capital**

Leadership capital was the capacity of a leader to steer an organization in the right direction. It was vital that supervisors foster their initiative abilities and exhibit their obligation to quality by laying out a common vision and setting an unmistakable bearing for the association. In order to meet the requirements of their customers and employees, managers altered their organization's culture, policies, and value system.

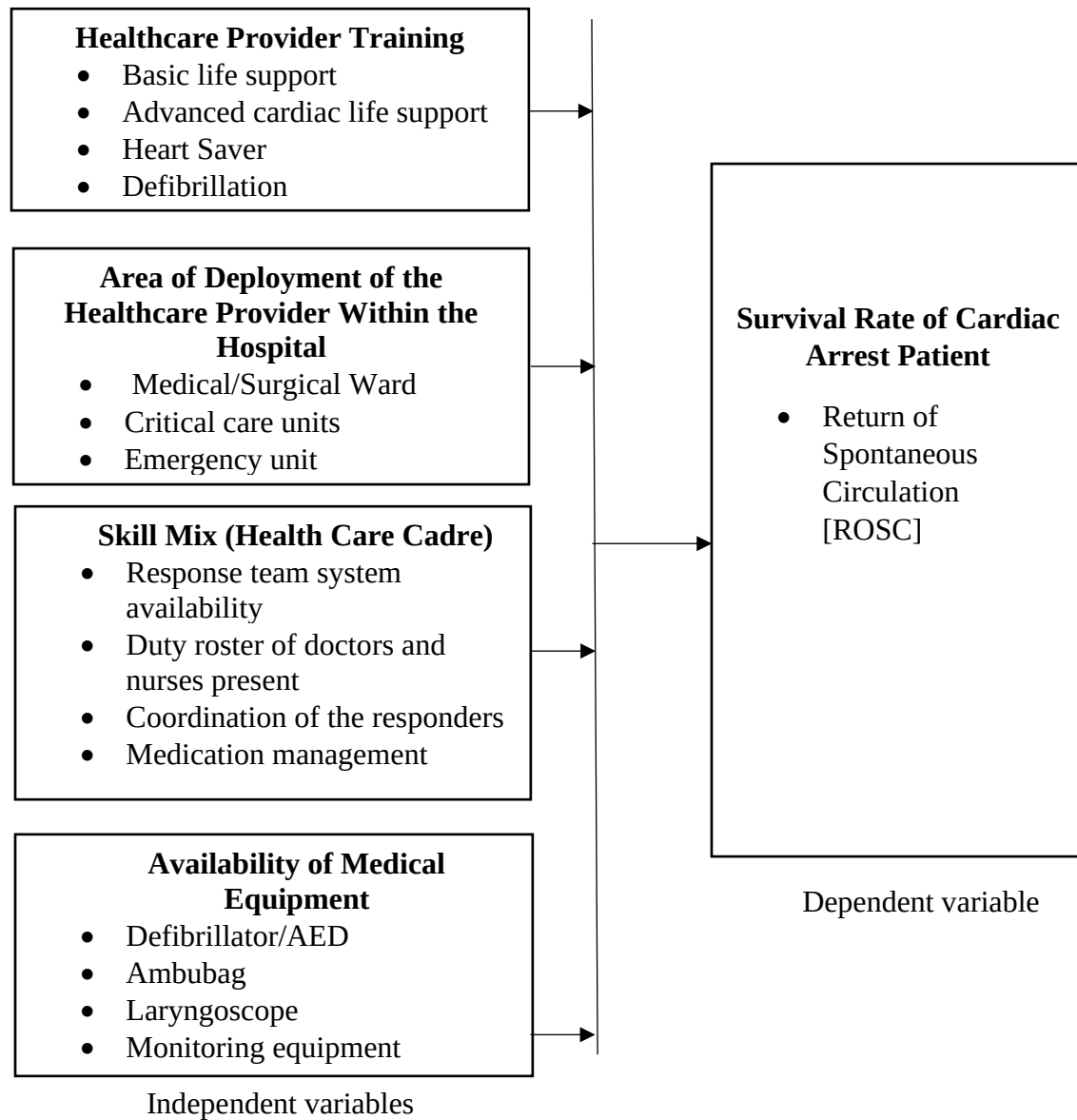
The five-star theory was found relevant to this study since incorporation of the right mix of the five stars could improve cardiac arrest outcomes in Kenya.

## **2.8 Conceptual Framework**

The dependent variable in this study was survival rate of cardiac arrest, represented by safety standard protocols on CPR, basic Life Support (BLS), advanced Cardiac Life Support (ACLS), advanced Life Support in Obstetrics (ALSO), and Advanced Trauma Life Support (ATLS). The independent variables were healthcare provider training with indicators like basic life support, advanced cardiac life support, heart saver, and defibrillation. Additionally, there were area of deployment of the healthcare provider within the hospital variable with indicators like medical/surgical wards, critical care, emergency units, and time of the day. Further, there was the skill mix (health care cadre) variable which had indicators like response team system availability, duty roster of doctors and nurses present, coordination of the responders and medication management. Lastly there was the availability of medical equipment which had indicators like defibrillators/AED, ambubag, laryngoscope and monitoring equipment. Figure 2.1 indicates the conceptual framework.

**Figure 2.1**

***Conceptual Framework***



## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

The chapter comprises of the research design, target population, sampling procedure, data collection tools, data collection procedure, methods of data analysis and ethical considerations.

#### **3.2 Research Design**

The study used a cross-sectional design which was basically applicable where the data was collected at one point in time as a retrospective study. The tools for data collection included open and closed ended questionnaires, interview guides and secondary data. Therefore, the data for this study was a mix of qualitative and quantitative which strengthened the result of this study. For instance, training, availability of equipment in relation to return of ROSC. In this study data on hospital aspects and patients' heart failure pre-historic data, CPR administration and diagnoses were collected for context (Wachira & Tyler, 2020).

#### **3.3 Location of the Study**

The study was carried out at 3 hospitals which are Machakos Level 5 Hospital, Muranga Level 5 Hospital and the Aga Khan University Hospital, Nairobi (AKUHN)-two major public hospitals and one private facility in Kenya. These three hospitals formed an ideal location for study since they were likely to present an unbiased picture of the current state of cardiac arrest responses in public and private facilities in Kenya. This was because, they had well developed and active cardiology departments hence would be suitable in the study. Further, AKUHN was located in Parklands area in Nairobi County whereby the

accident and emergency team led the code blue services at this facility. Machakos level 5 offered a 24-hour emergency medical service, inpatient care as well as out-patient services. It was the largest hospital in Machakos County which had a population of over a million. Muranga level 5 hospital also offered 24-hour emergency services and took care of acutely ill in-patients as well as out-patients.

### **3.4 Target Population**

The target population was 2,037 health providers who included 211 medical doctors and 402 nurses in Aga Khan University hospital; 269 medical doctors and 524 nurses in Machakos Level 5 hospital; and 216 medical doctors and 415 nurses in Murang'a level 5 hospital. These participants were selected because they ensured that they were in the first line of hospital workforce that immediately offered healthcare services to adult patients who suffered an in-hospital cardiac arrest. Structured forms documenting the cardiac arrest response provided were analyzed. These captured patient demographics (age, sex and other comorbidities), responder data-on numbers, life support training, equipment used and location of arrest and whether or not ROSC was achieved on patients above the age of eighteen. The medical doctors were relevant in this study since they were more knowledgeable and mainly in charge of CPRs, medical prescriptions and general evaluation of the patient experiencing cardiac arrest. The nurses were also included since they provided information of medical equipment management and general patient monitoring.

### **3.5 Sampling Technique**

This is the process of identifying and selecting sample units thorough which could be used as representatives of the larger population. Therefore, the study stratified the population into four strata based on medical/surgical wards such as cardiology, anesthesiology, emergency and Critical Care Units to participate as respondents. The medical doctors were selected using inclusion and exclusion criteria whereby doctors who had a bachelor's degree in departments such as cardiology, anesthesiology, emergency, medical/surgical wards, and ICU. They also needed to have at least 2 years extra professional courses done on CPR management.

This resulted to 17 doctors in Aga Khan, 29 doctors in Machakos and 26 doctors in Murang'a level 5 hospitals. The study used 30% to get a sample size of 120 nurses in Aga Khan, 157 nurses in Machakos and 125 nurses in Murang'a level 5 hospitals (Mugenda & Mugenda, 2003). Therefore, the total sample size was 72 medical doctors and 402 nurses in the three hospitals hence a total of 474 respondents. The doctors were selected using purpose sampling method while the nurses were selected using simple random method in each of the three hospitals as disclosed in Table 3.1.

**Table 3.1*****Sampled Population***

| <b>Hospitals</b>                    | <b>Samples</b>  | <b>Cardiology</b> | <b>Anesthesiology</b> | <b>Emergency</b> | <b>Medical/Surgical Wards</b> | <b>ICU</b> | <b>Total</b> |
|-------------------------------------|-----------------|-------------------|-----------------------|------------------|-------------------------------|------------|--------------|
| <b>Aga Khan University Hospital</b> | Medical Doctors | 5                 | 2                     | 3                | 4                             | 3          | 17           |
|                                     | Nurses          | 29                | 23                    | 23               | 20                            | 25         | 120          |
| <b>Machakos Level 5 Hospital</b>    | Medical Doctors | 9                 | 4                     | 5                | 5                             | 6          | 29           |
|                                     | Nurses          | 48                | 34                    | 30               | 24                            | 21         | 157          |
| <b>Murang'a Level 5 Hospital</b>    | Medical Doctors | 4                 | 3                     | 6                | 6                             | 7          | 26           |
|                                     | Nurses          | 25                | 21                    | 26               | 25                            | 28         | 125          |
| <b>Total</b>                        |                 | <b>120</b>        | <b>87</b>             | <b>93</b>        | <b>84</b>                     | <b>90</b>  | <b>474</b>   |

**3.6 Data Collection Instruments**

These are the tools that the study intends to use in bid of gathering necessary information from the respondents. The study gathered both quantitative and qualitative data whereby there were questionnaires, interviews and secondary data as described in section 3.6.1 to 3.6.3.

### **3.6.1 Questionnaires**

A structured questionnaire was administered to the sampled nurses in cardiology, anesthesiology, emergency surgical wards, and ICU departments (appendix III). This was because they were part of the cardiac arrest response team who often participated in a resuscitation attempt following a cardiac arrest. The structured questionnaires were presented by the researcher to the emergency response teams in participating facilities to validate the accuracy of the knowledge and skills in carrying out code blue. The questionnaire comprised of open and closed questionnaires which had 5 Ordinal Likert scale that the participants were required to fill. On a scale of 1 to 5 where 1=Strongly Disagree (SD), 2=Disagree (D) 3=Neutral (N) 4=Agree (A) 5=Strongly Agree (SA) they indicated their level of agreement with the statements. The instrument was pretested in one private and two public hospitals to check any deficiencies thus improving quality and efficiency of the tools.

### **3.6.2 Interview Guides**

The study also interviewed medical doctors in the facilities to get more detailed information regarding on the operations involved in identifying a patient with cardiac arrest, implementation of CPR, use of chest compressions (appendix VIII), and the protocols involved in ROSC. The interview guide had six section whereby demographic information was asked in addition to three questions on the healthcare provider training, area of deployment within the hospital, skill mix (health care cadre), availability of medical equipment and survival rate. The questions were based on the indicators of the study and as well as the gaps identified in literature review.

### **3.6.3 Secondary Data**

The study also collected secondary data from the three hospitals whereby pre-existing conditions at time of cardiac arrest, CPR forms, airway/ ventilation details, circulation, Time CPR ended and reason why CPR ended, family details on witnessing resuscitation and the timeline the family was informed on the outcome. The study accessed general medical reports on CPR operations for the last one year (August 2022- August 2023).

### **3.7 Pretest of Research Instruments**

According to Ullah et al. (2023), a pilot test was necessary done to a small number of subjects from a different type of setting. In this study, a pilot test was done at Nairobi hospital and Kenyatta hospital which were private and public hospitals respectively. The study used 10% of the sampled population as guided by Mugenda and Mugenda (2003). The pilot test samples were 7 medical doctors and 40 nurses selected using simple random sampling method. That is, 4 medical doctors and 24 nurses in Kenyatta and 3 medical doctors and 16 nurses in Nairobi hospital. The pilot test enabled the researcher ascertain whether the questions on IHCA outcomes were relatable and easily comprehensible did not have repetitiveness, ambiguity and length of the questions were ascertained.

#### **3.7.1 Validity**

Validity is the process of ensuring that the instruments of data collection are able to measure what they are supposed to measure with uttermost clarity (Kubai, 2019). The study examined three types of validity which are face, content and criterion. Face validity was measured by ensuring that the data collection instruments assess the influence of healthcare provider training, area of deployment within the hospital, skill mix (health care

cadre), availability of medical equipment on survival rate of adults (Cheung et al., 2023). Content validity was measured by ensuring that the questionnaires and interview guide ask questions related to the variables of the study and not off topic questions. Criterion validity was ensured when every finding generated by the study was compared to past studies (Cheung et al., 2023).

### **3.7.2 Reliability**

According to Golafshan (2019) reliable results were an accurate representation of the total population and could be reproduced under similar methodology. It guaranteed that there was consistency in the creation of the outcomes to such an extent that similar or a different researcher, could gather a similar data as the first instrument planned in a similar kind of population (Kothari, 2019). To accomplish dependability, the sampled population was obviously characterized, and the researcher ensured that the piloting respondents were able to point out repetitiveness, ambiguity and length of the questions hence corrected. In order to test the reliability, Cronbach's alpha coefficient was performed to find out whether the  $\alpha$  is greater than 0.7 (Orodho, 2009).

### **3.8 Data Collection Procedure**

The researcher got the required approvals so as to collect data in the three hospitals. The researcher consulted the services of research assistants in the process of collecting data. On different days of data collection, the researcher visited the three hospitals and meet the in charge. The purpose of the study was communicated as well as brief introduction on the research tools. The researcher then requested to be authorized to collect data in each hospital. If the in-charge had the capacity to authorize, then the researcher gladly offered

the authorization form (appendix I) to be stamped. Once the authorization had taken place, the researcher then requested the in-charge manager to direct on how to identify the medical doctors and nurses in various sampled departments. Once identified, the researcher began by requesting for consent from doctors and nurses to interview and administer questionnaires respectively. The participants that agreed to take part, paved way for data collection immediately, while those who declined, were thanked and not engaged further.

Thereafter, the researcher interviewed the doctors while noting down the responses using a pen and a notebook. The researcher did not use a recorder since the respondents would be uncomfortable and hence not give a lot of details on the subject matter. The administration of the questionnaires began immediately the interviews were completed and the questionnaires were collected same day. However, for the respondents who were not available to take part, were given a period of one week and thereafter the researcher picked the complete questionnaires.

Immediately after the interviews and questionnaires were completed, the researcher then headed to the records department to access various daily, weekly and monthly CPR reports so as to fill in the secondary data forms as required by the study. The researcher only noted down information under a notebook and did not take photos of the reports due to the confidentiality of the hospital-patient data. The researcher then thanked the participants and the in-charge manager for their time as the collected data was stored in a safe place awaiting analysis.

### 3.9 Data Analysis and Presentation

Collected data from questionnaires was cleaned, coded, entered and analyzed through statistical software (SPSS 23). Descriptive frequencies, percentages and mean described the data while Pearson correlation and multivariate analysis were used to explain relationships. Pearson correlation test was performed to test the hypothesis by checking the difference in means. Multivariate analysis was used to test the relationship between healthcare provider training, location within the hospital, skill mix (health care cadre), availability of medical equipment and survival rate of this study. Further, the multivariate analysis allowed the study to examine how one affects the other-the degree with which one variable changed with the units change in another variable, as a means of answering the model of the study which included:

$$Y = C + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e$$

Where:

Y = Survival Rate

$\beta_i$  = Coefficients to be estimated

C = Constant

X<sub>1</sub> = Healthcare provider training

X<sub>2</sub> = Area of deployment of the Healthcare Provider within the hospital,

X<sub>3</sub> = Skill mix (health care cadre)

X<sub>4</sub> = Availability of medical equipment

e = error

The study also examined various diagnostic tests such as normality, linearity and multicollinearity to ascertain that the data had achieved the various regression assumptions. Further on, the findings of the study were presented through tables, figures and explanations. The interview data was analyzed using thematic method whereby a common responses pattern once noted were used as a theme for the study when analyzing qualitative type of data.

### **3.10 Ethical Considerations**

The Scientific approval and ethical clearance to carry out the study was sought from School Graduate Committee at the Kenya Methodist University. Ethical clearance was also sought from the Aga Khan University Institutional Ethics Review Committee (IERC) after requesting for authorization to collect data (appendix I). A NACOSTI license was obtained and site permits to conduct the study at participating public hospitals sought from the leadership at each facility. No respondent's identifiers were collected and participation by healthcare providers was voluntary (appendix II). Participants were guaranteed anonymity and confidentiality such that the interview guides and questionnaires did not require them to give personal details. Additionally, when quoting the interview responses in the results presentation, the study used a combination of numerals and letters such as MD01 to represent what a certain doctor said.

Secondary data forms were accessible to the researcher only. Once completed, the participant's responses and secondary data filled forms were put the form in a sealed box-located in a designated area in the hospital. The final completed forms were kept under lock and key by the researcher and entered electronically into a password-protected

computer by the researcher. Data was stored for up to 7 years as per AKUHN policy and destroyed securely thereafter under the guidance of the AKU IERC. Results were shared and presented with the administration at each site so that the information could be used to inform their processes, for further improvement where required. Further, data was published at both local and international selected journals.

## CHAPTER FOUR

### RESULTS AND DISCUSSION

#### 4.1 Introduction

The chapter provided various findings the study gathered after collecting data. It entailed the reliability results, response rate, background information of respondents, diagnostic tests, descriptive results, thematic findings on interviews and Pearson correlation of each variable. Additionally, secondary data was provided and as well as multiple regression analysis that comprised of model summary, ANOVA and regression weights.

#### 4.2 Response Rate

The study had sampled 72 doctors for the interviews while 402 nurses were to be issued with questionnaires. Their response rates are presented in Table 4.1.

**Table 4.1**

***Response Rate***

| <b>Respondents</b> | <b>Sampled</b> | <b>Response</b> | <b>Percentage</b> |
|--------------------|----------------|-----------------|-------------------|
| Doctors            | 72             | 54              | 75                |
| Nurses             | 402            | 321             | 80                |
| <b>Total</b>       | <b>474</b>     | <b>375</b>      | <b>79%</b>        |

According to Table 4.1, 54(75%) of doctors agreed to be interviewed while 321(80%) of nurses returned filled in questionnaires. Notably, the study was able to access secondary records for 39 patients that had undergone through the process of IHCA. The average

response rate of the two instruments was 79% which was according to Mugenda and Mugenda (2003) indicated that any response rate above 70% was very good.

### 4.3 Reliability Results

The study conducted a pilot test from a sample of 7 medical doctors and 40 nurses whose results are provided in Table 4.2.

**Table 4.2**

#### *Reliability Results*

| <b>Research Instruments</b> | <b>Variables of the study</b>          | <b>Pilot Population</b> | <b>Cronbach Alpha</b> |
|-----------------------------|----------------------------------------|-------------------------|-----------------------|
| Questionnaires              | Healthcare provider training           | 40                      | 0.930                 |
|                             | Area of deployment within the hospital | 40                      | 0.821                 |
|                             | Skill mix (health care cadre)          | 40                      | 0.847                 |
|                             | Availability of medical equipment      | 40                      | 0.919                 |
|                             | Survival rate of cardiac arrest        | 40                      | 0.865                 |
|                             | <b>Average</b>                         |                         | <b>0.876</b>          |
| Interview guides            | Healthcare provider training           | 7                       | 0.802                 |
|                             | Area of deployment within the hospital | 7                       | 0.754                 |
|                             | Skill mix (health care cadre)          | 7                       | 0.883                 |
|                             | Availability of medical equipment      | 7                       | 0.911                 |
|                             | Survival rate of cardiac arrest        | 7                       | 0.870                 |
|                             | <b>Average</b>                         |                         | <b>0.844</b>          |

According to Table 4.2, the study gathered that questionnaires had a Cronbach alpha coefficient of an average of 0.876 while the interview guides had a 0.844. This showed that they were above 0.7 which showed that the questionnaires and interview guides used in the study were reliable. According to Nikmard et al. (2023), reliability of instruments was depicted when their Cronbach's alpha value was above 0.7.

#### 4.4 Background Information of Respondents

The doctors were asked various questions that enabled the study gather their background information and the results are presented in Table 4.3.

**Table 4.3**

##### *Background Information for Doctors*

| <b>Level of Education</b> | <b>Frequency</b> | <b>Percent</b> | <b>Cumulative Percent</b> |
|---------------------------|------------------|----------------|---------------------------|
| PhD                       | 8                | 15             | 15                        |
| Masters                   | 15               | 28             | 43                        |
| Bachelor's Degree         | 31               | 57             | 100                       |
| Total                     | 54               | 100            |                           |
| <b>Working Experience</b> |                  |                |                           |
| Above 21 years            | 5                | 9              | 9                         |
| 11-20 years               | 29               | 54             | 63                        |
| 5-10 years                | 11               | 20             | 83                        |
| Less than 5 years         | 9                | 17             | 100                       |
| Total                     | 54               | 100            |                           |
| <b>Departments</b>        |                  |                |                           |
| Cardiology                | 5                | 9              | 9                         |
| Anesthesiology            | 18               | 33             | 42                        |
| Emergency                 | 12               | 22             | 64                        |
| Medical/Surgical Wards    | 11               | 20             | 84                        |
| ICU                       | 8                | 14             | 100                       |
| Total                     | 54               | 100            |                           |

| <b>Professional Qualification Related to Cardiac Arrest Management</b> | <b>Frequency</b> | <b>Percent</b> |
|------------------------------------------------------------------------|------------------|----------------|
| Basic Life Support                                                     | 54               | 100            |
| Advanced Cardiovascular Life support                                   | 22               | 41             |
| Heart Saver                                                            | 42               | 78             |

The results in Table 4.3 pointed out that 31(57%) doctors who were majority had Bachelor's degree. Additionally, other 15(28%) had master's degree whereas only 8(15%) had PhD. The results indicate that the respondents were qualified to perform various medical tasks such as cardiac arrest management supervision. Additionally, 29(54%) had working experience of 11-20 years, while other 11(20%) had 5-10 years. However, 5(9%) had experience of above 21 years. Therefore, the results show that the respondents handling cardiac arrests cases were not only qualified but also had considerable years of experience in general medicine administration.

Further, Table 4.3 reveals that 18(33%) of the respondents were in Anesthesiology department, while 12(22%) were in emergency department. However, only 5(9%) were found in cardiology. These results reveal that the problem lies in low number of respondents available to handle complicated cardiac arrest cases in cardiology department as compared to other departments considered in the study. In relation to the professional qualifications that the respondents possessed, Table 4.3 indicate that all the 54 (100%) of the respondents had Basic Life Support, 42(78%) had heart saver but only 22(41%) had advanced cardiovascular life support qualification.

Considerably, though the respondents possessed acceptable academic qualifications and experience in general medicine, their low number in cardiology department and the dismal advanced cardiovascular life support professional qualification, was of concern. This

basically meant that complicated cases of cardiac arrests were unsatisfactory attended to, since there were few available respondents who could successfully ensure a patient survived the ordeal. In support of the findings, a past study such as Cheng et al. (2020) indicated that when there was quick diagnosis of a cardiac arrest case by a specialist, the patient had a high chance of survival. Therefore, when the numbers of specialists were less, the cases of cardiac arrests stood less chances of survival. Additionally, Nolan (2019) also found out that there were few medical practitioners with competency of handling majority of cardiac arrest cases which was also echoed by Hayes et al. (2023), that this issue was so rampant till physicians-in-training were mainly used to handle cardiac arrest cases.

The nurses were also asked various questions that enabled the study gather their background information and the results are presented in Table 4.4.

**Table 4.4*****Background Information for Nurses***

|                                   |                  |                |                           |
|-----------------------------------|------------------|----------------|---------------------------|
| <b>Gender</b>                     |                  |                |                           |
| Male                              | 132              | 41             | 41                        |
| Female                            | 189              | 59             | 100                       |
| <b>Total</b>                      | <b>321</b>       |                |                           |
| <b>Level of Education</b>         |                  |                |                           |
| Masters                           | 42               | 13             | 13                        |
| Bachelor's Degree                 | 87               | 27             | 40                        |
| Higher Diploma                    | 94               | 29             | 69                        |
| Diploma                           | 98               | 31             | 100                       |
| <b>Total</b>                      | <b>321</b>       | <b>100</b>     |                           |
| <b>Age</b>                        |                  |                |                           |
| 56-60 years                       | 19               | 6              | 6                         |
| 46-55 years                       | 102              | 32             | 38                        |
| 36-45 years                       | 116              | 36             | 74                        |
| 25-35 years                       | 84               | 26             | 100                       |
| <b>Total</b>                      | <b>321</b>       | <b>100</b>     |                           |
| <b>Working Experience</b>         |                  |                |                           |
| Above 21 years                    | 37               | 12             | 12                        |
| 16-20 years                       | 98               | 30             | 42                        |
| 11-15 years                       | 101              | 31             | 73                        |
| 5-10 years                        | 60               | 19             | 92                        |
| Less than 5 years                 | 25               | 8              | 100                       |
| <b>Total</b>                      | <b>321</b>       | <b>100</b>     |                           |
| <b>Departments</b>                | <b>Frequency</b> | <b>Percent</b> | <b>Cumulative Percent</b> |
| Cardiology                        | 45               | 14             | 14                        |
| Anesthesiology                    | 123              | 38             | 52                        |
| ICU                               | 67               | 21             | 73                        |
| Others                            | 86               | 27             | 100                       |
| <b>Total</b>                      | <b>321</b>       | <b>100</b>     |                           |
| <b>Professional Qualification</b> | <b>Frequency</b> | <b>Percent</b> | <b>Cumulative Percent</b> |
| Certified Nurse                   | 274              | 85             | 85                        |
| Nursing Assistant                 | 47               | 15             | 100                       |
| <b>Total</b>                      | <b>321</b>       |                |                           |

According to Table 4.4, there were 189 (59%) female nurses as compared to 132 (41%) male ones. Additionally, 98(31%) of the nurses had a diploma qualification and 94(29%) had a higher diploma. However, 42(13%) had masters qualifications. In regards to ages, majority who were 116(36%) were between 36-45 years while other 102(32%) had 46-55 years. However, it was noted that the minority group 19(6%) had ages of 56-60 years. In regards to experience, it was noted that 101(31%) had 11-15 years of experience, whereas 98(30%) had 16-20 years. However, the nurses with less experience of less than 5 years were 25(8%). Further, it was also established that most nurses 123(38%) were located in anesthesiology department while other high number of nurses 86(27%) were in other departments. That notwithstanding, 67(21%) nurses were in ICU and other 45(14%) nurses, who constituted the least number were in cardiology department. Additionally, in regards to professional qualification, 274(85%) were certified nurses while 47(15%) were nursing assistants.

The results implied that the hospitals had worked effortlessly to ensure that there was gender parity in nursing staff as compared to the tradition whereby it was a woman only profession. Additionally, most of the nurses had obtained the required academic qualification to perform nursing functions efficiently. Further, the hospital management was also keen in ensuring that number of nurses with advanced ages were reduced through succession programs to their younger colleagues. Therefore, the high number of nurses in mid-life ages (36-55 years) was a clear indication that they were mature enough and experienced to support in cardiac arrest management incidences. However, their low numbers in key departments such as cardiology and ICU remained a great concern. Comparatively, Graham et al. (2019b) provided evidence that the high demand in terms of

advanced professional qualification in cardiovascular courses was a limiting factor to many medical practitioners such as nurses and respondents. In support, Monangi et al. (2022) complimented that early recognition of cardiac arrest led to prompt initiation of CPR and defibrillation, with improved outcomes on each patient a time. This meant that the higher the number of qualified medical practitioners such as nurses dealing with CPR and defibrillation, the more patients would be served in a case of catastrophic event.

The nurses were asked to indicate the CPR events they had been involved in the hospital and the results were depicted in Table 4.5.

**Table 4.5**

***CPR Events Involvement***

| <b>CPR Events Involvement</b> | <b>Frequency</b> | <b>Percent</b> | <b>Cumulative Percent</b> |
|-------------------------------|------------------|----------------|---------------------------|
| More than 10 events           | 161              | 50             | 50                        |
| 4-10 events                   | 120              | 37             | 87                        |
| 1-3 events                    | 35               | 11             | 98                        |
| I don't remember              | 5                | 2              | 100                       |
| <b>Total</b>                  | <b>321</b>       | <b>100</b>     |                           |

Table 4.5 indicated that 120 (37%) nurses were involved in more than 10 CPR events and 120 (37%) in 4-10 events. Further only 5 (2%) did not remember the number of CPR events they had been involved. This indicated that nurses were critical in performing CPR on various patients and basically the first responders in a case of cardiac arrest. Therefore, their contribution was invaluable towards the survival of a cardiac arrest patient. In support Yoshikazu et al. (2018) indicated that cardiac responders such as nurses, doctors and other practitioners was relevant in ensuring the neurological survival of a patient.

The nurses were asked to indicate their participation level in a cardiac arrest incident and the results were depicted in Table 4.6.

**Table 4.6**

***Participation in a Cardiac Arrest Incident***

| <b>Participation in a Cardiac Arrest Incident</b> | <b>Frequency</b> | <b>Percent</b> | <b>Cumulative Percent</b> |
|---------------------------------------------------|------------------|----------------|---------------------------|
| Active participation                              | 184              | 57             | 57                        |
| Passive                                           | 101              | 32             | 89                        |
| Only Watch                                        | 36               | 11             | 11                        |
| <b>Total</b>                                      | <b>321</b>       | <b>100</b>     |                           |

From Table 4.6, it was clear that nurses' participation was active as 184(57%) attested to this. However, only 36 (11%) indicated their participation was only watching. Therefore, the results indicated that the nurses were key participants in ensuring that a patient survived the ordeal of cardiac arrest.

#### **4.5 Diagnostic Test**

The study conducted various diagnostic tests such as normality, linearity and multicollinearity to ascertain that the data that would be analyzed conformed to the required regression assumptions.

##### **4.5.1 Normality Test**

The study conducted One-Sample Kolmogorov-Smirnov Test to ascertain the normality of the collected data. Table 4.7 provided the normality test results.

**Table 4.7*****Normality Test***

|                                  |                | Healthcare Provider Training | Area of deployment of the Healthcare Provider Within the Hospital | Skill Mix (Health Care Cadre) | Availability of Medical Equipment | Survival Rate |
|----------------------------------|----------------|------------------------------|-------------------------------------------------------------------|-------------------------------|-----------------------------------|---------------|
| N                                |                | 375                          | 375                                                               | 375                           | 375                               | 375           |
| Normal Parameters <sup>a,b</sup> | Mean           | 27.7103                      | 38.7259                                                           | 36.3084                       | 44.8380                           | 24.6168       |
|                                  | Std. Deviation | 3.44422                      | 4.52143                                                           | 4.94358                       | 5.23199                           | 2.75900       |
| Most Extreme Differences         | Absolute       | .129                         | .082                                                              | .085                          | .132                              | .112          |
|                                  | Positive       | .061                         | .046                                                              | .085                          | .085                              | .112          |
|                                  | Negative       | -.129                        | -.082                                                             | -.085                         | -.132                             | -.099         |
| Kolmogorov-Smirnov Z             |                | 2.303                        | 1.466                                                             | 1.527                         | 3.370                             | 2.003         |
| Asymp. Sig. (2-tailed)           |                | .124                         | .069                                                              | .088                          | .223                              | .101          |

a. Test distribution is Normal.

b. Calculated from data.

Table 4.7 indicated that health care provider training' variable had a significance of 0.124; area of deployment of the healthcare provider within the hospital' variable had a significance of 0.069; Skill mix (health care cadre)' variable had a significance of 0.088; availability of medical equipment' variable had a significance of 0.223; and survival rate' variable had a significance of 0.101. The results pointed out that the significance values of all the variables were above 0.05 indicating that the data in consideration was normal. According to Chen and Genton (2023), data was considered normal if the p-values/significance values had anything above 0.05.

#### 4.5.2 Linearity Test

The study conducted a linearity test to ascertain the relationship of in-hospital cardiac arrest for survival rates of adults. The results were presented in Table 4.8.

**Table 4.8**

##### *Linearity Test*

|                                                                   |                |                          | Sum of Squares | df  | Mean Square | F     | Sig. |
|-------------------------------------------------------------------|----------------|--------------------------|----------------|-----|-------------|-------|------|
| Survival Rate * Healthcare Provider Training                      | Between Groups | (Combined)               | 233.671        | 19  | 12.298      | 1.681 | .038 |
|                                                                   |                | Linearity                | 5.435          | 1   | 5.435       | .743  | .189 |
|                                                                   |                | Deviation from Linearity | 228.236        | 18  | 12.680      | 1.733 | .133 |
|                                                                   | Within Groups  |                          | 2202.198       | 356 | 7.316       |       |      |
|                                                                   | Total          |                          | 2435.869       | 375 |             |       |      |
| Area of deployment of the Healthcare Provider Within the Hospital | Between Groups | (Combined)               | 247.546        | 24  | 10.314      | 1.395 | .107 |
|                                                                   |                | Linearity                | 3.565          | 1   | 3.565       | .482  | .488 |
|                                                                   |                | Deviation from Linearity | 243.981        | 23  | 10.608      | 1.435 | .092 |
|                                                                   | Within Groups  |                          | 2188.323       | 351 | 7.393       |       |      |
|                                                                   | Total          |                          | 2435.869       | 375 |             |       |      |
| Skill Mix (Health Care Cadre)                                     | Between Groups | (Combined)               | 204.436        | 23  | 14.975      | 2.367 | .000 |
|                                                                   |                | Linearity                | 2.417          | 1   | 2.417       | .777  | .102 |
|                                                                   |                | Deviation from Linearity | 202.019        | 22  | 27.383      | 4.985 | .087 |
|                                                                   | Within Groups  |                          | 2231.433       | 352 | 5.493       |       |      |
|                                                                   | Total          |                          | 2435.869       | 375 |             |       |      |
| Availability of Medical Equipment                                 | Between Groups | (Combined)               | 297.447        | 21  | 11.688      | 1.654 | .330 |
|                                                                   |                | Linearity                | .056           | 1   | .056        | .009  | .926 |
|                                                                   |                | Deviation from Linearity | 297.391        | 20  | 24.870      | 3.836 | .241 |
|                                                                   | Within Groups  |                          | 2138.422       | 354 | 6.483       |       |      |
|                                                                   | Total          |                          | 2435.869       | 375 |             |       |      |

According to Table 4.8, the health care provider training' variable had a p-value of 0.133; area of deployment of the healthcare provider within the hospital' variable had a p-value of 0.092; Skill mix (health care cadre)' variable had a p-value of 0.087; availability of medical equipment' variable had a p-value of 0.241. Therefore, since all the p-values were above 0.05, the results pointed that the data collected was linear meaning that there was an existing relationship between independent and the dependent variables. According to Jarantow et al. (2023), when linearity was evidenced if all the p-values of the relationship of the variables were more than 0.05.

#### 4.5.3 Multicollinearity Test

The study conducted multicollinearity test to explore whether the independent variables maintained their unique characteristics in relation to each other, as depicted in Table 4.9.

**Table 4.9**

#### *Multicollinearity Test*

| Model                                  | Collinearity Statistics |                                 |
|----------------------------------------|-------------------------|---------------------------------|
|                                        | Tolerance               | Variance Inflation Factor (VIF) |
| Healthcare provider training           | .528                    | 1.894                           |
| Area of deployment within the hospital | .699                    | 1.431                           |
| Skill mix (health care cadre)          | .909                    | 1.100                           |
| Availability of medical equipment      | .485                    | 2.063                           |
| Survival rate of cardiac arrest        | .528                    | 1.894                           |

The results presented in Table 4.9 indicated that the health care provider training' variable had a tolerance of 0.528 and VIF of 1.894; Area of deployment of the healthcare provider

within the hospital’ variable had a tolerance of 0.699 and VIF of 1.431; Skill mix (health care cadre)’ variable had a tolerance of 0.909 and VIF of 1.100; Availability of medical equipment’ variable had a tolerance of 0.485 and VIF of 2.063; Survival rate of cardiac arrest’ variable had a tolerance of 0.528 and VIF of 1.894. As per Oke et al. (2022), when the tolerance was above 0.2 and VIF was below 5, the study came to a consensus that the data in consideration did not have multicollinearity problem.

#### **4.6 Results of Healthcare Provider Training**

Health care provider training was the first variable and it was measured through various indicators like basic life support, advanced cardiac life support, heart saver, and defibrillation. It had dichotomous questions, closed ended questions and interview questions.

##### **4.6.1 Dichotomous Questionnaire of Healthcare Provider Training**

The study asked six questions that allowed the nurse to either answer a yes or no as depicted in Table 4.10.

**Table 4.10**

##### ***Dichotomous Questions of Healthcare Provider Training***

| <b>Statements</b>                                                     | <b>YES</b> | <b>NO</b> |
|-----------------------------------------------------------------------|------------|-----------|
| I have previously attended a CPR training                             | 191(60%)   | 130(40%)  |
| I hold a valid CPR certification                                      | 143(45%)   | 178(55%)  |
| I have undergone Basic Life Support (BLS) training                    | 207(64%)   | 114(36%)  |
| I have undergone Advanced Cardiovascular Life Support training (ACLS) | 128(40%)   | 193(60%)  |
| I have undergone Heart Saver Support training                         | 170 (53%)  | 151(47%)  |
| I have been instructed on the use of an automatic defibrillator       | 183(57%)   | 138 (43%) |

Table 4.10, 191(60%) had attended CPR training while 130(40%) did not attend. Further, 143(45%) had a valid CPR certification while 178(55%) did not have the certification. 207(64%) had undergone Basic Life Support (BLS) training while 114(36%) did not the training. Additionally, 128(40%) had undergone Advanced Cardiovascular Life Support training (ACLS), while 193(60%) did not. Considerably, 170 (53%) had undergone the Heart Saver Support training but 151(47%) did not. Lastly, 183(57) had been instructed on the use of an automatic defibrillator but 138 (43%) did not know how to use the defibrillator.

The results pointed out that the hospital management had made cognizable effort in encouraging its nurses to undertake various courses related to cardiac arrest management. However, there was still room for improvement for advanced professional courses such as ACLS since majority of the nurses had not undertaken. Therefore, this insinuated that the advanced training required to successfully manage a cardiac arrest incidence, was not yet achieved by the nurses. Additionally, it was also noted that most nurses had attended CPR training but were yet to attain the valid certification. This could mean that most of the nurses hardly completed the CPR management modules indicating that their knowledge was incomplete on a case of cardiac arrest. The same sentiments were established by Ko et al. (2018) who indicated that fully trained staff were in a position of not only recognizing worsening cardiac arrest cases but also establish quality solutions, such as knowing when to use CPR and defibrillation to the patients.

#### 4.6.2 Descriptive Statistics of Healthcare Provider Training

The results for the closed-ended questionnaires were presented in Table 4.11.

**Table 4.11**

##### *Descriptive Statistics of Healthcare Provider Training*

| <b>Statements<br/>N=321</b>                                                                               | <b>Strongly<br/>Disagree</b> | <b>Disagree</b> | <b>Neutral</b> | <b>Agree</b> | <b>Strongly<br/>Agree</b> | <b>Mean</b> |
|-----------------------------------------------------------------------------------------------------------|------------------------------|-----------------|----------------|--------------|---------------------------|-------------|
| Mandatory CPR training                                                                                    | 15(5%)                       | 23(7%)          | 3(1%)          | 56(17%)      | 224(70%)                  | 4.40        |
| CPR training in BLS                                                                                       | 0(0%)                        | 50(16%)         | 64(20%)        | 56(17%)      | 151(47%)                  | 3.89        |
| CPR training in ACLS                                                                                      | 112(35%)                     | 16(5%)          | 78(24%)        | 58(18%)      | 57(18%)                   | 2.64        |
| CPR training in Heart Saver                                                                               | 0(0%)                        | 64(20%)         | 87(27%)        | 37(12%)      | 133(41%)                  | 4.02        |
| Training in Life Support every 2years                                                                     | 6(2%)                        | 186(58%)        | 0(0%)          | 54(17%)      | 75(23%)                   | 2.19        |
| Adequate training in performing CPR                                                                       | 12(4%)                       | 70(22%)         | 1(1%)          | 155(47%)     | 83(26%)                   | 3.71        |
| Patient simulators were helpful                                                                           | 0(0%)                        | 34(11%)         | 2(1%)          | 162(50%)     | 123(38%)                  | 4.17        |
| Confident in operating the resuscitation equipment                                                        | 16(5%)                       | 57(18%)         | 4(1%)          | 168(52%)     | 76(24%)                   | 3.72        |
| Response to crisis management of communication                                                            | 2(1%)                        | 4(1%)           | 0(0%)          | 34(11%)      | 281(87%)                  | 4.83        |
| Response to the teamwork                                                                                  | 1(1%)                        | 47(14%)         | 0(0%)          | 91(28%)      | 182(57%)                  | 4.26        |
| Opportunity to practice multi-disciplinary, team-based CPR response                                       | 12(4%)                       | 149(46%)        | 0(0%)          | 160(50%)     | 0(0%)                     | 2.96        |
| ANSWER a OR b                                                                                             |                              |                 |                |              |                           |             |
| a) Anxious about participation in mock resuscitation CPR scenarios despite training                       | 3(1%)                        | 4(1%)           | 0(0%)          | 35(11%)      | 279(87%)                  | 4.82        |
| b) Anxious about participation in mock resuscitation scenarios since I have no resuscitation CPR training | 0(0%)                        | 31(10%)         | 90(28%)        | 85(26%)      | 115(36%)                  | 3.88        |
| Enough experience to respond to a CPR                                                                     | 5(2%)                        | 145(45%)        | 40(13%)        | 27(8%)       | 104(32%)                  | 2.85        |
| Recognize the cardiac rhythm correctly                                                                    | 12(4%)                       | 69(21%)         | 74(23%)        | 75(24%)      | 91(28%)                   | 3.14        |
| Recognition of a CPR scenario                                                                             | 21(7%)                       | 25(8%)          | 7(2%)          | 68(21%)      | 200(62%)                  | 4.25        |

|                                                                    |       |          |       |          |          |      |
|--------------------------------------------------------------------|-------|----------|-------|----------|----------|------|
| Use of equipment as assigned during CPR                            | 0(0%) | 57(18%)  | 0(0%) | 82(26%)  | 182(56%) | 4.21 |
| Perform chest compressions and mouth to mouth breathing adequately | 0(0%) | 149(46%) | 0(0%) | 121(38%) | 51(16%)  | 3.02 |
| Prescribe and administer medication in a CPR scenario              | 0(0%) | 188(59%) | 0(0%) | 40(13%)  | 93(29%)  | 2.94 |

The major results of Table 4.11 revealed that, 224(70%) strongly agreed and 56(17%) agreed that CPR training was relevant in their line of work hence should be made mandatory part of their continuing education (mean of 4.40). Other 248(77%) strongly agreed and 41(13%) agreed that they had acquired CPR training in BLS (mean of 3.89). Notably, 133(41%) strongly agreed and 124(39%) agreed they had gotten CPR training in heart saver (mean of 4.02). Additionally, 123(38%) strongly agreed and 162(50%) agreed that patient simulators shown to them during training was helpful during an actual resuscitation (mean of 4.17). Notably, 182(57%) strongly agreed and 91(28%) agreed that they could respond to the teamwork because of the designation of roles taught during the CPR training (mean of 4.26).

However, 112(35%) strongly disagreed and 16(5%) disagreed that they had received CPR training in ACLS (mean of 2.64). Further, 186(58%) disagreed that they were trained in Life Support- CPR every 2years (mean of 2.19). Notably, 149(46%) disagreed that they had an opportunity to practice multi-disciplinary, team-based CPR response (mean of 2.96). Other 145(45%) disagreed that they had enough experience to participate and respond to a CPR (mean of 2.85). Further 188(59%) disagreed that they could prescribe and administer appropriate medication in a CPR scenario due to the training of advanced life support (mean of 2.94).

The results implied that nurses had a positive attitude towards having CPR training as part of their advancement career course. Therefore, majority had undergone training in BLS and heart saver courses whereby various patient simulators shown to them during training was helpful during an

actual resuscitation. The training also came in handy in ensuring that they developed teamwork skills and the ability to recognize a CPR scenario. However, majority of the nurses had not undertaken ACLS training nor maintained consistency in life support training of CPR in every 2 years. The results agreed with Manono (2022) on the perspective of failure to have ACLS certification but also contradict the author at the same time on staff having undergone the BLS training. The context of certification of BLS was for nurses in the current study but Manono (2022) considered health providers such as clinical officers.

Additionally, the findings of the current study indicated that the nurses complained not to have been allowed to put into practice various team-based CPR response while others claimed not to have enough CPR management experience. Therefore, the fact that they lacked exposure, it led to poor skills in prescribing and administering appropriate medication in a CPR scenario. Similar complaints were brought forth by Kaihula et al. (2022) who indicated that health care providers in Tanzania's MNH departments were also affected by poor knowledge of cardiac arrest management. The same sentiments were also repeated by Wachira and Tyler (2020) who pointed knowledge gaps of medical practitioners in Kenya.

#### **4.6.3 Thematic Analysis of Healthcare Provider Training**

The study interviewed respondents by asking three questions related to healthcare provider training. There were 52 respondents that agreed to be interviewed and were coded as MD01-MD52 for purposes of this study.

The first question that the respondents were asked, was to elaborate the methods used by the hospital to incorporate training on Cardiopulmonary Resuscitation (CPR) among the healthcare workers. The feedback given by respondents was categorized into three themes which were charge

simulations, development of leadership skills and posterior analytical techniques. On charge simulations, the respondents mentioned that the medical practitioners undergoing training were exposed to a simulator which mostly contained a chest part of a doll. With this object, they were trained on how to open the airways, assessing the breathing patterns, chest compressions and or defibrillate in severe cases. In relation to defibrillation, the trainees were taught on how to administer electric shock, rules to be adhered when defibrillating to avoid electrocution injuries to other staff, and the most important thing is when to stop defibrillating. A respondent MD25 was quoted saying,

*“In defibrillation training, it is important to note that there is a limit on the number of electric shocking a medical practitioner can administer before a patient survives or is declared dead.”*

Further, on the second theme which was development of leadership skills, the respondents were keen in indicating that the training encompassed equipping knowledge to trainees on various people management. This was because, a cardiac arrest event is mainly an abrupt occurrence that could traumatize the people around leading to screams. Therefore, there was need to ensure that the medical team of responders are organized to avoid escalating the event to unmanageable one.

A respondent MD42 was quoted saying,

*“Administration of CPR is 70% linked to how the team of responders will not only coordinate themselves to save the patient but also onlookers.”*

A similar respondent MD09 was also quoted saying,

*“Leadership skills are equally important to medical responders since any poor concentration caused by disorganized team may lead to the demise of the patient.”*

Comparatively, a report by WHO (2020) also named leadership skills training among medical practitioners, as one of the key objectives of having a healthy and sustainable development goal. This was because, world health required leaders to manage their frustrations and worries of communicable and non-communicable complications.

Additionally, on posterior analytical techniques, the respondents mentioned that the medical team in training were also briefed on the key procedures to be strictly followed when administering CPR. They included ensuring that the patient is on a firm surface (lying flat on ground or on a bed), calling for help, opening the airway, assess the breathing patterns if any, begin chest compressions, provide rescue breaths, if the patient did not recover repeat the process again, and lastly use defibrillation for severe cases. A respondent MD51 was quoted saying,

*“Posterior analytical techniques also encompass reporting of the cardiac arrest management events which could be used in a medical review investigation.”*

The second question that the respondents were asked was, to highlight the sources of funding that are involved when training on Cardiopulmonary Resuscitation (CPR). The feedback given was categorized under two four themes which are funding from hospital management, donation from well-wishers, county government revenue allocation, and grants. The funding from the hospital management was mainly a deliberate decision that the board members made to provide money for training. This was supposed to be in accordance to the laid down policies and procedures of the hospital. Additionally, donations from well-wishers were welcome in terms of medical supplies, machine or money. Therefore, when there was money contributed to the hospital, the management

ensured that it was channeled to various training programs, of which cardiac arrest management was among.

Further, county government revenue allocation was also a source mentioned by respondents. This was whereby, part of the county budgetary allocation to health docket was issued to hospitals. When this was done, the hospital was at liberty to fund various in-hospital operations such as training of its staff on cardiac arrest management. Further on, since the hospital supported research at personal or institutional level, it attracted research grants. The grant was often used in various research functions which included training, administration of medicine and surgery in various departments such as cardiology. In support with the findings, WHO (2020) mentioned that universal health coverage involving funding research through grants and donations to low-income nations on possible solution for advanced health diseases and surgeries.

The last question that the respondents were asked under this section, was to explain the challenges that they experienced when working with a team that had low or no training on Cardiopulmonary Resuscitation (CPR). The challenges mentioned by the respondents were categorized under three themes which include physical harm to patients, emotional instability to family/onlookers leading to unnecessary court cases, and work-related conflicts/tension among medical staff.

Working with untrained team posed the danger of causing physical harm to patients undergoing CPR. The harm could relate to broken ribs, neurological and spinal issues. Therefore, since CPR administration was not a one man's show, when untrained person was allowed to do it by the respondents in charge, the entire team faced the possible reality of literally killing or causing more complicated harm to patients.

Additionally, when a team member was untrained on the correct procedure to administer CPR or maybe defibrillate, they either cause confusion to the entire team (such as carrying a defibrillation machine that has no charged batteries/ administering excessively high charge to a patient) or literally keep off and just watch as others perform it. If a family member/ on looker notices this kind of confusion, it would cause emotional breakdown to them hence accusing the hospital of negligence in a court of law, in case a patient does not survive the ordeal. According to Cheluvappaa and Selvendranb (2020), half of medical negligence cases are mainly caused by confusion brought about by lack of training.

Further, when a respondent noticed that a certain staff had no clue of proper administration of CPR, it led to scolding which may be cause of work-related conflicts/tension. This was because, the respondents expected that the staff should have undergone the training while the staff considered the respondent rude and unaccommodating. Comparatively, Dufourq et al., (2021) established that poor training limited the confidence, competence and skill application of the concerned medical practitioner. Therefore, Dufourq et al., (2021) noted that when lowly trained staff failed to attend to emergencies, it led to unnecessary conflicts with other staff that had attended the emergencies. Therefore, if unsettled, it led to division of various staff such as between nurses and respondents. This proved frustrating if the respondents and nurses had conflicts and by hospital policies, are required to work together. A respondent MD02 was also quoted saying,

*“Conflicts among doctors and other staff caused by poor training is a major problem in hospitals. When either of the side becomes entitled to scolding the other due to lack of training in a certain area such as cardiac arrest management, it leads to increased working tension.”*

#### **4.7 Results of Area of deployment of the Healthcare Provider Within the Hospital**

Area of deployment of the healthcare provider within the hospital was the second variable and it was measured through various indicators like medical/surgical wards, critical care, emergency units, and time of the day. It had general questions on the location in daily professional practice, closed ended questions and interview questions.

##### **4.7.1 Location in Daily Professional Practice**

The respondents were asked to indicate where they were mainly located in daily professional practice as described in Table 4.12.

**Table 4.12**

***Location in Daily Professional Practice***

| <b>Participation in a Cardiac Arrest Incident</b> | <b>Frequency</b> | <b>Percent</b> | <b>Cumulative Percent</b> |
|---------------------------------------------------|------------------|----------------|---------------------------|
| Ward                                              | 147              | 46             | 46                        |
| Critical care units                               | 60               | 19             | 65                        |
| Emergency unit                                    | 45               | 14             | 79                        |
| Consultation area                                 | 30               | 9              | 88                        |
| Elsewhere                                         | 39               | 12             | 100                       |
| <b>Total</b>                                      | <b>321</b>       | <b>100</b>     |                           |

Table 4.13 indicated that 147(46%) of the nurses were mainly located in the wards, 60(19%) in critical care units, 45(14%) in emergency units; 39(12%) in other areas of the hospital and 30(9%) in consultation area. The results implied that most nursing staff were in the wards area with few of them in the consultation area.

The study inquired further on the possibility of the nurses leaving their location because they were responders to the resuscitation-CPR team, especially when the resuscitation happened outside their daily location. 192(60%) of them said agreed while 129(40%) disagreed. In regards to whether their respective hospitals had responding teams, 250 (78%) agreed while 71(22%) disagreed.

**4.7.2 Descriptive Results of Area of deployment of the Healthcare Provider Within the Hospital**

The results for the closed-ended questionnaires are presented in Table 4.13.

**Table 4.13**

***Descriptive Statistics of Area of deployment of the Healthcare Provider Within the Hospital***

| <b>Statements<br/>N=321</b>                             | <b>Strongly<br/>Disagree</b> | <b>Disagree</b> | <b>Neutral</b> | <b>Agree</b> | <b>Strongly<br/>Agree</b> | <b>Mean</b> |
|---------------------------------------------------------|------------------------------|-----------------|----------------|--------------|---------------------------|-------------|
| Clear understanding of roles in my area of deployment   | 61(19%)                      | 25(8%)          | 20(6%)         | 58(18%)      | 157(49%)                  | 3.70        |
| Timely response during a call to a resuscitation(cod e) | 0(0%)                        | 72(22%)         | 0(0%)          | 163(51%)     | 86(27%)                   | 3.82        |
| Resuscitation (code) is negatively affected at          |                              |                 |                |              |                           |             |
| a) Night                                                | 0(0%)                        | 46(14%)         | 0(0%)          | 162(51%)     | 113(35%)                  | 2.07        |
| b) Day                                                  |                              |                 |                |              |                           |             |
| c)Weekends                                              | 149(46%)                     | 83(26%)         | 4(1%)          | 73(23%)      | 12(4%)                    | 3.68        |
| d) Public                                               | 163(51%)                     | 112(35%)        | 46(14%)        | 0(0%)        | 0(0%)                     | 4.06        |
| Holidays                                                | 134(42%)                     | 134(42%)        | 6(2%)          | 36(11%)      | 11(3%)                    | 4.07        |
| e) Weekdays                                             | 214(67%)                     | 32(10%)         | 19(6%)         | 46(14%)      | 10(3%)                    | 4.12        |
| Departments are aware how a resuscitation is activated  | 26(8%)                       | 0(0%)           | 0(0%)          | 161(50%)     | 134(42%)                  | 4.26        |
| The amount of help I receive is encouraging             | 0(0%)                        | 10(3%)          | 0(0%)          | 148(46%)     | 163(51%)                  | 4.40        |
| Effective running of resuscitation                      | 125(39%)                     | 45(14%)         | 44(14%)        | 61(19%)      | 46(14%)                   | 2.56        |

The major results on Table 4.13 reveal that 157(49%) strongly agreed and 58(18%) agreed that during a resuscitation they had a clear understanding of their role in the area of deployment they were present (mean of 3.70). Additionally, 134(42%) strongly agreed and 161(50%) agreed that all the departments (area of deployments) within the hospital were aware how a resuscitation was activated (mean of 4.26). Further, 163(51%) strongly agreed and 148(46%) agreed that when they called a resuscitation(code), they felt comfortable with the amount of help they received from their colleagues (mean of 4.40). However, 113(35%) strongly agreed and 162 (51%) agreed that their area of deployment during a call to a resuscitation (code) was significantly affected negatively during the night as compared to day, weekday, weekend or public holiday (mean of 2.07). Further, 125(39%) strongly disagreed and 45(14%) disagreed that they believed that resuscitation(code) in their unit was effectively run (mean of 2.56).

The results implied that nurses had a clear understanding of what they were to do in case of a cardiac arrest emergency, especially from the place that they were located. This entailed knowing how to activate resuscitation code and providing all the necessary help during the CPR event. That notwithstanding, their availability to an area of deployment where the cardiac arrest emergency was happening was hampered at night as compared to other times of day or week. This therefore contributed to ineffectiveness in running the overall resuscitation code in their area of deployment. Comparatively, Nolan et al. (2019) also indicated that failure of having a 24-hour emergency services due to low staffing was a contributing factor towards low response to resuscitation code. The reasons given by Nolan et al. (2019) were that when there was low number of staff, they were widely spaced in the hospital premise making it hard to immediately respond to a cardiac arrest

emergency. As a result, Chan et. al (2018) noted that this reduced the chances of survival of the patient by 30%.

#### **4.7.3 Thematic Analysis of Area of deployment of the Healthcare Provider Within the Hospital**

The study interviewed respondents by asking three questions related to area of deployment of the healthcare provider within the hospital. There were 52 respondents that agreed to be interviewed and were coded as MD01-MD52 for purposes of this study.

The first question that the respondents were asked, was to explain the standard protocols followed in their area of jurisdiction when a cardiac arrest happened. The feedback was majorly themed into two aspect which included acting as a team leader in a CPR process and mainly involved in defibrillation. In relation to team leadership, it was the standard procedure for the respondent to ensure that the available responders get a sense of direction. It was therefore the role of the respondent to allocate various tasks to the team members. Those in charge of crowd control, ventilation, chest compression. In support with the findings, Perman et al. (2021) reported that many cardiac arrests tend to happen within the ICU area as compared to other parts of the hospital. Therefore, this meant that in ICU there was always a respondent present to guide team members in an occurrence of cardiac arrest.

Additionally, the respondents oversaw the process of airway opening such as ensuring that there is a 5-6 cm and 100-200bpm opening that allows chest to recoil in case the event is outside the ICU or ward. The respondents also ensured that the chest compressions are within the required timeframe of 30:2 with ventilation respectively. Further on, they were also in charge in administering defibrillation and quantitative waveform capnography. A respondent MD49 was also quoted saying,

*“Cardiac arrest is a matter of life and death; hence the more qualified medical personnel should take charge and, in this case, a doctor is responsible.”*

The second question that the respondents were asked was, to highlight the communication channels used to notify the healthcare providers in the involved area of deployment, on a case of cardiac arrest requiring Cardiopulmonary Resuscitation (CPR). The feedback from the respondents was categorized into three themes which included code blue phone alerts, telephone calls, and in-person notification. In relation to code blue phone alert, the hospital provided high frequencies special kind of phones that enabled the staff to be notified of any developments regarding a cardiac arrest situation. It was the most common method used to make alerts on emergencies. Additionally, there were other channels used such as having direct telephone/mobile calls and verbal in-person calls especially when the proximity of the required staff is within visible range. A respondent MD36 was also quoted saying,

*“Code blue alert method is the most preferred but in case of technological failure, other methods such as phone calls and in-person calling could be used.”*

Comparatively, Goto et al. (2018) indicated that in-hospital cardiac arrests mainly used code blue and telephone calls whereas the out-of-hospital cases utilized phone calls to contact emergency services.

The third question that the respondents were asked was, to elaborate how the response teams coordinated with each other to save a situation of a patient having cardiac arrest within any part of the hospital. The respondents indicated that in every cardiac arrest case, there was always a team leader who preferably was a medical respondent. The respondent

would tell other team responders on what to do and when. Additionally, whenever there was a code blue alert the hospital had established a special team of responders who were on alert on such cases. The team ensured that the defibrillator was fully charged at all times, chest compressor and other necessary items were present as well. Further, the team was closely guided by medical practitioner's code of conduct and as well as hospital policies and procedures on saving life and administration of CPR.

Comparatively, Morrison et al. (2019) argued that when there lacked guidelines and procedures on how to manage IHCA and document CPR, it led to ineffectiveness and loss of life. This meant that when conducting a CPR, they followed to the letter on each step to minimize confusion. For example, defibrillation was the last item used during a CPR, whereas the opening of airways and ventilation was always first things done at the scene. A respondent MD11 was also quoted saying,

*“It is important that all the staff are well versed on how CPR is done. This saves time, gives sense of direction and limits injury to the patient and other medical staff.”*

In support of the findings, Cheng et al. (2020) pointed out that the aspect about team work in hospital key areas such as emergency department was of essence. This is because their collaboration with other medical staff was a determinant factor in the survival rate of cardiac arrest cases.

#### **4.8 Descriptive Results of Skill Mix (Health Care Cadre) of the Responders**

Skill mix (health care cadre) of the responders was the third variable and it was measured through various indicators like response team system availability, duty roster of

respondents and nurses present, coordination of the responders and medication management. It had closed ended questions and interview questions.

**Table 4.14**

***Descriptive Statistics of Skill Mix (Health Care Cadre)***

| <b>Statements<br/>N=321</b>                                                            | <b>Strongly<br/>Disagree</b> | <b>Disagree</b> | <b>Neutral</b> | <b>Agree</b> | <b>Strongly<br/>Agree</b> | <b>Mean</b> |
|----------------------------------------------------------------------------------------|------------------------------|-----------------|----------------|--------------|---------------------------|-------------|
| The number of responders in an event of cardiac arrest is very important               | 0(0%)                        | 63(20%)         | 34(11%)        | 139(43%)     | 85(26%)                   | 4.02        |
| The team can easily identify who is in charge during a resuscitation (code)            | 30(9%)                       | 50(16%)         | 3(1%)          | 142(44%)     | 96(30%)                   | 3.15        |
| During resuscitation (code), I ask colleagues for help.                                | 43(13%)                      | 61(19%)         | 50(16%)        | 136(42%)     | 31(10%)                   | 3.33        |
| A nurse is given the role of assessing the effectiveness of chest compressions         | 128(40%)                     | 60(19%)         | 42(13%)        | 52(16%)      | 39(12%)                   | 2.42        |
| A nurse is assigned to control the crowd                                               | 34(11%)                      | 11(3%)          | 18(6%)         | 126(39%)     | 132(41%)                  | 4.14        |
| A nurse scheduled in my unit to respond to a resuscitation(code)                       | 0(0%)                        | 15(5%)          | 0(0%)          | 79(25%)      | 227(70%)                  | 4.61        |
| A doctor scheduled in my unit to respond to a resuscitation(code)                      | 94(29%)                      | 35(11%)         | 7(2%)          | 122(38%)     | 63(20%)                   | 3.08        |
| The doctors respond to the resuscitation(code) withing the stipulated five (5) minutes | 0(0%)                        | 62(19%)         | 15(5%)         | 178(55%)     | 66(21%)                   | 3.77        |
| The nurses respond to the resuscitation within the stipulated five (5) minutes         | 8(3%)                        | 23(7%)          | 0(0%)          | 20(6%)       | 270(84%)                  | 4.62        |
| Doctor's skill of intubation is straight forward                                       | 10(3%)                       | 63(20%)         | 0(0%)          | 157(49%)     | 91(28%)                   | 3.80        |
| The medication management during the resuscitation scenario was well managed           | 192(60%)                     | 107(33%)        | 0(0%)          | 22(7%)       | 0(0%)                     | 2.13        |

Table 4.14 revealed that 85(26%) strongly agreed and 139(43%) agreed that the number of responders who attended to the patient in the event of cardiac arrest was very important (mean of 4.02). Additionally, 132(41%) strongly agreed and 126(39%) agreed that having a nurse to crowd control was helpful during a resuscitation situation (mean of 4.14). Further, 227(70%) strongly agreed and 79(25%) agreed that there was always at least one nurse scheduled a unit to respond to a resuscitation(code) (mean of 4.61). In addition, 270(84%) strongly agreed and 20(6%) agreed that the nurses responded to the resuscitation within the stipulated five (5) minutes after recognition of the arrest (mean of 4.62).

However, 128(40%) strongly disagreed and 60(19%) disagreed that there was a nurse given the role of assessing the effectiveness of chest compressions during cardiac arrest (mean of 2.42). Additionally, 192(60%) strongly disagreed and 107(33%) disagreed that the medication management during the resuscitation scenario was well managed because of the skill of either the doctors or nurses.

The results implied that nurses had the relevant skills in ensuring that they attended to patients with IHCA and also managed the crowd around. Their effectiveness was so much relevant such that not only were allocated in the unit to respond to a resuscitation(code) but responded within five minutes. However, the study unearthed that at times the hospital staff did not follow the laid down procedures which at times resulted to sidelining the nurses in assessment of the chest compressions during cardiac arrests. Therefore, this made it difficult to have quality medication management during the resuscitation scenario. Similar results were discovered by Ocen et al. (2019) and Munezero et al. (2018) that, even though the nurses had CPR training, conflict at work places with the senior staff sidelined them when conducting CPR process.

#### **4.8.1 Thematic Analysis of Skill Mix (Health Care Cadre) of the Responders**

The study interviewed respondents by asking three questions related to skill mix (health care cadre). There were 52 respondents that agreed to be interviewed and were coded as MD01-MD52 for purposes of this study.

The first question that the respondents were asked, was to describe the hospital policies that guided on who to respond on which issue in a case of cardiac arrest to avoid confusion. The respondent's feedback was categorized into 4 themes which include emergency care out of wards/ICU, emergency care inside the wards/ICU, Use of advanced IHCA machines/tools and team work. In regards to emergency care out of wards/ICU, most respondents indicated that there was a team on standby to handle such cases within and around the hospital perimeter. The team of responders' station was mainly at the emergency center but were at liberty to work from anywhere within the hospital especially where the cardiac arrest had happened.

In regards to emergency care inside the wards/ICU, it was the responsibility of the respondents in charge/nurses to respond. This is to avoid running of medical staff in the hospital hence causing panic and confusion in the entire place. Therefore, the assigned staff at a particular ward have the priority of conducting a CPR when it occurs within their area of jurisdiction. A past study such as Ocen et al. (2019) conducted an observational study whereby they noted that IHCA cases were majorly handled by a group of dedicated and trained medical staff in various hospitals.

Further, in regards to use of advanced IHCA medical equipment, it was the responsibility of a professional senior member of the team administering CPR to be in charge. This is to

ensure that care is taken not to spoil the equipment and maintain safety of the team members. A respondent MD33 was also quoted saying,

*“A good example if a defibrillator is not carefully used, it could result to electrocuting team members which could turn to be fatal. Therefore, an experienced staff is tasked with its use during a CPR process.”*

In relation to team work, the respondents noted that whenever two senior staff such as respondents find themselves responding to a cardiac arrest emergency, the hospital polices guide that they should immediately divide tasks to avoid confusion at the scene. Considerably, Ko et al. (2018) also noted that in as much as there may be policies, most times there was clash of health providers at the scene of both in and out of hospital cardiac arrest. During those times, the health providers have to agree and share different tasks with the main goal of ensuring that the patient survives irrespective of their previous working relationship.

The second question that the respondents were asked, was to elaborate how healthcare providers were able to differentiate cardiac arrest with other chest issues. The feedback given was categorized into three themes which were the heart stopping, failure to breathe and collapse of the patient. In relation to the heart stopping, the respondents mentioned that during a cardiac arrest, the heart of the patient immediately stops which makes them loose pulse. Therefore, when the responder notices the heart has stopped, they it has to be brought back to pumping through manual method or defibrillation.

In relation to failure of the patient to breathe, the respondents indicated that after the heart stops, the patient failed to breathe since there was no pumping mechanism to push blood

to the lungs for more oxygen hence triggering breathing. In relation to collapsing of the patient, the respondents indicated that collapsing was normally the last symptom before the people around notice. This was whereby a patient suddenly fell off if standing and lying down if seated. In such a scenario, the faster it was for the responders to administer CPR, the easier it was for the patient to survive. Comparatively, Bonny et al. (2017) found out that in Cameroon, the pandemic on sudden deaths related to cardiac arrest had symptoms such as stopping of the heart, shortness of breath and collapsing of the first population-based cohort study.

The third question that the respondents were asked, was to highlight the challenges encountered when there is no enough skill cadre responding to a cardiac arrest occurrence. The respondents indicated that when a cardiac arrest occurrence is not swiftly handled, it may lead to the death of the patient, immobility such that they are unable to walk again, loss of memory, inability to speak or concentrate. A report by British Heart Foundation (BHF, 2020) noted that cardiac arrests led to complications such as paralysis, memory loss and death of the patients in Britain. In further support of the findings, a respondent MD49 was also quoted saying,

*“Cardiac arrest is a very severe issue and it could literally paralyze the patient if not killing them.”*

Another respondent MD27 was also quoted saying,

*“The severity of the disease could affect the neurological part of the patient hence causing them to lose memory.”*

A respondent MD04 was also quoted saying,

*“Cardiac arrest means the heart has stopped hence the longer a patient stays without medical help, the higher their chances of dying or become immobile.”*

#### **4.9 Descriptive Results of Availability of Medical Equipment**

Availability of medical equipment was the fourth variable and it was measured through various indicators like defibrillators/AED, ambubag, laryngoscope and monitoring equipment. It had closed ended questions and interview questions.

**Table 4.15**

##### ***Descriptive Statistics of Availability of Medical Equipment***

| <b>Statements<br/>N=321</b>                                                      | <b>Strongly<br/>Disagree</b> | <b>Disagree</b> | <b>Neutral</b> | <b>Agree</b> | <b>Strongly<br/>Agree</b> | <b>Mean</b> |
|----------------------------------------------------------------------------------|------------------------------|-----------------|----------------|--------------|---------------------------|-------------|
| Most recent automated defibrillator devices.                                     | 214(67%)                     | 68(21%)         | 0(0%)          | 33(10%)      | 6(2%)                     | 2.02        |
| Functional defibrillator devices                                                 | 0(0%)                        | 52(16%)         | 4(1%)          | 165(52%)     | 100(31%)                  | 4.29        |
| Operates the defibrillator during a resuscitation (code).                        | 6(2%)                        | 103(32%)        | 85(26%)        | 61(19%)      | 66(21%)                   | 3.04        |
| Enough completes kits of ambu bags to arrest the multiple resuscitation          | 73(23%)                      | 158(49%)        | 0(0%)          | 78(23%)      | 12(4%)                    | 2.13        |
| I can use a laryngoscope                                                         | 44(14%)                      | 0(0%)           | 0(0%)          | 165(52%)     | 112(35%)                  | 4.07        |
| Enough laryngoscope devices in the hospital                                      | 168(52%)                     | 76(24%)         | 4(1%)          | 57(18%)      | 16(5%)                    | 2.39        |
| Lack of monitoring equipment has largely affected the survival rates of patients | 0(0%)                        | 66(21%)         | 0(0%)          | 154(48%)     | 101(31%)                  | 3.90        |
| Not comfortable using a Laryngoscope                                             | 6(2%)                        | 178(55%)        | 0(0%)          | 100(31%)     | 37(12%)                   | 2.98        |

|                                                       |          |          |       |          |         |      |
|-------------------------------------------------------|----------|----------|-------|----------|---------|------|
| No enough appropriate sizes of the endotracheal tubes | 0(0%)    | 80(25%)  | 0(0%) | 165(51%) | 76(24%) | 2.74 |
| Availability of cardiac monitor                       | 105(33%) | 162(50%) | 0(0%) | 54(17%)  | 0(0%)   | 2.39 |
| Functionality of cardiac monitor                      | 134(42%) | 161(50%) | 0(0%) | 26(8%)   | 0(0%)   | 4.26 |

Table 4.15 indicated that 100(31%) strongly agreed and 165(52%) agreed that the hospitals had functional defibrillator devices (mean of 4.29). Further, 112(35%) strongly agreed and 165(52%) nurses agreed that they could use a laryngoscope (mean of 4.07). Additionally, 161(50%) strongly agreed and 134(42%) agreed that the cardiac monitor was always functional during the resuscitation (mean of 4.26). However, 214(67%) strongly disagreed and 68(21%) disagreed that they had the most recent automated defibrillator devices (mean of 2.02). Additionally, 73(23%) strongly disagreed and 158(49%) disagreed that there were enough complete kits of ambu bags to arrest the multiple resuscitation situations their units (mean of 2.13). Further, 168(52%) strongly disagreed and 76(24%) disagreed that there were enough laryngoscope devices in the hospital (mean of 2.39). Further, 76(24%) strongly agreed and 165(51%) agreed that there were no enough appropriate sizes of the endotracheal tubes in the facility when in a resuscitation (mean of 2.74). Lastly, 105(33%) strongly disagreed and 162(50%) disagreed that the cardiac monitor was always available during the resuscitations (mean of 2.39).

The result's implications were that the hospital management had ensured that there were at least functional defibrillators, cardiac monitors and laryngoscopes. However, the defibrillators in use were of old models hence efficiency was negatively affected. Additionally, the hospitals lacked enough ambubags, laryngoscopes, endotracheal tubes

and cardiac monitors to ensure that the IHCA were amicably monitored and treated on time. Therefore, it was paramount that the hospital management was doing its best but challenges in enough medical equipment was crippling the IHCA treatment. Supportively, Mosadeghrad (2014) also pointed out that factors affecting medical service quality included availability of equipment. The easier it was to access them, the higher the chances that the medical practitioner would deliver on their task.

#### **4.9.1 Thematic Analysis of Availability of Medical Equipment**

The study interviewed respondents by asking three questions related to availability of medical equipment. There were 52 respondents that agreed to be interviewed and were coded as MD01-MD52 for purposes of this study.

The first question that the respondents were asked, was to highlight the major medical equipment needed in ensuring that Return of Spontaneous Circulation (ROSC) was effective in a case of cardiac arrest. The respondents named three most suitable equipment such as chest compressor, defibrillator, ambubag and endotracheal tubes. In relation to chest compressor, the respondents indicated that it was used to administer compression that to reestablish unconstrained dissemination (consider the picture in appendix XII). In relation to defibrillator, it was an equipment used to restore shockable rhythm through use of an AED. In relation to ambubag and endotracheal tubes, it was used to force oxygen in the lungs of the patient through the trachea, after undergoing the resuscitation process. A respondent MD 17 was also quoted saying,

*“Any responder performing CPR should always have at least a compressor or ambu bag for a patient to survive. However, they could also have defibrillator for effectiveness.”*

Comparatively, Andersen et al. (2021) noted that most healthcare responders of an in-hospital cardiac arrest worked with medical equipment such as chest compressor, defibrillator, ambubag and monitoring screen to ensure there was no relapse of the IHCA.

The second question that the respondents were asked, was to elaborate the standard protocols followed to ensure that the medical equipment were sterilized to avoid transmission of infection especially on endotracheal breathing tubes. The respondents mentioned that they ensured that all used medical equipment was kept in a designated region indicating that they are dirty/used. Thereafter, the used equipment was soaked before being moved to scrubbing/cleaning region. Once the cleaning was done, they were packaged and sterilized to eliminate all kind of contamination. The sterilization included either steam, dry heat or Ethylene Oxide (EtO) sterilization. Lastly, the equipment was stored to be distributed when needed. A respondent MD 32 was also quoted saying,

*“The main thing is ensuring that an equipment is cleaned first then sterilization follows. Dirt such as blood clots or rust cannot be eliminated with sterilization alone.”*

The third question that the respondents were asked, was to describe how the hospital coordinated the sharing of medical equipment particularly when there were multiple cardiac arrest cases. The responses given by the respondents was categorized under three themes which included having a people in charge of equipment distribution, collection of used equipment and sterilization. In relation to equipment distribution, there was the need to have a person in charge of ensuring that the required clean and sterilized medical equipment were readily provided.

Through this way, there was a procedure to ensure that not everyone handle the clean equipment from the storage area. Additionally, there was also another person in charge of collecting all used medical equipment to ensure that they are not re-used without cleaning and sterilization. The medical staff needed to ensure that after use of a medical equipment, they keep it in the designated region for collection. Further, the person in charge of cleaning and sterilization ensured that all used medical equipment underwent thorough cleaning process for next use. The person in charge was always keen in ensuring that there were not blood stains, mucus, or rust in the equipment and as well as ensuring that they are sterilized.

A past study such as Drezner et al. (2019) found out that the emergency response team in American high schools was issued with external different defibrillators that would be used to revive the heart. Therefore, to ensure that there was effectiveness in case of multiple cases of cardiac arrests, the emergency team ensured that the sharing of medical equipment with other teams from the hospital dealing with other institutions, was according to the hospital policy structure. A respondent MD 01 was also quoted saying,

*“The process of sharing of medical equipment begins from storage area to the various destinations such as wards, ICU then returned back for cleaning and sterilization.”*

#### **4.10 Descriptive Results on Survival Rate of Cardiac Arrest Among Adults**

Survival rate of cardiac arrest among adults was the dependent variable and it was measured by ROSC which comprised of safety standard protocols on CPR, basic Life Support (BLS), advanced Cardiac Life Support (ACLS), advanced Life Support in Obstetrics (ALSO), and Advanced Trauma Life Support (ATLS). It had closed ended questions and interview questions.

**Table 4.16*****Descriptive Statistics of Survival Rate of Cardiac Arrest Among Adults***

| <b>Statements<br/>N=321</b>                                                                  | <b>Strongly<br/>Disagree</b> | <b>Disagree</b> | <b>Neutr<br/>al</b> | <b>Agree</b> | <b>Strongly<br/>Agree</b> | <b>Mean</b> |
|----------------------------------------------------------------------------------------------|------------------------------|-----------------|---------------------|--------------|---------------------------|-------------|
| Safety standard<br>protocols<br>implemented stability<br>of patient's breathing<br>pattern   | 0<br>(0%)                    | 40<br>(13%)     | 0<br>(0%)           | 155<br>(48%) | 126<br>(39%)              | 4.14        |
| Healthcare providers<br>are assigned to<br>monitor the patient                               | 0<br>(0%)                    | 26<br>(8%)      | 8<br>(3%)           | 68<br>(21%)  | 219<br>(68%)              | 4.50        |
| Clear communication<br>channels used to<br>notify the<br>family/relatives of the<br>patients | 20<br>(6%)                   | 0<br>(0%)       | 8<br>(3%)           | 61<br>(19%)  | 232<br>(72%)              | 4.57        |
| Hospital staff<br>educate the patients<br>on healthy lifestyles                              | 3<br>(1%)                    | 27<br>(8%)      | 0<br>(0%)           | 162<br>(51%) | 129<br>(40%)              | 4.55        |
| Increased rate of<br>survival of patients<br>that experience<br>cardiac arrest               | 94<br>(29%)                  | 35<br>(11%)     | 7<br>(2%)           | 122<br>(38%) | 63<br>(20%)               | 3.08        |
| Hospital committee<br>established to<br>evaluate the medical<br>negligence                   | 0<br>(0%)                    | 62<br>(19%)     | 15<br>(5%)          | 178<br>(55%) | 66<br>(21%)               | 3.77        |

Table 4.16 revealed that 126(39%) strongly agreed and 155(48%) agreed that there were safety standard protocols implemented to ensure that the patient breathing pattern was stabilized after Cardiopulmonary Resuscitation (CPR) (mean of 4.14). Additionally, 219

(68%) strongly agreed and 68(21%) agreed that healthcare providers were assigned to monitor the patient (mean of 4.50). Further, 232(72%) strongly agreed and 61(19%) agreed that there were clear communication channels used to notify the family/relatives of the patients on their ROSC status (mean of 4.57). In addition, 129(40%) strongly agreed and 162(51%) agreed that the hospital staff educated the patients on healthy lifestyles as measures of avoiding a reoccurrence of cardiac arrest (mean of 4.55). Further on, 63(20%) strongly agreed and 122(38%) agreed that there had been an increased rate of survival of patients that experienced cardiac arrest while in hospitals (mean of 3.08). Notably, 66(21%) strongly agreed that 178(55%) agreed that there was a hospital committee established to evaluate the medical negligence as a possible cause of fatalities from cardiac arrest (mean of 3.77).

The results indicated that hospital management had done their best towards ensuring that its patients survive IHCA. Therefore, there had been establishment of several standard protocols related to stability in breathing patterns especially after the administration of CPR, monitoring the patients, keeping constant communication with the family, and providing post-recovery awareness to patients to avoid re-occurrence. These measures were found to be effective towards keeping patients alive and in a case of negligence there was a team of hospital committee established to investigate and explicate who, when and how it occurred. Supportively, Graham et al. (2019b) observed that for the burden on public health's cardiac arrest cases to be manageable, hospitals had to take various factors seriously. The factors include provision of medical staff, equipping the health centers, creating awareness through aggressive campaigns, and investigation of any slight negligence from the medical practitioners.

#### **4.10.1 Thematic Analysis of Survival Rate of Cardiac Arrest Among Adults**

The study interviewed respondents by asking three questions related to survival rate of cardiac arrest among adults. There were 52 respondents that agreed to be interviewed and were coded as MD01-MD52 for purposes of this study.

The first question that the respondents were asked, was to explain how they ensured that spontaneous circulation was stabilized in a patient after resuscitating them. The feedback indicated by the respondents was grouped into five themes which was oxygenation of the patient, control of their blood pressure, monitoring the percutaneous coronary intervention, control and management of patient's temperature and multimodal neuroprognostication. In relation to oxygenation, the respondents indicated that once a pulse has been restored in a patient and they are able to breathe, they should be put in an oxygen mask to have clean air to breathe. This enabled the body acquire the so much needed oxygen to ensure stability in its cells. In relation to control of blood pressure, it was noted that the patient's flow of blood should always be between 90/60mmHg and 120/80mmHg. If the patient could have a re-occurrence of IHCA, their blood pressure went below 90/60mmHg which required defibrillation.

Further on, monitoring the percutaneous coronary intervention included deploying a wire meshed tube to widen or open coronary arteries that had narrowed down hence unable to allow enough blood to pass through. Once this was done, there was need to keep evaluating its effectiveness in restoring stability to the patient. In relation to management of patient's temperature, the hospital staff needed to always ensure that the temperatures were within the required threshold of 98.6°F (37°C). When the temperature was within this point, it

indicated that the blood supply was being done effectively and pumped accurately by the heart. In relation to multimodal neuroprognostication, the respondents ensured that the patient was able to make basic human mental and physical functions such as speaking, recalling their names, family or friends, seeing, hearing, and moving their limbs. Comparatively, Nolan et al. (2019) established that once cardiopulmonary resuscitation was done there should be basic management of the patient's temperature, blood pressure, oxygenation and neuroprognostication to ensure that stability was enhanced. Additionally, Morrison et al. (2019) found out that one strategy of increasing the survival of the patient that had undergone CPR was to ensure that they are closely monitored and all mental and physical aspects were correctly functional.

The second question that the respondents were asked, was to indicate the measures that the hospital was taking to educate the public on ways of identifying cardiac arrest on time and the treatment available to increase their chances of survival. The respondents indicated several methods which included using main stream media (television adverts and radio) and as well as social media platforms such as twitter, Facebook, Instagram, YouTube and other channels to raise awareness on cardiac arrest menace. Additionally, the respondents also indicated that they were running various campaigns and programs in hospitals, whereby the people in the waiting bay were informed on what cardiac arrest was, causes, how to avoid such as eating healthy and exercising, and the help they would get from the resuscitation care in case they suffered or their relative underwent the ordeal.

The respondents also mentioned that there was public awareness in the hospital counseling facilities within the cardiology department. The hospital had put up a staff to brief the

patients, family members or general public on how life-threatening cardiac arrest is, what could be done to avoid it, what to do and where to go in case of re-occurrence. Further, there were also awareness creation through conferences and seminars/webinars sponsored by various financiers. This is whereby the hospital was able to conduct conferences or seminars to educate the masses on matters related to IHCA. Lastly on this question, the respondents indicated that they also relied on health camps on various social gatherings such as churches, mosques, political and private meetings to ensure that people know how to save not only their lives but those around them. A respondent MD14 was also quoted saying,

*“The public needs to be told the plain truth about the threat that cardiac arrest has on their lives. This could be done through counseling or simply placing camps around where people are gathered to educate them.”*

The third question that the respondents were asked, was to rate their participation in a cardiac arrest resuscitations incident. The respondents’ feedback was categorized into two themes which included active and passive participation. In relation to active participation where most respondents’ opinion was centered indicated that, they ensured that they tried their best to save a life. This included ensuring that the patient is resuscitated successfully, quickly and professionally to avoid injury to the patient or those around. Therefore, respondents ensured that they took charge of most resuscitation processes so that the patient could survive. Comparatively, Ko et al. (2018) found out that when a healthcare provider was present and mostly a first responder, there was a chance of higher survival of a patient since the resuscitation process was effectively done during out-of-hospital cardiac arrest.

However, Kolte et al. (2019), pointed that the reason why there was less fatal cases of IHCA and compared to out of hospital occurrences was the contribution made by professional health care providers such as respondents towards CPR and patient's stability afterwards. Additionally, in relation to passive participation, some respondents indicated that when a cardiac arrest emergency meets them attending other patients, they would delegate the task of CPR to nurses. This was to ensure that both patients got the best healthcare as possible. Therefore, their participation would be providing professional advice to the nurses when asked a question on emerging issue.

#### **4.11 Secondary Data Results of the Patients**

The study also collected data using secondary data collection sheets of 39 patients who had undergone through the process of IHCA. The results were provided in Tables 4.17, 4.18, 4.19, 4.20, 4.21, 4.22, 4.23.

**Table 4.17**

#### ***Secondary Data of Patient's Information-Sheet One***

| <b>Pre-existing Conditions at Time of Cardiac Arrest</b> | <b>Frequency</b> | <b>Percent</b> |
|----------------------------------------------------------|------------------|----------------|
| None                                                     | 2                | 5              |
| Diabetes mellitus                                        | 5                | 13             |
| Hypertension                                             | 3                | 7              |
| MI (This admission)                                      | 2                | 5              |
| MI (Prior to admission)                                  | 2                | 5              |
| CCF (This admission)                                     | 3                | 7              |
| CCF (Prior admission)                                    | 2                | 5              |
| HIV/AIDS                                                 | 2                | 5              |
| Renalin sufficiency                                      | 5                | 13             |
| Hepaticin sufficiency                                    | 2                | 5              |
| Malignancy                                               | 3                | 7              |
| Stroke                                                   | 6                | 16             |
| Other                                                    | 2                | 5              |

|              |           |            |
|--------------|-----------|------------|
| <b>Total</b> | <b>39</b> | <b>100</b> |
|--------------|-----------|------------|

According to Table 4.17, majority the major pre-existing conditions at time of cardiac arrest were; 6(16%) stroke, 5(13%) Diabetes mellitus, and 5(13%) Renalin sufficiency. Notably, the minor pre-existing conditions at the time of cardiac arrest included MI, CCF, HIV/AIDS, and Hepaticin sufficiency, where all had 2(5%) cases. Therefore, the results implied that lifestyle diseases related stroke, diabetes and kidney were key contributors to cardiac arrests. This signified a worrying trend due to high number of people in the community suffering from these illnesses could at any time get a cardiac arrest.

In regards to age, gender, date and time when the cardiac arrest was recognized in hospitals was provided in Table 4.18.

**Table 4.18***Secondary Data of Patient's Information-Sheet Two*

| <b>Age</b>                   | <b>Frequency</b> | <b>Percent</b> |
|------------------------------|------------------|----------------|
| Above 71 years               | 11               | 28             |
| 61-70 years                  | 9                | 23             |
| 51-60 years                  | 7                | 18             |
| 41-50 years                  | 6                | 16             |
| 31-40 years                  | 4                | 10             |
| 18-30 years                  | 2                | 5              |
| <b>Total</b>                 | <b>39</b>        | <b>100</b>     |
| <b>Gender</b>                |                  |                |
| Male                         | 28               | 72             |
| Female                       | 11               | 28             |
| <b>Date Event Recognized</b> |                  |                |
| August 2022- October 2022    | 4                | 10             |
| November 2022- January 2023  | 31               | 79             |
| February 2023- April 2023    | 3                | 8              |
| May 2023- August 2023        | 1                | 3              |
| <b>Total</b>                 | <b>39</b>        | <b>100</b>     |
| <b>Time</b>                  |                  |                |
| 12:00am-6:59am               | 27               | 69             |
| 7:00am-11:59am               | 7                | 18             |
| 12:00pm-6:59pm               | 2                | 5              |
| 7:00pm-11:59pm               | 3                | 8              |
| <b>Total</b>                 | <b>39</b>        | <b>100</b>     |

As per Table 4.18, 11(28%) patients were above 71 years, 9(23%) were between 61-70 years and 7(18%) were 51-60 years. Further, 28(72%) were male while the rest were female. Consequently, 31(79%) were admitted between November 2022- January 2023 and 27(69%) were admitted between 12am to 7 am. These results implied that old aged patients who were of male gender were at more risk of suffering from IHCA. In the same vein it

was observed that IHCA were reported in the months of November, December and January early morning hours.

In regards to the area of deployment where IHCA occurred, code blue activation, timelines for activation, and arrival of medical personnel in responding to code blue is provided in Table 4.19.

**Table 4.19**

***Secondary Data of Patient's Information-Sheet Three***

| <b>Area of deployment</b>                | <b>Frequency</b> | <b>Percent</b> |
|------------------------------------------|------------------|----------------|
| ICU                                      | 14               | 36             |
| CCU                                      | 5                | 13             |
| HDU                                      | 4                | 10             |
| A & E (Adult)                            | 2                | 5              |
| Ward                                     | 7                | 18             |
| Renal                                    | 6                | 15             |
| Other                                    | 1                | 3              |
| <b>Total</b>                             | <b>39</b>        | <b>100</b>     |
| <b>Code Blue Activated</b>               |                  |                |
| Yes                                      | 30               | 77             |
| No                                       | 9                | 23             |
| N/A                                      | 0                |                |
| <b>Time When Code Blue was Activated</b> |                  |                |
| 12:00am-6:59am                           | 27               | 69             |
| 7:00am-11:59am                           | 7                | 18             |
| 12:00pm-6:59pm                           | 2                | 5              |
| 7:00pm-11:59pm                           | 3                | 8              |
| <b>Total</b>                             | <b>39</b>        | <b>100</b>     |
| <b>Code Blue Arrival Time</b>            |                  |                |
| 12:00am-6:59am                           | 21               | 54             |
| 7:00am-11:59am                           | 15               | 38             |
| 12:00pm-6:59pm                           | 1                | 3              |
| 7:00pm-11:59pm                           | 2                | 5              |
| <b>Total</b>                             | <b>39</b>        | <b>100</b>     |

Table 4.19 indicated that 14(36%) of IHCA occurred in ICU and 7(18%) occurred at the ward. Additionally, 30(77%) cases of IHCA were labelled as code blue and 27(69%)

activation done between 12:00am-6:59am. Notably, 21(54%) of code blue responded between 12:00am-6:59am and 15(38%) between 7:00am-11:59am. The results implied that most IHCA cases were at ICU of which code blue was activated and responded to accordingly.

In regards to current diagnosis, category, and defibrillation monitoring process were provided in Table 4.20.

**Table 4.20**

*Secondary Data of Patient's Information-Sheet Four*

| <b>Current Diagnosis</b>                                                     | <b>Frequency</b> | <b>Percent</b> |
|------------------------------------------------------------------------------|------------------|----------------|
| Medical cardiac                                                              | 11               | 28             |
| Medical non-cardiac                                                          | 8                | 21             |
| Sepsis                                                                       | 18               | 46             |
| Obstetric                                                                    | 2                | 5              |
| <b>Total</b>                                                                 | <b>39</b>        | <b>100</b>     |
| <b>Category</b>                                                              |                  |                |
| Surgical cardiac                                                             | 11               | 28             |
| Surgical non-cardiac                                                         | 6                | 15             |
| Trauma                                                                       | 17               | 44             |
| Other                                                                        | 5                | 13             |
| <b>Total</b>                                                                 | <b>39</b>        | <b>100</b>     |
| <b>Condition when need for compression/defibrillation</b>                    |                  |                |
| Pulseless                                                                    | 30               | 77             |
| Pulse (poor perfusion)                                                       | 9                | 23             |
| <b>Did the Patient with a Pulse Requiring Compressions become Pulseless?</b> |                  |                |
| Yes                                                                          | 25               | 64             |
| No                                                                           | 14               | 36             |
| <b>Conscious at Onset</b>                                                    |                  |                |
| Yes                                                                          | 10               | 26             |
| No                                                                           | 29               | 74             |
| <b>Monitoring Present at Onset</b>                                           |                  |                |
| ECG                                                                          | 35               | 90             |
| Pulse Oximeter                                                               | 4                | 10             |

According to Table 4.20, 18(46%) IHCA's current diagnosis was due to Sepsis followed by 11(28%) cases on medical cardiac. Notably, 17(44%) was categorized as trauma and 11(28%) as surgical cardiac. Further, the condition when need for compression/defibrillation was due to pulseless 30(77%). Also, the study noted that 25(64%) of the patients with a pulse requiring compressions became pulseless. It was also noted that 29(74%) of the cases were that the patients were conscious at onset and that 35(90%) cases were monitored using ECG.

In regards to ventilation breathing, ventilation, advanced airway, time, size and number of attempts, is provide in Table 4.21.

**Table 4.21**

***Secondary Data of Patient's Information-Sheet Five***

| <b>Airway/Ventilation Breathing</b> | <b>Frequency</b> | <b>Percent</b> |
|-------------------------------------|------------------|----------------|
| Spontaneous                         | 8                | 21             |
| Apnoeic                             | 10               | 26             |
| Agonal                              | 9                | 23             |
| Assisted                            | 12               | 30             |
| <b>Total</b>                        | <b>39</b>        | <b>100</b>     |
| <b>Ventilation</b>                  |                  |                |
| Bag-Valve-Mask                      | 9                | 23             |
| Endotracheal Tube (ET)              | 3                | 8              |
| Tracheostomy                        | 11               | 28             |
| Laryngoscope                        | 16               | 41             |
| Other                               | 0                | 0              |
| <b>Total</b>                        | <b>39</b>        | <b>100</b>     |
| <b>Advanced Airway</b>              |                  |                |
| LMA                                 | 32               | 82             |
| ETTube                              | 7                | 18             |
| <b>Time</b>                         |                  |                |
| 12:00am-6:59am                      | 27               | 69             |
| 7:00am-11:59am                      | 7                | 18             |
| 12:00pm-6:59pm                      | 2                | 5              |
| 7:00pm-11:59pm                      | 3                | 8              |
| <b>Total</b>                        | <b>39</b>        | <b>100</b>     |
| <b>Size</b>                         |                  |                |
| Above 8ml/kg                        | 32               | 82             |
| 8ml/kg                              | 7                | 18             |
| <b>Number of Attempts</b>           |                  |                |
| Above 5 times                       | 35               | 90             |

|           |   |    |
|-----------|---|----|
| 1-5 times | 4 | 10 |
|-----------|---|----|

Table 4.21 indicated that there were 12(30%) cases of assisted breathing and 10(26%) cases of apnoeic breathing. Further 16(41%) patients used Laryngoscope while 11(28%) used tracheostomy which were the major methods used. In regards to advanced airways, LMA was mostly used with a recording of 32(82%) patients to have used it as compared to 7(18%) who used ETTube. In terms of size, 8ml/kg was mostly used where 32(82%) were recorded to have used it. In addition, the time of administration was mainly at 12:00am-6:59am since 27(69%) of cases recorded were done at that time. Notably, there were more than 5 attempts done on 35(90%) patients to use ventilation meaning the medical staff tried all means possible to ensure that the patients had regained their appropriate breathing patterns.

Further on, the results of circulation 1<sup>st</sup> rhythm requiring compressions, compressions, time when chest compressions began, application of AED, timelines of AED application and pacemaker provision, are provided in Table 4.22

**Table 4.22*****Secondary Data of Patient's Information-Sheet Six***

| <b>Circulation</b>                       |                  |                |
|------------------------------------------|------------------|----------------|
| <b>1st Rhythm requiring Compressions</b> | <b>Frequency</b> | <b>Percent</b> |
| PEA                                      | 6                | 15             |
| Asystole                                 | 3                | 8              |
| VF                                       | 9                | 23             |
| Pulseless VT                             | 18               | 46             |
| Other                                    | 3                | 8              |
| <b>Total</b>                             | <b>39</b>        | <b>100</b>     |
| <b>Compressions</b>                      |                  |                |
| None                                     | 3                | 7              |
| CPR                                      | 26               | 67             |
| Device                                   | 10               | 26             |
| <b>Total</b>                             | <b>39</b>        | <b>100</b>     |
| <b>Time Chest Compressions Started</b>   |                  |                |
| 12:00am-6:59am                           | 21               | 54             |
| 7:00am-11:59am                           | 15               | 38             |
| 12:00pm-6:59pm                           | 1                | 3              |
| 7:00pm-11:59pm                           | 2                | 5              |
| <b>Total</b>                             | <b>39</b>        | <b>100</b>     |
| <b>AED Applied</b>                       |                  |                |
| Yes                                      | 31               | 79             |
| No                                       | 8                | 21             |
| <b>Time AED was Applied</b>              |                  |                |
| 12:00am-6:59am                           | 27               | 69             |
| 7:00am-11:59am                           | 7                | 18             |
| 12:00pm-6:59pm                           | 2                | 5              |
| 7:00pm-11:59pm                           | 3                | 8              |
| <b>Total</b>                             | <b>39</b>        | <b>100</b>     |
| <b>Pacemaker</b>                         |                  |                |
| Yes                                      | 27               | 69             |
| No                                       | 12               | 31             |

According to Table 4.22, circulation 1st rhythm requiring compressions was as a result of pulseless VT with a record of 18(46%) patients. Additionally, 26(67%) of compressions were done using CPR with 21(54%) of cases being attended to between 12:00am-6:59am. Further, Table 4.22, 31(79%) patient's heart rhythm was restored by application of AED between 12:00am-6:59am whereby 27(69%) application cases were noted. Further on, there were 27(69%) patient cases where pacemaker was used.

Additionally, the results on the existence of medical equipment checklist compressions like AED, ambubag, laryngoscope, and monitoring equipment is given. Additionally, the results on Table 4.23 indicated the time CPR ended, reason why CPR ended, type of ventilation applied and whether family witnessed resuscitation.

**Table 4.23**

***Secondary Data of Patient's Information-Sheet Seven***

| <b>Medical Equipment Checklist Compressions</b> |                  |                |
|-------------------------------------------------|------------------|----------------|
| <b>Defibrillator/AED</b>                        | <b>Frequency</b> | <b>Percent</b> |
| Yes                                             | 36               | 92             |
| No                                              | 3                | 8              |
| <b>Ambubag</b>                                  |                  |                |
| Yes                                             | 32               | 82             |
| No                                              | 7                | 18             |
| <b>Laryngoscope</b>                             |                  |                |
| Yes                                             | 21               | 54             |
| No                                              | 18               | 46             |
| <b>Monitoring Equipment</b>                     |                  |                |
| Yes                                             | 17               | 44             |
| No                                              | 22               | 56             |
| <b>Time CPR Ended</b>                           |                  |                |
| 12:00am-6:59am                                  | 14               | 36             |
| 7:00am-11:59am                                  | 11               | 28             |
| 12:00pm-6:59pm                                  | 9                | 23             |
| 7:00pm-11:59pm                                  | 5                | 13             |
| <b>Total</b>                                    | <b>39</b>        | <b>100</b>     |
| <b>Reason why CPR Ended</b>                     |                  |                |

|                                                |           |            |
|------------------------------------------------|-----------|------------|
| Survived – Return of circulation (ROSC) >20min | 11        | <b>28</b>  |
| Died–Efforts Terminated (No Sustained ROSC)    | 12        | <b>31</b>  |
| Died – Medical Futility                        | 7         | 18         |
| Died – Advance Directives                      | 5         | 13         |
| Died – Restrictions by Family                  | 4         | 10         |
| <b>Total</b>                                   | <b>39</b> | <b>100</b> |
| <b>Ventilation</b>                             |           |            |
| Bag-Valve-Mask                                 | 10        | 27         |
| LMA                                            | 19        | 49         |
| Intubated                                      | 6         | 15         |
| Tracheostom                                    | 4         | 10         |
| Other                                          | 0         | 0          |
| <b>Total</b>                                   | <b>39</b> | <b>100</b> |
| <b>Family Witnessed Resuscitation</b>          |           |            |
| Yes                                            | 10        | 26         |
| No                                             | 29        | 74         |

Table 4.23 provided that in regards to medical equipment checklist there were 36(92%) cases where Defibrillator/AED was used, 36(92%) on Ambubag, 21(54%) on Laryngoscope, and 17(44%) on monitoring equipment. Additionally, there were 14(36%) cases where CPR ended between 12:00am-6:59am. Notably, 12(31%) patients died as a result of efforts terminated since there was no sustained ROSC, while 11(28%) patients survived due to Return of circulation (ROSC) greater than 20minutes. In regards to ventilation, 19(49%) patients used LMA and 10(27%) patients used bag-valve-mask. Lastly, 29(74%) patient's family did not witness, resuscitation.

#### **4.12 Inferential Statistics of In-hospital Cardiac Arrest for Survival Rates of Adults**

The study conducted Pearson correlation and multiple regression analysis as the inferential statistics.

##### **4.12.1 Pearson Correlation Analysis of Healthcare Provider Training**

The study had a null hypothesis that stated that healthcare provider training did not have significant influence on the survival rate of cardiac arrest among adults in Kenya.

Therefore, Pearson correlation analysis was used to determine whether there was any influence or absence of it. Table 4.24 provides the results.

**Table 4.24**

***Pearson Correlation of Healthcare Provider Training***

|                                    |                 | Survival Rate of<br>Cardiac Arrest | Healthcare<br>Provider<br>Training |
|------------------------------------|-----------------|------------------------------------|------------------------------------|
| Survival Rate of Cardiac<br>Arrest | Pearson         | 1                                  | .495                               |
|                                    | Correlation     |                                    |                                    |
|                                    | Sig. (2-tailed) |                                    | .002                               |
|                                    | N               | 321                                | 321                                |
| Healthcare Provider<br>Training    | Pearson         | .495                               | 1                                  |
|                                    | Correlation     |                                    |                                    |
|                                    | Sig. (2-tailed) | .002                               |                                    |
|                                    | N               | 321                                | 321                                |

\*\*. Correlation is significant at the 0.01 level (2-tailed)

Table 4.24 indicates that the Pearson correlation coefficient  $r=0.495^{**}$  at  $\alpha < 0.002$  and 99% significance level. Therefore, since the correlation values were less than 1 and significance level less than 0.05, the study rejected the null hypothesis. The implication of the results provides that healthcare provider training determined a lot on the survival rate of cardiac arrest patients. The results agree with Manono (2022) who pointed out that the knowledge and skills training of healthcare providers increased their effectiveness of CPR in Nakuru county hospital. Additionally, Pareek et al. (2018) indicated that training nurses on CPR improved patient's mortality rate.

#### 4.12.2 Pearson Correlation Analysis of Area of Deployment of the Healthcare Provider Within the Hospital

The study had a null hypothesis that stated that area of deployment within the hospital did not have significant influence on the survival rate of cardiac arrest among adults in Kenya. Therefore, Pearson correlation analysis was used to determine whether there was any influence or absence of it. Table 4.25 provides the results.

**Table 4.25**

***Pearson Correlation of Area of deployment of the Healthcare Provider Within the Hospital***

|                                           |                 | Survival Rate of<br>Cardiac Arrest | Area of<br>deployment<br>Within the<br>Hospital |
|-------------------------------------------|-----------------|------------------------------------|-------------------------------------------------|
| Survival Rate of Cardiac<br>Arrest        | Pearson         | 1                                  | .117                                            |
|                                           | Correlation     |                                    |                                                 |
|                                           | Sig. (2-tailed) |                                    | .000                                            |
|                                           | N               | 321                                | 321                                             |
| Area of deployment<br>Within the Hospital | Pearson         | .117                               | 1                                               |
|                                           | Correlation     |                                    |                                                 |
|                                           | Sig. (2-tailed) | .000                               |                                                 |
|                                           | N               | 321                                | 321                                             |

\*\*. Correlation is significant at the 0.01 level (2-tailed)

Table 4.25 indicates that the Pearson correlation coefficient  $r=0.117^{**}$  at  $\alpha < 0.000$  and 99% significance level. Therefore, since the correlation values were less than 1 and significance level less than 0.05, the study rejected the null hypothesis. The implication of the results provides that area of deployment of the healthcare provider within the hospital determined a lot on the survival rate of cardiac arrest patients. Comparatively, Nallamothu

et al. (2018) also established that the availability of resuscitation teams played a significant influence on the success of in-hospital cardiac arrest.

#### 4.12.3 Pearson Correlation Analysis of Skill Mix (Health Care Cadre)

The study had a null hypothesis that stated that skill mix (health care cadre) did not have significant influence on the survival rate of cardiac arrest among adults in Kenya. Therefore, Pearson correlation analysis was used to determine whether there was any influence or absence of it. Table 4.26 provides the results.

**Table 4.26**

#### *Pearson Correlation of Skill Mix (Health Care Cadre)*

|                                    |                 | Survival Rate of<br>Cardiac Arrest | Skill Mix<br>(Health Care<br>Cadre) |
|------------------------------------|-----------------|------------------------------------|-------------------------------------|
| Survival Rate of Cardiac<br>Arrest | Pearson         | 1                                  | .309                                |
|                                    | Correlation     |                                    |                                     |
|                                    | Sig. (2-tailed) |                                    | .000                                |
|                                    | N               | 321                                | 321                                 |
| Skill Mix (Health Care<br>Cadre)   | Pearson         | .309                               | 1                                   |
|                                    | Correlation     |                                    |                                     |
|                                    | Sig. (2-tailed) | .000                               |                                     |
|                                    | N               | 321                                | 321                                 |

\*\*. Correlation is significant at the 0.01 level (2-tailed)

Table 4.26 indicates that the Pearson correlation coefficient  $r=0.309^{**}$  at  $\alpha < 0.000$  and 99% significance level. Therefore, since the correlation values were less than 1 and significance level less than 0.05, the study rejected the null hypothesis. The implication of the results provides that skill mix (health care cadre) was relevant towards ensuring that patient's survived cardiac arrest. Comparatively, Kaihula et al. (2022) dealing with Tanzania's urban tertiary referral hospital, also gathered that when the health care providers

had adequate knowledge and skills in CPR, the chance of patient's death reduced significantly and as well as reduced work-related errors that would cause other complications such as paralysis.

#### 4.12.4 Pearson Correlation Analysis of Availability of Medical Equipment

The study had a null hypothesis that stated that availability of medical equipment did not have significant influence on the survival rate of cardiac arrest among adults in Kenya. Therefore, Pearson correlation analysis was used to determine whether there was any influence or absence of it. Table 4.27 provides the results.

**Table 4.27**

#### *Pearson Correlation of Availability of Medical Equipment*

|                                      |                 | Survival Rate of<br>Cardiac Arrest | Availability of<br>Medical<br>Equipment |
|--------------------------------------|-----------------|------------------------------------|-----------------------------------------|
| Survival Rate of Cardiac<br>Arrest   | Pearson         | 1                                  | .412                                    |
|                                      | Correlation     |                                    |                                         |
|                                      | Sig. (2-tailed) |                                    | .000                                    |
|                                      | N               | 321                                | 321                                     |
| Availability of Medical<br>Equipment | Pearson         | .412                               | 1                                       |
|                                      | Correlation     |                                    |                                         |
|                                      | Sig. (2-tailed) | .000                               |                                         |
|                                      | N               | 321                                | 321                                     |

\*\*. Correlation is significant at the 0.01 level (2-tailed)

Table 4.27 indicated that the Pearson correlation coefficient  $r=0.412^{**}$  at  $\alpha < 0.000$  and 99% significance level. Therefore, since the correlation values were less than 1 and significance level less than 0.05, the study rejected the null hypothesis. The implication of the results provided that availability of medical equipment determined a lot on the survival

rate of cardiac arrest patients. Comparatively, past studies such as Merchant et al. (2014) established that when a health facility had quality medical facilities and equipment, it improved the outcome of cardiac arrest rates as compared to those that did not have them. Additionally, Morrison et al. (2019) established that guidelines and procedures to use various medical equipment enabled the medical practitioners to effectively and consistently improve the IHCA cases.

#### **4.13 Multivariate Analysis of In-hospital Cardiac Arrest for Survival Rates of Adults**

The study conducted a multivariate analysis of in-hospital cardiac arrest for survival rates of adults. The comprised of model summary, analysis of variance and regression weights.

##### **4.13.1 Model Summary of In-hospital Cardiac Arrest for Survival Rates of Adults**

A model summary was conducted to examine the percentage influence of in-hospital cardiac arrest determinants on survival rates of adults, as indicated in Table 4.28.

**Table 4.28**

##### ***Model Summary of In-hospital Cardiac Arrest for Survival Rates of Adults***

| Model | R                 | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson      |
|-------|-------------------|----------|-------------------|----------------------------|--------------------|
| 1     | .903 <sup>a</sup> | .815     | .804              | 2.62642                    | 1.324 <sup>a</sup> |

a. Predictors: (Constant), Availability of Medical Equipment, Skill Mix (health care cadre), Area of deployment Within the Hospital, Healthcare Provider Training,

b. Dependent Variable: Survival Rates of Adults

Table 4.28 revealed that R is .903 while the R-square is 0.815 at a Durbin Watson value of 1.324. This meant that in-hospital cardiac arrest determinants such as healthcare provider

training, area of deployment within the hospital, skill mix (health care cadre), and availability of medical equipment when combined dictated an 81.5% influence on the survival rates of adults in Kenya. The other 18.5% were related to factors that were not considered in this study.

#### 4.13.2 ANOVA of In-hospital Cardiac Arrest for Survival Rates of Adults

The purpose of the study was to evaluate the determinants of in-hospital cardiac arrest and how they impacted the survival rates of adults in Kenya. Therefore, the study used ANOVA to determine the nature of relationship of these determinants in addressing the survival rates of adults in Kenya. Table 4.29 provided the results of the analysis.

**Table 4.29**

#### *ANOVA of In-hospital Cardiac Arrest for Survival Rates of Adults*

| Model |            | Sum of Squares | df  | Mean Square | F     | Sig.              |
|-------|------------|----------------|-----|-------------|-------|-------------------|
| 1     | Regression | 256.070        | 4   | 64.018      | 9.280 | .000 <sup>b</sup> |
|       | Residual   | 2179.799       | 371 | 6.898       |       |                   |
|       | Total      | 2435.869       | 375 |             |       |                   |

a. Dependent Variable: Survival Rates of Adults

b. Predictors: (Constant), Availability of Medical Equipment, Skill Mix (health care cadre), Area of deployment Within the Hospital, Healthcare Provider Training,

The results in Table 4.29 reveal that the p-value was 0.000 at an F-statistic of 9.28. This meant that the in-hospital cardiac arrest determinants had a significant positive influence on survival rates of adults. Therefore, their relevance as building blocks of ensuring that Kenyan adults survived the ordeal of cardiac arrest was paramount.

#### 4.13.3 Regression Weights of In-hospital Cardiac Arrest for Survival Rates of Adults

The study had a model whereby  $Y = C + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e$

Where:

$Y$  = Survival Rate

$\beta_i$  = Coefficients to be estimated

$C$  = Constant

$X_1$  = Healthcare provider training

$X_2$  = Area of deployment of the healthcare provider within the hospital,

$X_3$  = Skill mix (health care cadre)

$X_4$  = Availability of medical equipment

$e$  = error

The study analyzed the regression weights to ascertain the coefficients of the variables as shown in Table 4.30.

**Table 4.30*****Regression Weights of In-hospital Cardiac Arrest for Survival Rates of Adults***

| Model                                                             | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig. |
|-------------------------------------------------------------------|-----------------------------|------------|---------------------------|--------|------|
|                                                                   | B                           | Std. Error | Beta                      |        |      |
| (Constant)                                                        | 21.610                      | 1.635      |                           | 13.216 | .000 |
| Healthcare Provider Training                                      | .184                        | .031       | .330                      | 5.913  | .214 |
| Area of deployment of the Healthcare Provider Within the Hospital | -.065                       | .039       | -.107                     | -1.681 | .094 |
| Skill Mix (health care cadre)                                     | .134                        | .040       | .165                      | .846   | .398 |
| Availability of Medical Equipment                                 | .097                        | .028       | .121                      | 1.647  | .101 |

a. Dependent Variable: Survival Rates of Adults

Table 4.30 indicated the unstandardized coefficient of healthcare provide training was 0.184; area of deployment of the healthcare provider within the hospital was -0.065; Skill mix (health care cadre) was 0.1134; and availability of medical equipment was 0.097. Therefore, when equated to the mode, it resulted to:  $Y = C + 0.184X_1 - 0.065X_2 + 0.134X_3 + 0.097X_4 + 1.635e$ . The results imply that separately, the survival of adults (Y) was either increased or decreased by  $0.0184 - 0.065 + 0.134 + 0.097$ . However, when combined, area of deployment within the hospital was insignificant warranting the need of hospitals to take keen consideration on the same. This was because the structural infrastructure of the hospital is a key limiting factor for fast response to cardiac arrest by the staff. If the wards were located far away from the emergency area/critical area, it became difficult for some health providers to respond on time. Additionally, when the health providers were low in

number and sparsely distributed over the hospital premise, specifically emergency area, it became a challenge to respond to emergencies at specific times of the day such as night. This was because, they lacked other staff to delegate their current duties as they attended to the pending cardiac arrest emergency.

Additionally, the study also noted that healthcare provider training played a significant role towards preparing the medical staff to handle cardiac arrest cases. Therefore, the hospital management should take into consideration the training gaps of basic life support, advanced cardiac life support, heart saver, and defibrillation with precision. It should not only be the responsibility of the hospital management to fund training needs but also at a personal capacity.

The medical practitioners such as respondents and nurses should not view the training costs as a punishment but a chance of equipping their skills to save human life in the cause of their profession. This is because, according to WHO (2021), cardiac arrest cases have continued to increase, fueled by poor health lifestyles and spread of communicable and non-communicable diseases. A good example was in 2019, whereby cardiac arrest claimed 30% of the 17 million and nine hundred thousand of deaths reported that year. This is the major reason why when pandemics such as COVID-19 began, the rate of cardiac arrest outcomes were even more unpredictable (Shao et al., 2020).

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

The purpose of this study was to evaluate the determinants of in-hospital cardiac arrest for survival rates of adults in Kenya. The specific objectives were to: Determine the influence of healthcare provider training, area of deployment of the healthcare provider within the hospital, skill mix (health care cadre) and availability of medical equipment on the survival rate of cardiac arrest among adults in Kenya. A cross-sectional design was used on collecting data from 2,037 respondents and nurses in Machakos Level 5 Hospital, Muranga Level 5 Hospital and the Aga Khan University Hospital, Nairobi. The respondents were selected using inclusion and exclusion criteria to have a sample of 72 medical respondents. The nurses were sampled using simple random method to have a sample of 474 in medical/surgical wards such as cardiology, anesthesiology, emergency and Critical Care Units [CCU]. The study gathered both quantitative and qualitative data whereby there were questionnaires, interviews and secondary data. Nurses answered questionnaires while the respondents were interviewed. The study also collected secondary data from general medical reports on CPR operations for the last one year (August 2022- August 2023).

#### **5.2 Summary of Results**

Sections 5.2.1 to 5.2.6 provide a summary of the results established from the collected data on questionnaires, interviews and secondary data on each objective.

### **5.2.1 Healthcare Provider Training**

The major results of the questionnaire provided 280(77%) nurses were of the positive opinion on the relevance of CPR in their work jurisdiction. Therefore, out of 191(60%) who attended CPR training, 143(45%) had completed the training to get a certificate. Further, 207(64%) had acquired BLS training and 170(53%) had heart saver training. In the training, 273(85%) noted that they had gained teamwork skills while at the same time, 285(88%) said that they were able to use patient simulators that enabled them gain relevant skills applicable during actual occurrence. That notwithstanding, 193(60%) had no training in ACLS while 186(58%) did not get the life support training in every 2 years. More discouraging was that 149(46%) never got a chance to put into practice their CPR skills on a team-based CRP event therefore .145(45%) lacking the actual real-life experience to respond to a CPR. It was also noted that 188(59%) nurses were not in a position to administer medication in a CPR occurrence since they lacked training in advanced life support.

In relation to the interview conducted, respondents indicated that for purposes of facilitating training, the sources of finances were from hospital management, donation from well-wishers, county government revenue allocation, and grants. Considerably, the training methods used by the hospital to incorporate training on Cardiopulmonary Resuscitation (CPR) included charge simulations, development of leadership skills and posterior analytical techniques. Consequently, poor/low training resulted in physical harm to patients, emotional instability to family/onlookers leading to unnecessary court cases, and work-related conflicts/tension among medical staff. Further, the regression results indicated that the Pearson correlation coefficient of  $r$  was 0.495\*\* at  $\alpha < 0.002$  and 99%

significance level. Therefore, since the correlation values were less than 1 and significance level less than 0.05, the study rejected the null hypothesis.

### **5.2.2 Area of deployment of the Healthcare Provider Within the Hospital**

The major results of the questionnaire revealed 215(67%) nurses were knowledgeable on what pertained resuscitation's role in the area of deployment they were placed. Further, 295(92%) of the nurses were able to activate the resuscitation code blue and 311(97%) confirmed that the support they got from colleagues whenever they activated the code was encouraging. That notwithstanding, 275(86%) complained that during the night their area of deployment during a resuscitation code was hampered as compared to weekday, weekend or public holiday. Additionally, 170(53%) nurses complained that still the resuscitation(code) in their unit was ineffectively run.

In relation to the interview conducted, respondents indicated that the standard protocol in a case of cardiac arrest in the area they were, it was required that they act as a team leader in a CPR process and also be involved in defibrillation. In case they were the one's calling the resuscitation code, they mainly used code blue phone alerts, telephone calls, and in-person notification. Further, the regression results indicated that the Pearson correlation coefficient of  $r$  was 0.117\*\* at  $\alpha < 0.000$  and 99% significance level. Therefore, since the correlation values were less than 1 and significance level less than 0.05, the study rejected the null hypothesis.

### **5.2.3 Skill Mix (health care cadre)**

The major results of the questionnaire revealed 290(90%) nurses consenting that they ensured that they responded within 5 minutes, while 224(69%) nurses agreed to the fact

that the number of responders conducting CPR to a patient in the event of cardiac arrest was very important. Therefore, 258(80%) concurred that there was need to have a staff in charge to crowd control to minimize distraction during CPR event. That notwithstanding, 188(59%) were of the contrary opinion that nurses were given a chance to assess effectiveness of chest compressions while 299(99%) nurses indicated that the process of resuscitation was not well managed.

In relation to the interview conducted, healthcare providers were able to pinpoint that a patient was suffering from cardiac arrest through examining their failure to breathe, heart stopping, and collapse of the patient. Additionally, the challenge of respondents working with responders with low skills resulted to death of the patient, immobility such that they are unable to walk again, loss of memory, inability to speak or concentrate. However, there were hospital policies such as emergency care out of wards/ICU, emergency care inside the wards/ICU, use of advanced IHCA machines/tools and team work. These policies guided on who to respond on which issue in a case of cardiac arrest to avoid confusion or worsen the situation. Further, the regression results indicated that the Pearson correlation coefficient of  $r$  was 0.309\*\* at  $\alpha < 0.000$  and 99% significance level. Therefore, since the correlation values were less than 1 and significance level less than 0.05, the study rejected the null hypothesis.

#### **5.2.4 Availability of Medical Equipment**

The major results of the questionnaire revealed 265(83%) nurses, agreed that their hospitals had defibrillator devices, 277(87%) agreed on their hospital's having laryngoscope and 294(92%) agreed on their hospitals' having functional cardiac monitors. Regrettably, 282(88%) complained of their hospitals having old defibrillator devices while 231(72%)

also noted that there were low numbers of complete kits of ambu bags to arrest the multiple resuscitation situations their units. Others 244(76%) raised concerns on low number of laryngoscope devices in their hospitals, 241(95%) had issues with low number of enough appropriate sizes of the endotracheal tubes, and 267(83%) complained of unavailability of cardiac monitors during the resuscitations.

In relation to the interview conducted, it revealed that chest compressor, defibrillator, ambu bag and endotracheal tubes were the major medical equipment needed in ensuring that Return of Spontaneous Circulation (ROSC) in a patient. Further, the standard sanitizing protocols included either steam, dry heat or Ethylene Oxide (EtO) sterilization. Additionally, to ensure that medical equipment was shared reasonably the process entailed having a people in charge of equipment distribution, collection of used equipment and sterilization for redistribution. Further, the regression results indicated that the Pearson correlation coefficient of  $r$  was  $=0.412^{**}$  at  $\alpha < 0.000$  and 99% significance level. Therefore, since the correlation values were less than 1 and significance level less than 0.05, the study rejected the null hypothesis.

#### **5.2.5 Survival Rate of Cardiac Arrest among Adults.**

The major results of the questionnaire revealed 185(58%) nurses noting that the survival rate of patients had improved while 244(76%) provided information on the presence of committee to investigate any medical negligence causing deaths related to cardiac arrests in hospitals. Further, 281(87%) nurses confirmed that their hospitals had safety standard protocols implemented to ensure that the patient breathing pattern was stabilized after Cardiopulmonary Resuscitation (CPR). Other 289(89%) agreed that there was monitoring of patients by healthcare providers, 291(91%) revealed that hospital staff educated the

patients on healthy lifestyles as measures of avoiding a reoccurrence of cardiac arrest, and 293(91%) confirmed that family/relatives were briefed on their loved one's condition.

In relation to the interview conducted, the respondents noted that spontaneous circulation was stabilized through oxygenation of the patient, control of their blood pressure, monitoring the percutaneous coronary intervention, control and management of patient's temperature and multimodal neuroprognostication. Further, the hospitals were using mainstream media, social media, campaigns and programs in hospitals, public awareness in the hospital counseling facilities within the cardiology department. There was awareness creation through conferences and seminars/webinars sponsored by various financiers.

#### **5.2.6 Secondary Data Results of the Patients**

The results provided that the major pre-existing conditions at time of cardiac arrest were; 6(16%) stroke, 5(13%) Diabetes mellitus, and 5(13%) Renal insufficiency. Additionally, 11(28%) patients were above 71 years, 9(23%) were between 61-70 years and 7(18%) were 51-60 years. Further, 28(72%) were male while the rest were female. Consequently, 31(79%) were admitted between November 2022- January 2023 and 27(69%) were admitted between 12am to 7 am. Most IHCA cases 14(36%) occurred in ICU and 7(18%) occurred at the ward. Additionally, 30(77%) cases of IHCA were labelled as code blue and 27(69%) activation done between 12:00am-6:59am. Notably, 21(54%) of code blue responded between 12:00am-6:59am and 15(38%) between 7:00am-11:59am. Further, 18(46%) IHCA's current diagnosis was due to Sepsis followed by 11(28%) cases on medical cardiac. Notably, 17(44%) was categorized as trauma and 11(28%) as surgical cardiac. Further, the condition when need for compression/defibrillation was due to pulseless 30(77%).

Also, the study noted that 25(64%) of the patients with a pulse requiring compressions became pulseless. It was also noted that 29(74%) of the cases were that the patients were conscious at onset and that 35(90%) cases were monitored using ECG. In regards to ventilation, there were 12(30%) cases of assisted breathing and 10(26%) cases of apnoeic breathing. Further 16(41%) patients used Laryngoscope while 11(28%) used tracheostomy which were the major methods used. In regards to advanced airways, LMA was mostly used with a recording of 32(82%) patients to have used it as compared to 7(18%) who used ETTube. In terms of size, 8ml/kg was mostly used where 32(82%) were recorded to have used it. At the end of ROSC, 12(31%) patients died as a result of efforts terminated since there was no sustained ROSC, while 11(28%) patients survived due to Return of circulation (ROSC) greater than 20minutes

### **5.3 Conclusions of the Study**

The conclusion remark on healthcare provider training is that, it had a significant influence on the survival rate of cardiac arrest among adults. On the one hand, the healthcare providers lacked advanced professional skills such as ACLS training, lacked the zeal and discipline to consistently attend the CPR training in every 2 years. On the other hand, hospitals were noted to have poor implementation of policies that guided on the correct exposure to CPR management to all healthcare providers. This ‘privilege’ was only left to the chosen few that and as a result, it was discovered that there was a gap on the skills that the health workers possessed related to prescribing and administering appropriate medication in a CPR scenario.

The conclusion remark on area of deployment of the healthcare provider within the hospital is that, it had a significant influence on the survival rate of cardiac arrest among adults. Consequently, in as much as the healthcare providers had clear understanding on what they were to do in case of a cardiac arrest emergency, their effectiveness was greatly affected due to low number of staff assigned tasks at night in different units. As a result, it became almost impossible for a staff to leave their area of jurisdiction so as to attend to an emergency. This was because units lacked a good number of staff who could support various medical operations alternatively or jointly contributing to ineffectiveness in running the overall resuscitation code in their area of deployment.

The conclusion remark on the skill mix (healthcare cadre) is that, it had a significant influence on the survival rate of cardiac arrest among adults. It was noted that even though various healthcare providers such as nurses and respondents had the required professional qualifications and skills, there lacked team work effort. As a result, there were work related divisions and sidelining each other during critical scenarios like assessment of the chest compressions during cardiac arrests, defibrillation and others. Therefore, the overall quality of medication management was greatly paralyzed in various hospitals since different healthcare providers could hardly work together.

The conclusion remark on the availability of medical equipment is that it had a significant influence on the survival rate of cardiac arrest among adults. Notably, the study discovered that hospitals lacked advanced medical equipment such as modern defibrillators, adequate ambubags, laryngoscopes, endotracheal tubes and cardiac monitors to ensure that the IHCA were amicably monitored and treated on time. As a result, the patients were required to

share what was available which is a recipe for health disaster such as spread of communicable diseases as secondary to the ailment they have, and also to the cardiac arrest.

#### **5.4 Recommendations of the Study**

The recommendations on the healthcare provider training are that, the hospital management should enact learning and development policies that make it mandatory for various staff in different units to attend CPR training. Additionally, the medical staff should improve more awareness through internal forums such as hospital workers union on the need to acquire advanced professional skills such as ACLS training. The hospital management could motivate the healthcare providers through rewarding the certified staff or offering priority on promotional opportunities to the ones that have shown effort of getting certification in advanced ACLS training. The departmental unit leaders should consistently keep training members on the need of working as a team in emergencies so that every member could get a chance to improve key skills such as CPR management.

The recommendations on the area of deployment of the healthcare provider within the hospital are that, the hospital board should push and seek more funding both at national and county governments and in private sector. This would enable them have more resources that could be used to employ appropriate staff numbers, appropriate skill mix and improve on resourcing for certifications. In addition, it would enable them have more qualified staff work in different shifts such as during the night. This would increase more healthcare providers in various units to improve the effectiveness of emergency response particularly at night.

The recommendations on the skill mix (healthcare cadre) are that, the hospital management should provide more activities that enhance multidisciplinary approach to care. In addition, sessions where nurses and respondents interact more to understand working connections, should be enhanced. Ongoing continuous education on topics such as communication skills, conflict resolution, and respect at work, should be delivered as mandatory courses, so as to improve their working and learning environment. But the hospital management should ensure that they strengthen the implementation and monitoring of policies related to work environment.

The recommendations on the availability of medical equipment are that, the hospital management should come up with unique fund-raising programs that enable the hospital to purchase the much-required medical equipment. In addition, the government should ensure and regulate that the health system is well resolved to be able to have the correct and current equipment used for resuscitation.

The fund-raising programs could be related to donations from well-wishers, re-investing the income generated from hospital treatments offered to different individuals, partnering with international organizations that can support in purchase of medical equipment, and liaising with the government of the day for funding.

### **5.5 Suggestion for Future Studies**

The study was conducted on determinants of IHCA like healthcare provider training, area of deployment of the health provider within the hospital, skill mix (health care cadre), availability of medical equipment. Future studies could widen the scope and consider other factors like health-related social needs of the health care providers.

Further, the study considered nurses, respondents and secondary data of patients. Future studies could include other healthcare providers such as clinical health officers, laboratory technologists, and radiologists among others. Their input of resuscitation issues could of great impact to the study.

Additionally, the study focused on collecting data from hospitals such as the Aga Khan, Machakos level 5 and Muranga level 5 to represent Nairobi, Machakos and Muranga counties. Future studies could consider other hospitals in other counties/regions to enrich the results. Additionally, future studies could either do a comparative study or concentrate with more hospitals in a specific county at a time. They could also conduct a comparative study to assess how cardiac arrest cases were handled in public and as well as private hospitals at a specific county or a series of counties.

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## **APPENDICIES**

### **Appendix I: Authorization Letter**

Eunice Beatrice Njeri Tole  
Email: eunice.tole@gmail.com,  
P.O Box 45240-00100,  
Nairobi-Kenya.

To: CEO  
Aga Khan University Hospital, Nairobi  
Machakos Level 5 Hospital, Machakos  
Muranga Level 5 Hospital, Muranga

#### **RE: AUTHORIZATION TO CONDUCT A STUDY IN YOUR HOSPITAL**

I am a student pursuing degree of master in health systems management of Kenya Methodist University. Am conducting a study on the to the determinants of in-hospital cardiac arrest for survival rates of adults in selected counties in Kenya, which is part of my academic requirement. Therefore, am requesting your office to authorize and allow me to conduct the study. The study has sampled medical doctors and nurses preferably in medical surgical wards such as cardiology, anesthesiology, emergency and Critical Care Units [CCU] to participate as respondents.

The study will interview doctors, administer questionnaires to nurses and also collect secondary data from medical reports related to CPR operations from August 2022 to August 2023. I have attached the questionnaires, interview guide and secondary data collection forms to this letter for your review.

Please note that the responses gathered will only be used for academic purposes. Thank you for your consideration towards my request.

Yours faithfully,

Eunice Beatrice Njeri Tole  
HSM-3-2339-1/2011

## **Appendix II: Consent Letter to Respondents**

Eunice Beatrice Njeri Tole  
HSM-3-2339-1/2011  
Kenya Methodist University  
P.O. Box 267 – 60200.

Dear respondent,

I am writing to request for consent to participate in my study which will help me to actualize my academic research that investigates on: ***Determinants of in-hospital Cardiac Arrest for Survival Rates of Adults in Selected Counties in Kenya***. This research intends to enable educational stakeholders put into practice these proficiencies and others in ensuring that they become even better stewards to secondary schools' funds.

### **Procedure to be followed**

The specific questions in the questions and interviews are organized from part one to six. The first part contains questions related to background information, while the other parts are organized based on the objectives of the study. The questions asked in the questionnaires are closed ended with an ordinal Likert scale of 1 to 5. You are required to answer the questions in a period of 20 minutes while the interview questions will take 30 minutes. Kindly note that you are not obligated to participate in the study if you feel not like participating. In case you find out that you would not wish to answer a specific question, simply skip it.

### **Discomforts and risks**

In this study, there is no risks of participating in the research. The reputation of the participant will also not be injured. The respondent is welcome to discontinue participation in the study at any time, should one wish to do so due to discomfort. You may also stop the answering the questionnaire or interview schedule at any time.

### **Benefits**

Your participation in this study will be key in ensuring that you get a chance to speak out the concerns you have been experiencing while performing the resuscitation. Therefore, this will enable you have a higher bargaining power as far as better working conditions and allowances are concerned. You will also have an opportunity to enhance awareness to the public through sharing on how to identify a cardiac arrest on time to avoid undergoing through CPR and access better healthcare on time.

### **Rewards**

Please note that you will not be rewarded or receive any favors if you choose to take part in the study.

### **Confidentiality**

The study will maintain confidentiality on the personal details of the respondents. To ensure this is done, the questionnaires and interviews will not have any sections requesting their names, telephone numbers or emails. Further the study will maintain privacy on the responses of the respondents hence secure the answered questionnaires in a safe place.

### **Contact Information**

In case you have any further inquiry on the details of the study, do not hesitate to contact me on **eunice.tole@gmail.com**. You can also reach out to my supervisors who are **kezianjoroge@kemu.ac.ke** and **musa.oluoch@kemu.ac.ke**.

Please provide your signature below as a way of agreeing that you consent in participating in this study.

### **Participant's Statement**

I agree to participate as a respondent and will give relevant information on the questions asked. I have understood that my responses will be used for this study's purpose and have voluntarily made a decision to participate.

Signature of the respondent.....Date.....

### **Investigator's Statement**

I, the undersigned, have explained to the volunteer in a language s/he understands the procedures to be followed in the study and the risks and the benefits involved.

Name of the researcher.....Date.....

Researcher's Signature.....

## Appendix III: Questionnaire for Nurses

## SECTION A: SOCIAL DEMOGRAPHIC FACTORS

1. Gender Female ( ) Male ( )
2. Level of education.....
3. Age 25-35 years ( )  
36-45 years ( )  
46-55 years ( )  
56-60 years ( )
4. Years experience Less than 5 years ( ) 5-10 years ( ) 11-15 years ( ) 16-20 years ( )  
21+ years ( )
5. Department  
(a) Cardiology ( ) (b) Anesthesiology ( ) (b) Intensive care units ( ) other  
departments (name).....
6. What is your professional qualification?
7. In how much resuscitation (CPR) have you previously been involved in as a caregiver?  
a) 1-3 events  
b) 4-10 events  
c) More than 10 events  
d) I don't remember
8. How would you rate your participation in a cardiac arrest incident?  
a) Active participation ( )  
b) Passive participation ( )  
c) Only watch ( )

## SECTION B: HEALTHCARE PROVIDER TRAINING AND SURVIVAL RATE

9. a) I have previously attended a CPR training

Yes ( ) No ( )

b) I hold a valid CPR certification

Yes ( ) No ( ) When?.....

10. I have undergone Basic Life Support (BLS) training? Yes ( ) No ( ) When?.....

11. I have undergone Advanced Cardiovascular Life Support training (ACLS)? Yes ( )  
No ( ) When?.....

12. I have undergone Heart Saver Support training Yes ( ) No ( ) When?.....

13. I have been instructed on the use of an automatic defibrillator? Yes ( ) No ( )

14. On a scale of 1 to 5 where; 1=Strongly Disagree (SD), 2=Disagree (D) 3=Neutral (N) 4=Agree (A) 5=Strongly Agree (SA) please indicate your level of agreement with the following statement.

|    | Statements                                                                                                         | Strongly Agree (SA)<br>5 | Agree (A)<br>4 | Neutral (N)<br>3 | Disagree (D)<br>2 | Strongly Disagree (SD)<br>1 |
|----|--------------------------------------------------------------------------------------------------------------------|--------------------------|----------------|------------------|-------------------|-----------------------------|
| 1. | CPR training should be a mandatory part of my continuing education                                                 |                          |                |                  |                   |                             |
| 2. | I feel confident with the CPR training I have in (circle as appropriate)<br><br>BLS<br><br>ACLS<br><br>Heart Saver |                          |                |                  |                   |                             |

|     |                                                                                                                                                          |  |  |  |  |  |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| 3.  | I am trained in Life Support- CPR every 2years                                                                                                           |  |  |  |  |  |
| 4.  | I believe I have received adequate training in performing CPR                                                                                            |  |  |  |  |  |
| 5.  | Patient simulators shown to me during training was helpful during an actual resuscitation                                                                |  |  |  |  |  |
| 6.  | I feel confident in operating the resuscitation equipment due to the training I received                                                                 |  |  |  |  |  |
| 7.  | I can respond to the crisis management of communication because of the designation of roles taught during the CPR training                               |  |  |  |  |  |
| 8.  | I can respond to the teamwork because of the designation of roles taught during the CPR training                                                         |  |  |  |  |  |
| 9   | I have had an opportunity to practice multi-disciplinary, team-based CPR response                                                                        |  |  |  |  |  |
| 10. | <b>ANSWER a OR b</b><br><br>a) I would feel anxious about participation in mock resuscitation CPR scenarios in the unit if organized despite my training |  |  |  |  |  |

|     |                                                                                                                                                   |  |  |  |  |  |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
|     | b) I would feel anxious about participation in mock resuscitation scenarios in the unit if organized because I have no resuscitation CPR training |  |  |  |  |  |
| 11. | I believe I have enough experience to participate and respond to a CPR                                                                            |  |  |  |  |  |
| 12. | I am confident that I can recognize the cardiac rhythm correctly because of my advanced life support training                                     |  |  |  |  |  |
| 13. | I can recognize a CPR scenario because of my heart saver training                                                                                 |  |  |  |  |  |
| 14. | I can use all the equipment as assigned during resuscitation-CPR because of my training                                                           |  |  |  |  |  |
| 15. | I can perform chest compressions and mouth to mouth breathing adequately because of the training I got in basic life support                      |  |  |  |  |  |
| 16. | I can prescribe and administer appropriate medication in a CPR scenario due to the training of advanced life support                              |  |  |  |  |  |

**SECTION C: THE LOCATION OF THE HEALTHCARE PROVIDER WITHIN THE HOSPITAL AND SURVIVAL RATE**

15. Where are you usually located in your daily professional practice?

a) Ward ( )

b) Critical care units ( )

c) Emergency unit ( )

d) Consultation area

e) Elsewhere .....(please specify)

16. a) You must leave your area of deployment because you are a responder to the resuscitation-CPR team when the resuscitation happens outside your daily area of deployment

Yes ( ) No( )

b) We have no responding teams in our hospital Yes ( ) No( )

17. On a scale of 1 to 5 where; 1=Strongly Disagree (SD), 2=Disagree (D) 3=Neutral (N)

4=Agree (A) 5=Strongly Agree (SA) please indicate your level of agreement with the

following statement.

|    | Statements                                                                                             | Strongly Agree (SA)<br>5 | Agree (A)<br>4 | Neutral (N)<br>3 | Disagree (D)<br>2 | Strongly Disagree (SD) 1 |
|----|--------------------------------------------------------------------------------------------------------|--------------------------|----------------|------------------|-------------------|--------------------------|
| 1. | During a resuscitation I have a clear understanding of my role in my area of deployment                |                          |                |                  |                   |                          |
| 2. | My area of deployment during a call to a resuscitation(code) significantly affects my response timings |                          |                |                  |                   |                          |
| 3. | <b>Score Each</b><br><br>My area of deployment during a call to a resuscitation (code) is              |                          |                |                  |                   |                          |

|    |                                                                                                                   |  |  |  |  |  |
|----|-------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
|    | significantly affected negatively during<br>a) Night<br>b) Day<br>c)Weekends<br>d) Public Holidays<br>e) Weekdays |  |  |  |  |  |
| 4. | All the departments(area of deployments)within the hospital are aware how a resuscitation is activated            |  |  |  |  |  |
| 5. | When I call a resuscitation(code), I feel comfortable with the amount of help I receive from my colleagues        |  |  |  |  |  |
| 6. | I believe that resuscitation(code) in my unit is effectively run.                                                 |  |  |  |  |  |

#### SECTION D: SKILL MIX OF THE RESPONDERS AND SURVIVAL RATE

18). On a scale of 1 to 5 where; 1=Strongly Disagree (SD), 2=Disagree (D) 3=Neutral (N) 4=Agree (A) 5=Strongly Agree (SA) please indicate your level of agreement with the following statement.

|    | Statements                                                                                          | Strongly Agree (SA)<br>5 | Agree (A)<br>4 | Neutral (N)<br>3 | Disagree (D)<br>2 | Strongly Disagree (SD) 1 |
|----|-----------------------------------------------------------------------------------------------------|--------------------------|----------------|------------------|-------------------|--------------------------|
| 1. | The number of responders who attend to the patient in the event of cardiac arrest is very important |                          |                |                  |                   |                          |

|     |                                                                                                                          |  |  |  |  |  |
|-----|--------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| 2.  | The team can easily identify who is in charge during a resuscitation (code)                                              |  |  |  |  |  |
| 3.  | While part of a resuscitation (code) in the unit, I feel comfortable asking colleagues for help.                         |  |  |  |  |  |
| 4.  | There is a nurse given the role of assessing the effectiveness of chest compressions during cardiac arrest               |  |  |  |  |  |
| 5.  | Having a nurse to crowd control is helpful during a resuscitation situation                                              |  |  |  |  |  |
| 6.  | There is always at least one nurse scheduled in my unit to respond to a resuscitation(code)                              |  |  |  |  |  |
| 7.  | There is always at least one doctor scheduled in my unit to respond to a resuscitation(code)                             |  |  |  |  |  |
| 8.  | The doctors responded to the resuscitation(code) withing the stipulated five (5) minutes after recognition of the arrest |  |  |  |  |  |
| 9   | The nurses responded to the resuscitation within the stipulated five (5) minutes after recognition of the arrest         |  |  |  |  |  |
| 10. | The doctor's skill of intubation was straightforward                                                                     |  |  |  |  |  |

|     |                                                                                                          |  |  |  |  |  |
|-----|----------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| 11. | The medication management during the resuscitation scenario was well managed because of the skill of the |  |  |  |  |  |
|     | a) Doctor                                                                                                |  |  |  |  |  |
|     | b) Nurse                                                                                                 |  |  |  |  |  |

### **SECTION E: AVAILABILITY OF MEDICAL EQUIPMENTS AND SURVIVAL RATE**

19) On a scale of 1 to 5 where; 1=Strongly Disagree (SD), 2=Disagree (D) 3=Neutral (N) 4=Agree (A) 5=Strongly Agree (SA) please indicate your level of agreement with the following statement.

|    | <b>Statements</b>                                                                                      | <b>Strongly Agree (SA)<br/>5</b> | <b>Agree (A)<br/>4</b> | <b>Neutral (N)<br/>3</b> | <b>Disagree (D)<br/>2</b> | <b>Strongly Disagree (SD) 1</b> |
|----|--------------------------------------------------------------------------------------------------------|----------------------------------|------------------------|--------------------------|---------------------------|---------------------------------|
| 1. | We have got the most recent automated defibrillator devices.                                           |                                  |                        |                          |                           |                                 |
| 2. | We have got functional defibrillator devices                                                           |                                  |                        |                          |                           |                                 |
| 3. | I am comfortable operating the defibrillator during a resuscitation (code).                            |                                  |                        |                          |                           |                                 |
| 4. | There are enough completes kits of ambubags to arrest the multiple resuscitation situations in my unit |                                  |                        |                          |                           |                                 |
| 5. | I can use a laryngoscope                                                                               |                                  |                        |                          |                           |                                 |

|     |                                                                                                           |  |  |  |  |  |
|-----|-----------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| 6.  | We have enough laryngoscope devices in the hospital                                                       |  |  |  |  |  |
| 7.  | In case of an emergency lack of monitoring equipment has largely affected the survival rates of patients. |  |  |  |  |  |
| 8.  | I am not comfortable using a Laryngoscope even when it is available                                       |  |  |  |  |  |
| 9.  | There are not enough appropriate sizes of the endotracheal tubes in the facility when in a resuscitation  |  |  |  |  |  |
| 10. | The cardiac monitor is always available during the resuscitations                                         |  |  |  |  |  |
| 11. | The cardiac monitor is always functional during the resuscitation                                         |  |  |  |  |  |

#### SECTION F: SURVIVAL RATE

20) On a scale of 1 to 5 where; 1=Strongly Disagree (SD), 2=Disagree (D) 3=Neutral (N) 4=Agree (A) 5=Strongly Agree (SA) please indicate your level of agreement with the following statement.

|    | Statements                                                                                      | Strongly Agree (SA)<br>5 | Agree (A)<br>4 | Neutral (N)<br>3 | Disagree (D)<br>2 | Strongly Disagree (SD) 1 |
|----|-------------------------------------------------------------------------------------------------|--------------------------|----------------|------------------|-------------------|--------------------------|
| 1. | There are safety standard protocols implemented to ensure that the patient breathing pattern is |                          |                |                  |                   |                          |

|    |                                                                                                                                                    |  |  |  |  |  |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
|    | stabilized after<br>Cardiopulmonary<br>Resuscitation (CPR)                                                                                         |  |  |  |  |  |
| 2. | Healthcare providers are<br>assigned to monitor the<br>patient                                                                                     |  |  |  |  |  |
| 3. | There are clear<br>communication channels<br>used to notify the<br>family/relatives of the<br>patients on their ROSC<br>status                     |  |  |  |  |  |
| 4. | The hospital staff educate<br>the patients on healthy<br>lifestyles as measures of<br>avoiding a reoccurrence of<br>cardiac arrest                 |  |  |  |  |  |
| 5. | There had been an<br>increased rate of survival<br>of patients that experience<br>cardiac arrest while in our<br>hospitals                         |  |  |  |  |  |
| 6. | There is a hospital<br>committee established to<br>evaluate the medical<br>negligence as a possible<br>cause of fatalities from<br>cardiac arrest. |  |  |  |  |  |

## **Appendix IV: Interview Guide for Medical Doctors**

### **SECTION ONE: BACKGROUND INFORMATION**

1. What is your level of education?
2. How many years of experience do you have as a doctor?
3. Please name the department that you work in?
4. Which professional qualification related to cardiac arrest management do you possess?

### **SECTION TWO: HEALTHCARE PROVIDER TRAINING AND SURVIVAL RATE**

1. Elaborate the methods used by the hospital to incorporate training on Cardiopulmonary Resuscitation (CPR) among the healthcare workers?
2. Highlight the sources of funding that are involved when training on Cardiopulmonary Resuscitation (CPR)?
3. Explain the challenges that you get when working with a team that has low or no training on Cardiopulmonary Resuscitation (CPR)?

### **SECTION THREE: THE AREA OF DEPLOYMENT OF THE HEALTHCARE PROVIDER WITHIN THE HOSPITAL AND SURVIVAL RATE**

1. Explain the standard protocols followed in your area of jurisdiction when a cardiac arrest happens?
2. Highlight the communication channels used to notify the healthcare providers in the involved area of deployment, on a case of cardiac arrest requiring Cardiopulmonary Resuscitation (CPR)?
3. Elaborate how the response teams coordinate with each other to save a situation of a patient having cardiac arrest within any part of the hospital?

### **SECTION FOUR: SKILL MIX OF THE RESPONDERS AND SURVIVAL RATE**

1. Describe the hospital policies that guide on who to respond on which issue in a case of cardiac arrest to avoid confusion?
2. Elaborate how healthcare providers are able to differentiate cardiac arrest with other chest issues?
3. Highlight the challenges encountered when there is no enough skill cadre responding to a cardiac arrest occurrence?

## **SECTION FIVE: AVAILABILITY OF MEDICAL EQUIPMENTS AND SURVIVAL RATE**

1. Please highlight the major medical equipment needed in ensuring that Return of Spontaneous Circulation (ROSC) is effective in a case of cardiac arrest?
2. Elaborate the standard protocols followed to ensure that the medical equipment is sterilized to avoid transmission of infection especially on endotracheal breathing tubes?
3. Briefly describe how the hospital coordinates the sharing of medical equipment particularly when there are multiple cardiac arrest cases?

## **SECTION SIX: SURVIVAL RATE**

1. Explain how you ensure that spontaneous circulation is stabilized in a patient after resuscitating them?
2. Briefly indicate the measures that the hospital is taking to educate the public on ways of identifying cardiac arrest on time and the treatment available to increase their chances of survival?
3. How would you rate your participation in a cardiac arrest resuscitations incident?

## Appendix V: Secondary Data Collection Sheets

Hospital's Name.....

| Pre-existing conditions at time of cardiac arrest                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                  | Age of the Patient                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> None<br><input type="checkbox"/> Diabetes mellitus<br><input type="checkbox"/> Hypertension<br><input type="checkbox"/> MI (This admission)<br><input type="checkbox"/> MI (Prior to admission)<br><input type="checkbox"/> CCF (This admission)<br><input type="checkbox"/> CCF (Prior admission) | <input type="checkbox"/> HIV/AIDS<br><input type="checkbox"/> Renal insufficiency<br><input type="checkbox"/> Hepatic insufficiency<br><input type="checkbox"/> Malignancy<br><input type="checkbox"/> Stroke<br><input type="checkbox"/> Other: | <input type="checkbox"/> 18-30 years<br><input type="checkbox"/> 31-40 years<br><input type="checkbox"/> 41-50 years<br><input type="checkbox"/> 51-60 years<br><input type="checkbox"/> 61-70 years<br><input type="checkbox"/> Above 71 years |

### Cardiopulmonary Resuscitation Form

Sex: Male ☐ Female ☐

Date event recognized: \_\_\_\_\_ Time: \_\_\_\_\_ ☐ AM ☐ PM

Location: ☐ ICU ☐ CCU ☐ HDU ☐ A&E (Adult) ☐ Ward ☐ Renal ☐ Other: .....

Code blue activated. ☐ Yes ☐ No N/A ☐

Time: \_\_\_\_\_ ☐ AM ☐ PM

Code blue arrival time: ☐ AM ☐ PM (where applicable)

Current diagnosis: ☐ Medical cardiac ☐ Medical non-cardiac ☐ Sepsis ☐ Obstetric

Category: ☐ Surgical Cardiac ☐ Surgical non-cardiac ☐ Trauma ☐ Other: .....

Condition when need for compressions/defibrillation was identified? ☐ Pulseless ☐ Pulse (poor perfusion)

Did the patient with a pulse requiring compressions become pulseless? ☐ Yes ☐ No

Conscious at onset? ☐ Yes ☐ No

Monitoring present at onset: ☐ ECG

☐ Pulse oximeter

| Airway/ Ventilation                                                                                                                                                                                                                                                                                                                                                                                        | Circulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Breathing:</b> <input type="checkbox"/> Spontaneous <input type="checkbox"/> Apnoeic<br><input type="checkbox"/> Agonal <input type="checkbox"/> Assisted (on vent)<br><b>Ventilation:</b> <input type="checkbox"/> Bag-Valve-Mask <input type="checkbox"/><br>Endotracheal (ET) Tube <input type="checkbox"/><br>Tracheostomy <input type="checkbox"/> Laryngoscope<br><input type="checkbox"/> Other: | <b>1st Rhythm requiring compressions:</b> <input type="checkbox"/> PEA <input type="checkbox"/><br>Asystole <input type="checkbox"/> VF <input type="checkbox"/> Pulseless VT<br><input type="checkbox"/> Other<br><b>Compressions:</b> <input type="checkbox"/> None <input type="checkbox"/> CPR <input type="checkbox"/> Device<br><b>Time chest compressions started:</b> _____ <input type="checkbox"/><br>AM <input type="checkbox"/> PM<br><br><b>AED Applied:</b> <input type="checkbox"/> Yes <input type="checkbox"/> No<br><br>Time: _____ <input type="checkbox"/> AM <input type="checkbox"/> PM<br><br><b>Pacemaker On:</b> <input type="checkbox"/> Yes <input type="checkbox"/> No |
| <b>Advanced airway:</b><br><input type="checkbox"/> LMA <input type="checkbox"/> ET Tube<br><br><b>Time:</b> _____ <input type="checkbox"/> AM <input type="checkbox"/> PM                                                                                                                                                                                                                                 | <b>Medical Equipment Checklist:</b><br><br>Defibrillator/AED <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Ambubag <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Laryngoscope <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Monitoring equipment <input type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                                                                                                                                                                                                                |
| <b>Size:</b>                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Number of attempts:</b>                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                     |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>Time CPR ended:</b><br><input type="checkbox"/> AM <input type="checkbox"/> PM                                                                                                                         | <b>Reason why CPR ended:</b><br><input type="checkbox"/> Survived – Return of circulation (ROSC) >20min<br><input type="checkbox"/> Died–Efforts Terminated (No Sustained ROSC)<br><input type="checkbox"/> Died – Medical Futility<br><input type="checkbox"/> Died – Advance Directives<br><input type="checkbox"/> Died – Restrictions by Family |  |
| <b>Ventilation:</b> <input type="checkbox"/> Bag-Valve-Mask <input type="checkbox"/> LMA <input type="checkbox"/> Intubated <input type="checkbox"/> Tracheostom<br><input type="checkbox"/> Other: _____ |                                                                                                                                                                                                                                                                                                                                                     |  |
| <b>Family witnessed resuscitation:</b> <input type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                           |                                                                                                                                                                                                                                                                                                                                                     |  |

## Appendix VI: Introduction Letter from KeMU



### KENYA METHODIST UNIVERSITY

P. O. Box 267 Meru - 60200, Kenya

Fax: 254-64-30162

Tel: 254-064-30301/31229/30367/31171

Email: [deanrd@kemu.ac.ke](mailto:deanrd@kemu.ac.ke)

#### DIRECTORATE OF POSTGRADUATE STUDIES

September 29, 2023

Commission Secretary,  
National Commission for Science, Technology and Innovations,  
P.O. Box 30623-00100  
NAIROBI.

Dear Sir/Madam,

RE: EUNICE BEATRICE NJERI TOLE – (REG. NO. HSM-3-2339-1/2011)

This is to confirm that the above named person is a bona fide student of Kenya Methodist University, in the School of Medicine and Health Sciences, Department of Health System Management undertaking a Master's Degree in Health System Management. She is conducting research on: "Determinants of In-hospital Cardiac Arrest for Survival Rates of Adults in Kenya".

We confirm that her research proposal has been presented and approved by the University.

In this regard, we are requesting your office to issue a research license to enable her collect data.

Any assistance accorded to her will be appreciated.

Yours sincerely,



Dr. John M. Mochiri (PhD)

Director, Postgraduate Studies

Cc: Dean SMHS

CoD, HSM

Program Coordinator -HSM

Student Supervisors

## Appendix VII: Ethics Clearance Letter



### KENYA METHODIST UNIVERSITY

P. O. BOX 267 MERU - 60200, KENYA  
TEL: 254-064-30301/31229/30367/31171

FAX: 254-64-30162  
EMAIL: [INFO@KEMU.AC.KE](mailto:INFO@KEMU.AC.KE)

September 29, 2023

KeMU/ISERC/HSM/24/2023

EUNICE BEATRICE NJERI TOLE  
HSM-3-2339-1/2011

Dear Eunice,

**SUBJECT: DETERMINANTS OF IN-HOSPITAL CARDIAC ARREST FOR SURVIVAL RATES OF ADULTS IN KENYA**

This is to inform you that Kenya Methodist University Institutional Scientific Ethics and Review Committee has reviewed and approved your research proposal. Your application approval number is KeMU/ISERC/HSM/24/2023. The approval period is 29<sup>th</sup> September, 2023 – 29<sup>th</sup> September, 2024.

This approval is subject to compliance with the following requirements:-

- I. Only approved documents including (informed consents, study instruments, MTA) will be used.
- II. All changes including (amendments, deviations, and violations) are submitted for review and approval by Kenya Methodist University Institutional Scientific Ethics and Review Committee.
- III. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KeMU ISERC within 72 hours of notification.
- IV. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to KeMU ISERC within 72 hours.
- V. Clearance for export of biological specimens must be obtained from relevant institutions.

VI. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.

VII. Submission of an executive summary report within 90 days upon completion of the study to KeMU ISERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://oris.nacosti.go.ke> and also obtain other clearances needed.



## Appendix VIII: Nacosti Permit

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>REPUBLIC OF KENYA</b>                                                                                                                                                                                                                                                                                                                                                                                           | <br><b>NATIONAL COMMISSION FOR<br/>SCIENCE, TECHNOLOGY &amp; INNOVATION</b> |
| Ref No: <b>119829</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Date of Issue: <b>31/October/2023</b>                                                                                                                          |
| <b>RESEARCH LICENSE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                |
| <p><b>This is to Certify that Miss. EUNICE BEATRICE NJERI TOLE of Kenya Methodist University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Machakos, Muranga, Nairobi on the topic: DETERMINANTS OF IN-HOSPITAL CARDIAC ARREST FOR SURVIVAL RATES OF ADULTS IN KENYA (A Cross-Sectional Study Between Public and Private Facilities in Nairobi, Machakos and Murang'a) for the period ending : 31/October/2024.</b></p> |                                                                                                                                                                |
| License No: <b>NACOSTI/P/23/31032</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                |
| <b>119829</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                           |
| Applicant Identification Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Director General<br><b>NATIONAL COMMISSION FOR<br/>SCIENCE, TECHNOLOGY &amp;<br/>INNOVATION</b>                                                                |
| Verification QR Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                |
| <p><b>NOTE: This is a computer generated License. To verify the authenticity of this document,<br/>Scan the QR Code using QR scanner application.</b></p>                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                |
| See overleaf for conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                |

## Appendix IX: Aga Khan Hospital Approval for Data Collection

Dear Ms Eunice Tole,

The Institutional Scientific and Ethics Review Committee has successfully reviewed and approved your application.  
Kindly submit the CVs and GCP certificates for all the investigators to complete the approval process.

Kind regards,

Research Office Secretariat

## Appendix X: Machakos Level 5 Hospital Approval for Data Collection



**REPUBLIC OF KENYA**  
**COUNTY GOVERNMENT OF MACHAKOS**  
**DEPARTMENT OF HEALTH**  
*Office of the County Director of Medical Services*

Telephone: +254-44-20246  
Fax: 254-44-20655

Machakos Highway  
P.O. Box 2574-90100  
Machakos, Kenya

Ref No. MKS/DHES/RSCH/VOLI/380

10/11/2023

Dear Eunice Tole,

**RE: LETTER OF AUTHORIZATION FOR CONDUCTING PROPOSED RESEARCH**

The Department of Health, Machakos County is keen to collaborate in your study titled,  
“**DETERMINANTS OF IN-HOSPITAL CARDIAC ARREST FOR SURVIVAL RATES OF ADULTS IN KENYA (A Cross-Sectional Study Between Public and Private Facilities in Machakos).**”

Note is taken of the letter of Ethical Clearance from KEMU ISERC, REF: **KeMU/ISERC/HSM/24/2023** for the approval period **29<sup>th</sup> September 2023 to 29<sup>th</sup> September 2024** as well as the Research License from the National Commission for Science, Technology & Innovation number **NACOSTI/P/23/31032** for the period ending **31<sup>st</sup> October 2024**.

You are hereby authorized to proceed with the research in Machakos County and urged to share the findings with the Department of Health and Emergency Services; Machakos County, through this Email: [research.dhes@gmail.com](mailto:research.dhes@gmail.com)

Sincerely,

  *Dr. Sharon Mweni, County Epidemiologist*  
Dr. Sharon Mweni  
County Research Coordinator  
Deputy- Director Medical Services  
**Machakos County**

CC:  
County Executive Committee Member – Health  
Chief Officer – Medical Services & Public health  
Medical Superintendent, Machakos Level 5  
County Research Committee

## Appendix XI: Murang'a Level 5 Hospital Approval for Data Collection

Eunice Beatrice Njeri Tole  
Email: eunice.tole@gmail.com,  
P.O Box 45240-00100,  
Nairobi-Kenya.

To: CEO  
Murang'a Level 5 Hospital,  
P. O. Box 69-10200,  
Murang'a- Kenya.

6/11/2023



### RE: AUTHORIZATION TO CONDUCT A STUDY IN YOUR HOSPITAL

I am a student pursuing degree of master in health systems management of Kenya Methodist University. Am conducting a study on the to the determinants of in-hospital cardiac arrest for survival rates of adults in Kenya, which is part of my academic requirement. Therefore, am requesting your office to authorize and allow me to conduct the study. The study has sampled medical doctors and nurses preferably in medical surgical wards such as cardiology, anesthesiology, emergency and Critical Care Units [CCU] to participate as respondents.

The study will interview doctors, administer questionnaires to nurses and also collect secondary data from medical reports related to CPR operations from August 2022 to August 2023. I have attached the questionnaires, interview guide and secondary data collection forms to this letter for your review.

Please note that the responses gathered will only be used for academic purposes. Thank you for your consideration towards my request.

Yours faithfully,

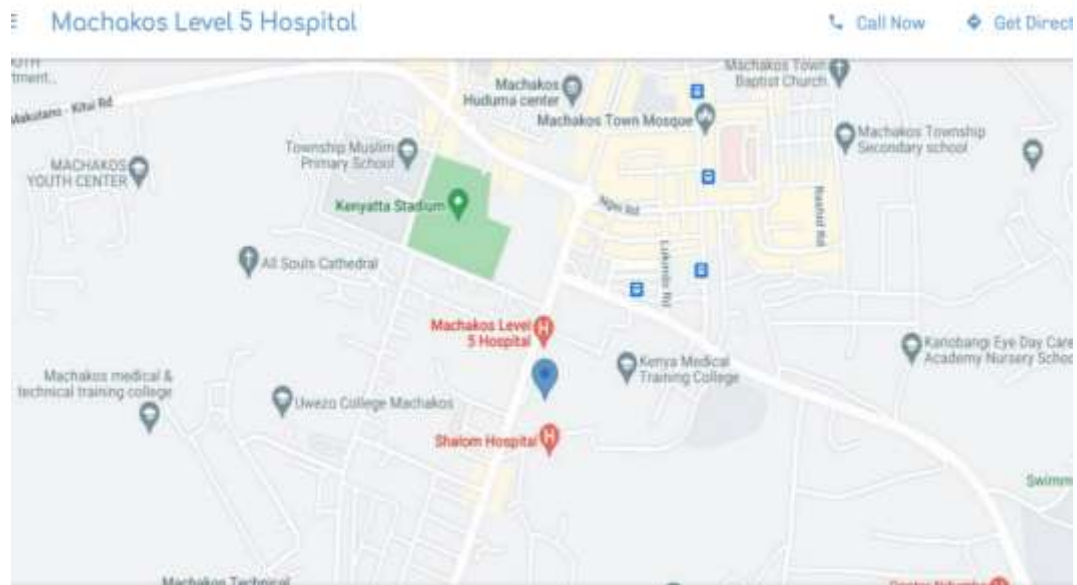
Eunice Beatrice Njeri Tole  
Mobile no: 0799261559  
Reg no: HSM-3-2339-1/2011

## Appendix XII: LUCAS™ Chest Compression System





## Appendix XIV: Location of Machakos Level five Hospital



## Appendix XV: Location of Muranga Level 5 Hospitals

