



St. Paul's Hospital Millennium Medical College Graduate Study Program

ASSESSMENT OF SURVIVAL RATE OF IN HOSPITAL CARDIAC ARREST AND ITS ASSOCIATED
FACTORS AMONG PATIENTS ADMITTED TO EMERGENCY DEPARTMENT OF SELECTED
HOSPITAL, ADDIS ABABA, ETHIOPIA

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A thesis report to be submitted to Department of Emergency Medicine and Critical Care;
Presented in Partial fulfillment of the Requirements for the Degree of Specialty in Emergency
Medicine and Critical Care; St. Paul's Hospital Millennium Medical College

Addis Ababa, Ethiopia

December, 2023

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Full title of the research project	Assessment of survival rate of in hospital cardiac arrest and its associated factors among patients admitted to the emergency department of SPHMMC, Addis Ababa, Ethiopia
Duration of the project	March, 2022- Dec, 2023
Study Area	SPHMMC
Total Cost of the project	22, 183 ETB
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ACKNOWLEDGMENT

First ,I would like to thank to my advisors Ashenafi Jemal (M.D., EMCC specialist) and Etsegenet Aklog(M.D., EMCC specialist) for their support and guidance in this research project, as well as study participants, SPMMC & every single person who has helped me in any way during this process.

Abstract

Background:

As defined by the American Heart Association and the American College of Cardiology cardiac arrest is the sudden cessation of cardiac activity so that the victim becomes unresponsive, with no normal breathing and no signs of circulation.

Cardiac arrest is typically classified as either out-of-hospital or in-hospital cardiac arrest. According to the Utstein criteria, a cardiac arrest is classified as 'in-hospital' if it occurs in a hospitalized patient who had a pulse at the time of admission. Although evidence from out-of-hospital cardiac arrest is frequently extrapolated to in-hospital cardiac arrest, the epidemiology is different, and success determinants may differ accordingly & data on IHCA incidence and survival are scarce.

Objectives: To assess the survival rate of in hospital cardiac arrest and its associated factors among patient admitted to Emergency department in SPHMMC, Addis Ababa, Ethiopia; 2023

Methods: A hospital based cross sectional study was conducted to assess survival rate of in-hospital cardiac arrest among patients admitted to emergency department of Saint Paul's hospital millennium medical college. Data were collected using a structured questionnaire from the participant's medical records ; coded, transferred and analyzed in descriptive and analytical software ; SPSS Version-25. Both bivariate and multivariable logistic regression models were used. P-value < 0.05 was considered as statistically significant association.

Results: The immediate survival rate after CPR was 46.5%. Respiratory failure and hypotension were the most common cause cardiac arrest(25.12% and 21%) respectively. Having respiratory failure as cause of arrest (AOR: 15.04; 95%CI: 2.34,95.13), ECG monitoring (AOR: 4.94;95% CI: 1.59,15.39), initial rhythm of Ventricular fibrillation and Pulse less v.tachycardia (AOR: 37.93;95% CI: 2.20,655.58 and AOR: 25.64; 95% CI: 5.08,129.47) respectively and Delivery of electric shock during CPR (AOR: 12.09; 95% CI: 4.15,35.21) were statistically significant in multivariable analysis, while majority of patients with sepsis as the cause of admission were less likely to survive as compared with those who had no sepsis during admission(AOR:0.05; 95%CI: .01,.68).

Conclusion and recommendations: The immediate survival rate of IHCA was 46.5%. ECG monitor, respiratory failure, initial rhythm of Ventricular fibrillation and Pulse less v.tachycardia, electric shock during CPR, were the independent factors associated with survival rate of patients with IHCA. Patients with sepsis as the cause of admission should trace the essential treatment modalities to minimize the risk of mortality. Structured and standardized resuscitation registration and checklist format should adopted and practiced not only in ED but also in all area of care and the study will used as entry to do it with multicenter bases and in different area of care

Keywords: In hospital cardiac arrest, Emergency Department, Ethiopia

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ACRONYM AND ABBREVIATIONS

AaBET: Addis Ababa burn emergency and trauma

ACLS: Advance Life support

CPR: Cardio pulmonary resuscitation

ED: Emergency Department

ETB: Ethiopian Birr

GWTG-R: Get With The Guidelines- Resuscitation

HCW: Health Care Worker

HICs: High income countries

IHCA: In hospital cardiac arrest

LICs”: Low-income countries

MICs: Middle income countries

NCD: Non-Communicable Disease

NGO: Non- Governmental Organization

OHCA: Out of hospital cardiac arrest

ROSC: Return of spontaneous circulation

SPHMMC: Saint Paul's hospital millennium medical college

STEMI: ST- Segment elevation Myocardial Infraction

UN: United nation

WHO: World Health Organization

1. INTRODUCTION

1.1. Background

As defined by the American Heart Association and the American College of Cardiology cardiac arrest is the sudden cessation of cardiac activity so that the victim becomes unresponsive, with no normal breathing and no signs of circulation(1).

Cardiac arrest is typically classified as either out-of-hospital or in-hospital cardiac arrest. According to the Utstein criteria, a cardiac arrest is classified as 'in-hospital' if it occurs in a hospitalized patient who had a pulse at the time of admission(2,3). Although evidence from out-of-hospital cardiac arrest is frequently extrapolated to IHCA, the epidemiology is different, and success determinants may differ accordingly & data on IHCA incidence and survival are scarce(3).

The global incidence of IHCA in adults has not been well described, but can be calculated either as the number of events per hospital beds per year or as the number of events per number of patient admissions. The first approach gives an estimate of the number of the expected events in a single institution, while the second method takes into account the patients' turnover. Based on GWTG-R data from 2003 to 2007, the estimated incidence of IHCA in the United States was 211 000 annually, or roughly 6 to 7 cardiac arrests per 1000 admissions. Data from 2008 to 2017 showed the incidence increased to 292 000 annually, or 9 to 10 IHCA per 1000 admissions. In contrast, an incidence of 1.6 IHCA per 1000 admissions in the United Kingdom from 2011-2013 was estimated using data from the UK National Cardiac Arrest Audit(1,2).

Based on data from the GWTG-R registry, the mean age of patients with IHCA in the United States is 66 years, 58% are men, and the presenting rhythm is most often (81%) non-shockable.

Approximately half of IHCA occur in wards, the half occurring in intensive care units and operating rooms(1).

Survival from IHCA can be expressed in relation to time as: 'immediate' (ROSC), 'short-term' (discharged alive from the hospital), and 'long-term' (6–12 months). ROSC represents mainly a success of the CPR maneuvers. Unfortunately, between 25% and 67% of the successfully resuscitated patients die during the first 24 h after ROSC. In a review from 2007, survival varied from 0% to 42% between studies, although most large studies reported survival around 20%. Survival has been increasing over the last 2 decades and, in 2017, survival to hospital discharge was 25% in the GWTG-R registry. Data from 2011 to 2013 indicate 18% survival to hospital discharge in UK(1,2).

Clinical deterioration is common prior to IHCA, and many IHCA are considered preventable or avoidable on retrospective review. Prevention has therefore been added as the first link in the Chain of Survival for IHCA. Key elements of success include identification of at-risk patients. Contrary to the out-of-hospital setting, IHCA facilitates observation of a patient's clinical condition prior to cardiac arrest. Chest compressions, ventilation, early defibrillation, and immediate attention to potentially reversible causes, such as hyperkalemia or hypoxia, are critical components of treatment during cardiac arrest. Although multiple individual factors are associated with outcomes (e.g., age, initial rhythm, duration of the cardiac arrest), a multifaceted approach that takes into account both the potential for neurological recovery and ongoing multiorgan failure is required for prognosis and clinical decision-making in the post-cardiac arrest period(1,3).

Successful IHCA resuscitations are based on data extrapolated either from OHCA or IHCA studies conducted in HICs, for which evidence in the local clinical setting is limited. Compared to HICs, LMICs such as Ethiopia have less expertise and resources to effectively manage IHCA(4).

A better understanding of the factors associated with successful resuscitation of IHCA patients was required. This information will be used in the development of a predictive model that used in clinical decision making during IHCA and after ROSC. As a result, we conducted a cross-sectional study and the associated factor of in-hospital cardiac arrest survival.

1.2. Statement of the problem

From 2008 to 2017, the American Heart Association's GWTG-R registry reported, 9 to 10 IHCA cases per 1,000 admissions. Of this 12% occurred in ED, and the value is much higher in LMICs. The mortality rate for IHCA is 5.1% higher in Sub-Saharan Africa, particularly in the central, east; such as Ethiopia, and west, than in HIC(1,5). This was because of the risks associated with hospital care and management time, residency requirements, a lack of or insufficiency of medical staff and equipment, and a slow flow of patients to other departments (for final treatment). The burden of ED mortality is also increased by a lack of prehospital emergency medical care and inadequate BLS and ATLS training for clinical staff, which exacerbates illnesses and cardiac arrest outcomes and may be fatal(6).

Survival after IHCA is higher in HICs, as recently reported, whereas in some developing countries, such as Uganda. The survival rate from IHCA is lower, with a significant reason being that before being trained, nurses had insufficient knowledge and skills in CPR(5).

Even though the problem is a huge burden for the community, the health system, and the country in general, evidence in LICs specifically in Ethiopia lacks adequate data and this has made it difficult for policy-makers to make major new investments in emergency care.

Therefore, this study aimed to determine the survival rate of IHCA, to identify and to characterize its associated factors among patients admitted in the ED of SPHMMC from March 2022 to dec, 2023, Ethiopia.

1.3. Rational of the Study

According to WHO, the majority of ED-related deaths are caused by cardiac arrest from a variety of causes and the burden of cardiac arrest is much higher in developing countries due to additional risks associated with hospital care and management system. ED mortality from cardiac arrest causes in Ethiopian hospitals is largely unknown. But the causes are thought to be multifactorial, including a significant burden of trauma and diseases, as well as limited access to quality resources, including a shortage of skilled health care providers(7).

As researchers search it appears there significant gap in the existing knowledge concerning IHCA particularly in ED. As such; the research can be used as an input more compressive study of the survival patients after IHCA in ED and will give valuable insight into the status of emergency care and helps to identify contributing factors to patient outcome. This can help to guide future interventions at the research facility that can be extrapolated to other facilities as well.

2. Literature Review

cardiac arrest is the sudden cessation of cardiac activity so that the victim becomes unresponsive, with no normal breathing and no signs of circulation. It is typically classified as either out-of-hospital or in-hospital cardiac arrest. According to the Utstein criteria, a cardiac arrest is classified as 'in-hospital' if it occurs in a hospitalized patient who had a pulse at the time of admission(2,3). Although evidence from out-of-hospital cardiac arrest is frequently extrapolated to IHCA, the epidemiology is different, and success determinants may differ accordingly & data on IHCA incidence and survival are scarce(3).

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2.1. Assessment of survival rate of IHCA

Survival after IHCA depends on 2 distinct phases: 1) Responsiveness and quality of the hospital code team (i.e., acute resuscitation phase) and intensive and specialty care expertise (i.e., post resuscitation phase). Understanding the association of these 2-phases with overall survival has implications for design of IHCA quality measures. Hospitals that excel in overall IHCA survival excel in either acute or post-resuscitation care, but not both; strengthening post-resuscitation care may have additional benefits, according to an observational cohort study named Association of Hospital-Level Acute Resuscitation and Post Resuscitation Survival for IHCA, which was carried out in US in 2023(8).

The other determinant factors are patient base line characteristics like; male sex, age 60 or older, active malignancy, and a history of chronic kidney disease were found to be prearrest factors associated with a lower risk of survival after IHCA in a systematic review and meta-analysis study titled Prearrest and intraarrest prognostic factors associated with survival after IHCA. Similarly; Increased age is associated with decreased survival following cardiac arrest in most studies, especially for patients older than 70 years. The prognosis after IHCA is significantly correlated with

the existence of prior medical and surgical conditions. Examples of significant predictors of poor survival include malignancy, sepsis, pneumonia, hypotension, poor functional status prior to cardiac arrest, renal dysfunction, and hepatic dysfunction(1,9).

On the other hand, compared to cardiac arrest that is not brought on by myocardial infarction, acute myocardial infarction that results in IHCA is linked to a higher survival rate. Better results are linked to early detection of cardiac arrest factors, such as the event happening in a monitored location or being witnessed. However, because patients in different locations have different case mixes, the relationship between monitoring/location and outcomes is complicated. In the review of 23 cohort studies shows greater likelihood of survival was linked to witnessed arrest, monitored arrest, arrest during the day(1,9).

The length of the cardiac arrest and the presenting rhythm are two of the variables most closely linked to the outcome when evaluating the acute resuscitation phase. Compared to patients with a non-shock able rhythm, those with a shock able rhythm have a two to three times higher survival rate until hospital discharge. While there is a chance that the shock able group received more effective treatment (defibrillation), this difference may also be partially explained by variations in patient characteristics and underlying medical conditions, which may have an impact on the presenting rhythm. The longer CPR is administered, the lower the 30-day survival rate is. Intubation during arrest and resuscitation lasting at least 15 minutes was linked to a lower chance of survival(1,9).

Three primary conclusions emerge from a retrospective study on the location of IHCA in the US using GWTG-R data: (1) When comparing events in the ICU versus inpatient wards, there are differences in the patient and hospital characteristics of IHCA. (2) Compared to inpatient wards, IHCA is more prevalent in the ICU. (3) The inpatient monitored ward has a higher rate of IHCA survival than the intensive care unit (ICU), while the unmonitored ward has the lowest rate of IHCA

survival. systematic review and meta-analysis titled One-year survival after IHCA found that the pooled one-year survival after IHCA was 13.4%. A subgroup analysis of cardiac patients revealed a one-year survival rate of 39.3%. Patients admitted to cardiac wards have a better chance of survival. The study concluded that IHCA population characteristics may reveal the issue of heterogeneity and stagnant survival over the past decades(10).

Data supporting the efficacy of medications during IHCA are sparse. Current guidelines recommend the use of epinephrine and amiodarone, both of which improve short-term outcomes in OHCA, but there is limited evidence supporting substantial neurological improvement when these medications are used(1).

A retrospective multi-center study conducted in Taiwan that included 14 regional hospitals, two district hospitals, and five medical centers between June and December 2018 under the title of the potential risk factor for mortality in patients after IHCA found that the odds ratio for mortality was higher in older patients, those treated with ventilators, and those treated with vasoactive agents. In contrast, better survival was reported in IHCA patients with initial rhythms of ventricular tachycardia and ventricular fibrillation. There was no difference in mortality between nursing shifts in the ER subgroups(11).

A study titled Survival and Factors Associated with Survival with Extracorporeal Life Support During Cardiac Arrest found that among the 81 studies included, involving 9256 patients, survival was 26.2% at discharge and 20.4% with a good neurologic outcome. After adjusting for age, intrahospital CA, and mean CPR duration, the only remaining factor associated with survival to discharge was an initial shockable rhythm(12).

Factors associated with survival in adult patients with traumatic arrest: a retrospective cohort analysis from a US trauma center indicates only 11.1% of patients with traumatic arrests survive to

be discharged from the hospital. The majority of patients were white (55.1%) and male (77.8%). Most injuries were penetrating (39.3%) or blunt (56.7%). Factors linked to lower survival include age group 65, male gender, self-inflicted and other or unknown forms of injuries, head and neck injuries, torso and ISS-16 injuries, and emergency department thoracotomy. The results have significance for formulating measures to prevent injuries and directing protocols for trauma management to enhance the results of traumatic arrests(13).

Factors Associated with IHCA Survival in a Referral Level Hospital in Uganda, a descriptive study carried out in 2022 at Mbarara Regional Referral Hospital in Southwestern Uganda, shows Eight months passed, and 74 individuals were enrolled. Survival over seven days was 14.86%.

Resuscitated CA patients at Mbarara Regional Referral Hospital (MRRH) had a poor 7-day survival rate, but those who made it out had good neurologic outcomes. Survival seemed to be correlated with CA in the OR, CPR for 20 minutes, and preventing post-arrest hypotension(4).

There are extremely few excellent assessments of training programs designed to enhance the early detection of patients at risk of arrest. The Acute Life-Threatening Events Recognition and Treatment and Immediate Life Support courses are more promising educational interventions, but thorough assessments of their effectiveness are still lacking. Acute Life-Threatening Events Recognition and Treatment course participants may make more prearrest calls, have fewer IHCAs, and have a higher survival-to-discharge rate following IHCA, according to a long-term multicenter study. A needs-based 1-day course's before-and-after comparison did not reveal any differences, but only 67% of the nursing staff received training(14).

2.2. Conceptual framework

The study was center on this perceived conceptual framework in the factors affecting survival rate of IHCA among those admitted in ED, which are sociodemographic factors (Gender, Age, and co morbidities), Clinical characteristics factors (Reason for hospital admission, causes of IHCA,

Treatment or procedure before ACLS, Types of initial rhythm, ACLS item types and Duration of CPR) and health care professional related factors (Health care profession Shifting hour and working day). This conceptual frame work adapted from a recent African literature and modified accordingly to fit this study.

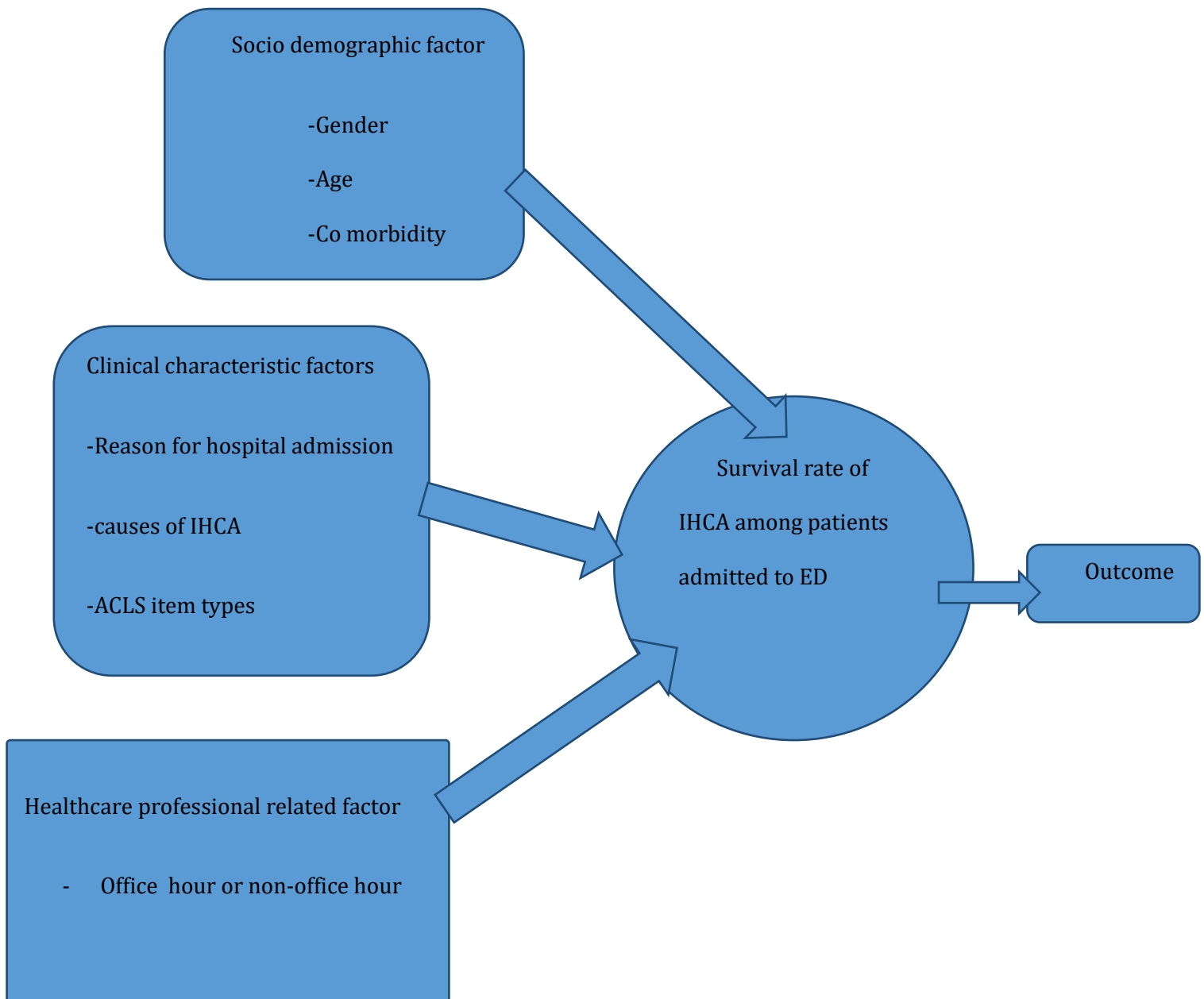


Figure 1: Conceptual framework of Factors that affect survival rate of IHCA.

3. Objectives

3.1. General Objectives

The primary objective of this study is to determine survival rate and its associated factors IHCA in patients admitted to ED of SPHMMC form March, 2022 to Dec, 2023.

3.2. Specific Objectives

1. To determine the immediate survival rate of IHCA among patients admitted to ED of SPHMMC, Addis Ababa, Ethiopia form March, 2022 to Dec, 2023.
2. To identify factors associated with acute resuscitation survival of IHCA among patients admitted to ED of SPHMMC, Addis Ababa, Ethiopia form March, 2022 to Dec, 2023.
3. To identify commonest cause of IHCA in given study period

4. Methods and Materials

4.1. Study area

The study was conducted in Saint Paul's Hospital Millennium Medical College and Addis Ababa Burn and emergency and trauma hospital (AaBET Hospital).

St. Paul millennium medical college was established through a decree of the council of Ministers in 2010, although the medical school opened in 2007 and the hospital was established in 1968 by the late Emperor Haile Selassie. It's governed by a board under the Federal Ministry of Health. The college-initiated Ethiopia's first integrated modular and hybrid problem-based curriculum for its undergraduate medical education and diversifying post graduates' programs. The college has more than 2800 clinical, academic and administrative and support staffs that provide medical specialty service to patients who are referred from all over the country. The inpatient capacity is more than 700 beds and an average of 600 emergency and outpatient clients are seen daily in the hospital(15).

Adiss ababa Burn Emergency and Trauma (AaBET Hospital) is a major trauma center in Addis Ababa, Ethiopia. It was established in 2015 as part of St. Paul millennium medical college. AaBET currently provide health care service in specialties namely; orthopedics, neurosurgery, plastic and reconstructive surgery and emergency and critical care. AaBET hospital has approximately 20-30,000 emergency visits to the hospital and provides an emergency and outpatient services and elective and emergency surgeries of the respective departments(16).

4.2. Study period

The study was conducted from March, 2022 to December 2023 G.C.

4.3. Study design

A hospital based cross-sectional study was conducted to assess the immediate survival rate of IHCA and its associated factors in patients admitted at ED, SPHMMC, Addis Ababa, Ethiopia.

4.4. Study population

4.4.1. **Source population:** All patients admitted in ED of SPHMMC and AaBET Hospital and develops cardiac arrest and CPR was tried from March, 2022 to Dec, 2023.

4.4.2. **Study population:** Source population who fulfill the inclusion criteria.

4.5. Eligibility: Inclusion and Exclusion Criteria

4.5.1. Inclusion Criteria:

All In hospital cardiac arrest in which CPR was initiated

In hospital arrest (admitted to ED with palpable central pulse)

Age above 18 years old

4.5.2. Exclusion Criteria:

Out of hospital cardiac arrest

Patient with incomplete medical record

In hospital Cardiac arrest other than emergency department

4.6. Sample size determination

A total of 521 patients had IHCA from both hospitals; i.e. 357 patients from SPHMMC and 164 patients from AaBET hospital during study period of 20 months (March, 2022 to December, 2023),

4.6.1. Sampling Technique

Saint Paul's millennium medical college and its affiliate Addis Ababa Burn Emergency and trauma hospital was selected by observation as study area.

Table 1: The sample size

Areas of study	Total number of patients who developed in hospital cardiac arrest
SPHMMC Hospital	357
AaBET Hospital	164
Total	521

4.7. Measurement

4.7.1. Study variables

4.7.1.1. Dependent Variable

Immediate survival rate

4.7.1.2. Independent Variables

Sociodemographic factors (Gender, Age, Co morbidities)

Clinical characteristics factors (admission category, Reason for hospital admission, causes of IHCA, ACLS item types, treatment or procedure before and during ACLS, initial arrest rhythm, duration of CPR)

Health care professional related factor (timing of IHCA)

4.8. Instruments

Data was collected through chart review using a structured questionnaire, which was developed after thoroughly reviewing previously relevant literatures and modified after intensive literature reviews and development of conceptual framework used to collect the data. Data was collected from Hospital data registries like; ED registry books, CPR registry and from patient's medical record.

4.9. Data collection and Procedure

Data was collected through chart review from Hospital data registries and from patient medical record in SPHMMC and AaBET hospital. A data abstraction sheet Questioner was consist of a total of 12 questions which contain part I: Patient demographic variables contain 3 questions. Part II: contain patient clinical characteristics questions (8 questions), part III: health care professional factors (1 question). About 124 patients (42 from AaBET and 82 from SPHMMC ED) had data collected prospectively in the last 13 months. 397 patients having IHCA as sorted their MRN from ED registry and CPR registry books and after review of their medical record ; 306 patients did not met inclusion. The rest of 91 patients were enrolled into the study.

4.10. Operational Definition

In hospital Cardiac arrest: A cardiac arrest in the patient after he/she triaged & admitted to the ED with palpable central pulse and CPR was tried.

Return of spontaneous circulation (ROSC): specifically defined as restoration of pulse for at least 20 min after CPR.

Survival rate :- The number of patients with ROSC for at least 20 minutes divided by the number of patients with a cardiac arrest and treated for cardiac arrest

Acute resuscitation survival :- Defined as ROSC for at least 20 minutes

post resuscitation survival: - Defined as survival from ROSC to hospital discharge

Office hour: The time which takes place during daytime hours, from 8 am to 5 pm

Non- office hour: The time which take place at night time shift from 5 pm to 8 am & from Friday evening through Sunday evening Including holidays

Health care professionals: Who belongs to one health related professional. This includes doctors, nurses, Interns, residents, specialist

4.11. Data Quality Control and Management

To ensure the validity and reliability of the data collection tool, pre-test was done on 5% of the total sample size 1 month after data collection and the questionnaire was checked for its clarity, understandability and simplicity. The researcher was responsible monitoring the data collection process. The filled questionnaire was checked for its completeness to assure the quality of data and the investigator was responsible for supportive supervision on the spot and on reviewing all filled questionnaires.

4.12. Data Analysis and Procedures

After the data was in hand it was entered into EPI-INFO. Random checking was done to verify the validity of the entered data. Frequencies and percentage was obtained from each variable and displayed on the table or graphs. The strength of association between variables was determined using odds ratio, with 95% confidence interval. P-values of 0.05 or lower were taken to declare that

there is association. Multinomial regression was used to indicate how significantly factors associated with dependent variable.

4.13. Ethical Consideration

written legal ethical clearance regarding the study was obtained from St. Paul's Hospital Millennium Medical College IRB. The data was used only for the intended purpose of the study.

4.14. Dissemination of the result

After being completed, the research paper will submit to SPHMMC and AaBET hospitals. If possible, the findings will be presented in different seminars and workshops and may be published in scientific journals.

5. Results

5.1. Socio demographic characteristics

Out of 521 patients experienced IHCA as identified their MRN from ED registry and CPR registry books and after review of their medical records; 306 patients did not met inclusion criteria. Therefore the study was conducted with a total of 215 study participants.

The minimum and maximum age of the study participants was 18 years old and 79 years old respectively with the an average of 50.70 years. More than half (110, 51.20%) of the participants had age lower than the average age (50.7 years). The majority of patients were (58.6%) were males.

Table 2: Socio demographic characteristics of patients with IHCA in ED of SPHMMC Addis Ababa, Ethiopia; 2023

Variables	Category	Frequency (n)	Percentage (%)
Age (in years)	<50 yrs	90	41.9
	50-59 yrs	29	13.5
	60-69 yrs	66	30.7
	70-79 yrs	30	14.0
Sex	Male	126	58.6
	Female	89	41.4
Total		215	100.0

5.2. Co morbidity and related characteristics

Hypertension was co morbidity in 31.2% of participants. Similarly, 40(18.6%) of the respondents have diabetes mellitus. In addition, 27(12.6%), 42(19.5%) and 25(11.6%) of the patients have hyperlipidemia, cardiac diseases and renal disease respectively.

Table 3: Co morbidity and related characteristics of IHCA at Emergency department of SPHMMC, Addis Ababa, Ethiopia; 2023

Variables	Category	Frequency (n)	Percentage (%)
Hypertension	Yes	67	31.2
	No	148	68.8
Diabetes Mellitus	Yes	40	18.6
	No	175	81.4
Hyperlipidemia	Yes	27	12.6
	No	188	87.48
Cardiac diseases	Yes	42	19.5
	No	173	80.5
Renal diseases	Yes	25	11.6
	No	190	88.4
Total		215	100.0

5.3. Admission and related characteristics

In considering the admission category, 125(58.1%), 37(17.2%) and 53(24.7%) of the study participants were categorized under, red, orange and yellow or green respectively. Among causes of IHCA: respiratory failure and hypotension are the common cause of arrest, 54(25.1%), 47(21.9%) respectively followed by fatal arrhythmia, metabolic disturbance and MI accounted 42(19.5%), 36(16.7%) and 24(11.2%) respectively. Trauma as the cause cardiac arrest accounted the least common, 12(5.6%). Regarding causes of admission cardiovascular (arrhythmias, heart failure and MI) is commonest reason of admission, 46(21.4%) followed by trauma, neurologic disease and respiratory failure; 36(16.7%), 30(14%) and 30(14%) respectively. Whereas admission caused by gastrointestinal problems is the least common, 12(5.6%).

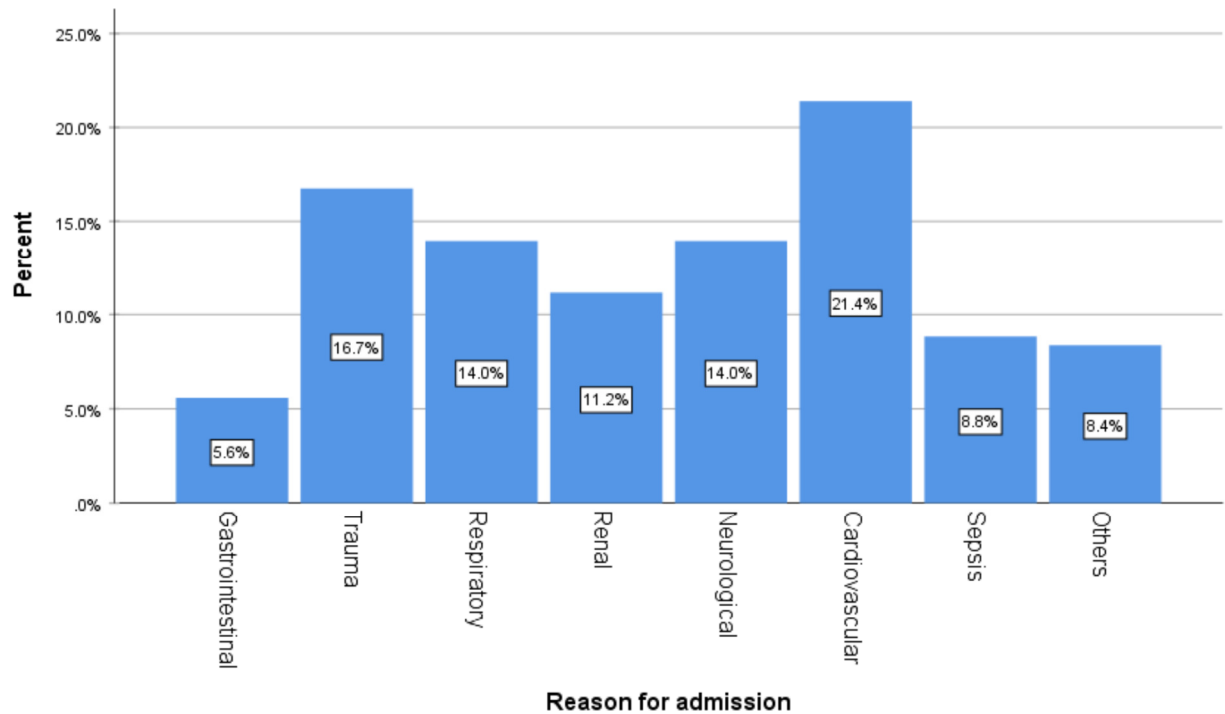


Figure 2: Causes of admission among IHCA at Emergency department of SPHMMC, Addis Ababa, Ethiopia; 2023

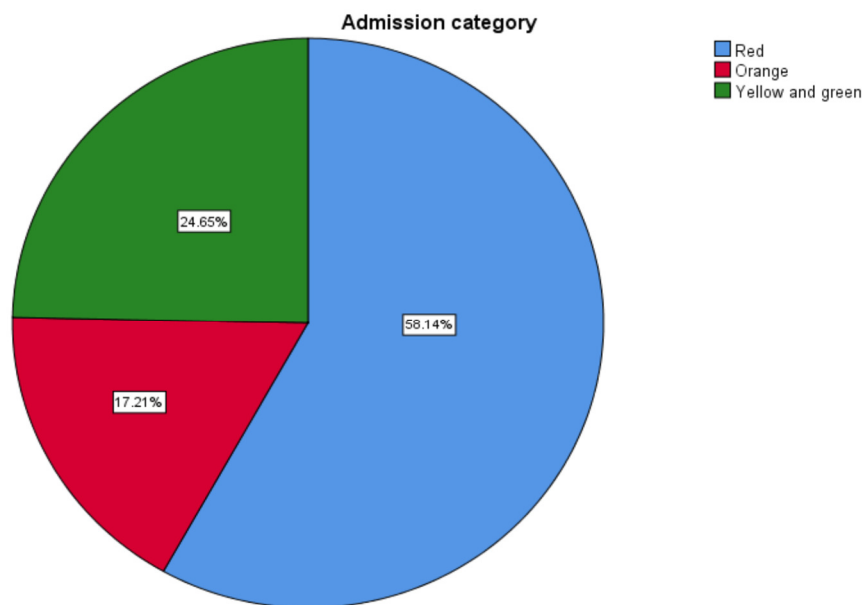


Figure 3: Admission category among patients with IHCA at Emergency department of SPHMMC, Addis Ababa, Ethiopia; 2023

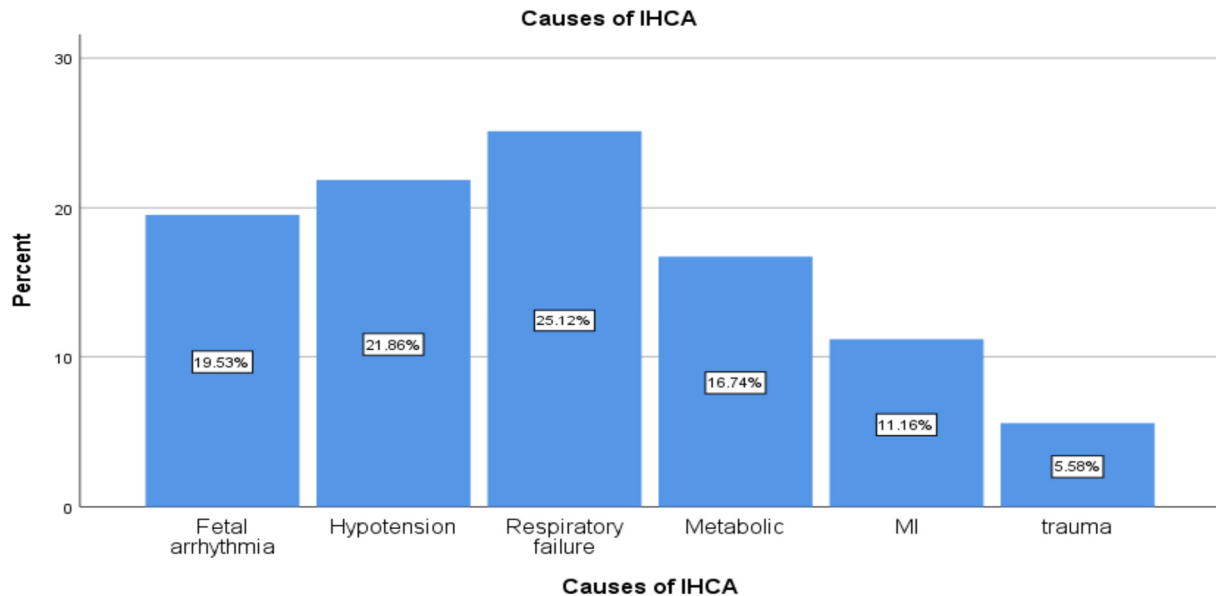


Figure 4: Cause of IHCA at Emergency department of SPHMMC, Addis Ababa, Ethiopia; 2023

5.4. Treatment and related characteristics

In considering the treatment during resuscitation all patients provided vaso active agent (adrenaline) and chest compression but did not mentioned during which cycle the medication was given. Air way management, provision of electrical discharge, provision of IV medications, ECG monitor, provision of ventilator, initial arrest rhythm, duration of CPR and timing of arrest were assessed. Almost half of arrested patients received advanced airway management (48.4%). Similarly, electrical discharge, ECG monitor and ventilator was provided for 60(27%), 130(60.5%) and 30(14%) respectively. Majority of detected initial rhythm was non-shock able (PEA and asystole), 71(33%) and 80(39.1%) respectively; whereas more than one fourth were shock able (Ventricular fibrillation and Ventricular tachycardia) 30(14%) each; in which all were shocked. But

the number of minute lapsed between detection of rhythm and shock delivery was not mentioned. More than half of patient were arrested during non-office hour, 111(51.6%) and majority of patients were resuscitated for more than 10 minutes of which; one fourth had received prolonged CPR. During resuscitation 48(23.7%) of patients were given IV fluid and 18(8.4%), 12(5.6%), 12(5.6%), 7(2.8%) and 7(2.8%) of patients were given calcium gluconate, magnesium, bicarbonate, amiodarone and glucose respectively. Nearly half of resuscitated patients did not receive any medication during CPR, 107(49%).

Table 4: Treatment and related characteristics of patients with IHCA at Emergency department of SPHMMC, Addis Ababa, Ethiopia; 2023

Variables	Category	Frequency (n)	Percentage (%)
Air way management	Yes	104	48.4
	No	111	51.6
Electrical discharge given	Yes	60	27.9
	No	155	72.1
ECG monitor	Yes	130	60.5
	No	85	39.5
Received ventilator	Yes	30	14.0
	No	185	86.0
Timing of arrest	Office hour	104	48.4
	Non-office hour	111	51.6
Initial rhythm	Ventricular fibrillation	30	14.0
	Ventricular tachycardia	30	14.0
	Acystole	84	39.1
	Pulse less electrical activity	71	33.0
Duration of CPR	<5 minutes	18	8.4
	5-9 minutes	18	8.4
	10-14 minutes	67	31.2
	15-29 minutes	58	27.0
	>29 minutes	54	25.1
Total		215	100

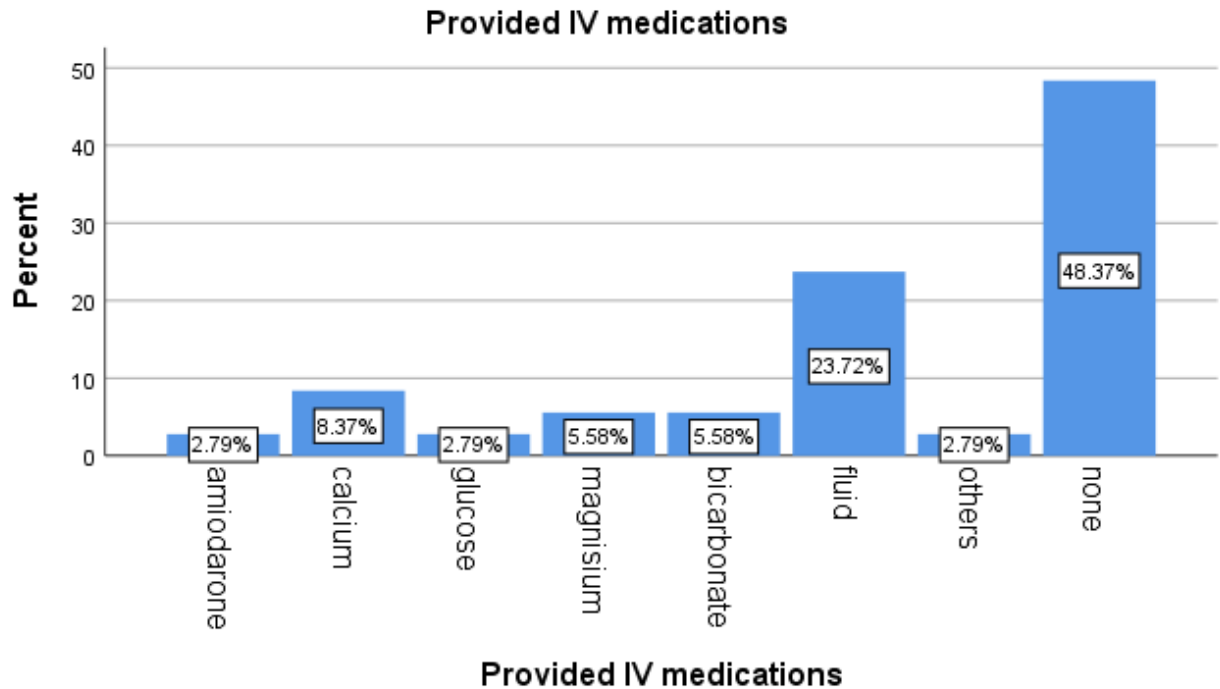


Figure 5: Provided IV medication among patients with IHCA at Emergency department of SPHMMC, Addis Ababa, Ethiopia; 2023

5.5. Immediate Survival rate of IHCA

In this study, 100(46.5%) among 215 patients with IHCA were survived immediately after CPR. Therefore, the immediate survival rate among IHCA was 46.5% (95%CI: 7.4, 13.3).

5.6. Factors associated with survival rate

The odd of the likelihood of survival among IHCA, who have male gender was 2.20 times higher as compared with the female counter parts(AOR: 2.20; 95%CI: 1.06,2.89). Patients who had been sepsis as the cause of admission were less likely to survive as compared with those who have no (AOR:0.05; 95%CI: .01,.68). In addition survival after cardiac arrest was fifteen folds better among patients having respiratory failure as cause of arrest compared with the other causes (AOR: 15.04; 95%CI: 2.34,95.13). patient who had been ECG monitor almost five times higher in chance survival

as compared to those who did not have ECG monitor (AOR: 4.94;95% CI: 1.59,15.39). Patients having initial rhythm of Ventricular fibrillation and Pulse less v.tachycardia have better chance of survival than asystole or PEA (AOR: 37.93;95% CI: 2.20,655.58 and AOR: 25.64; 95% CI: 5.08,129.47) respectively. Similarly among cares given during resuscitation, delivery of electric shock during CPR helps to improve chance of survival twelve folds compared to resuscitation without shock delivery (AOR: 12.09; 95% CI: 4.15, 35.21).

Table 5: Factors associated with survival among patients with IHCA at Emergency department of SPHMMC, Addis Ababa, Ethiopia; 2023

Variables	Category	Patient status		COR (95%CI)	AOR (95%CI)
		Survived	Died		
Age category	<50 yrs	47	43	1.89(.81-4.42)*	
	50-59 yrs	18	11	2.83(.98-8.12)*	
	60-69 yrs	24	42	.99(.40-2.42)	
	70-79 yrs	11	19	1	
Sex	Male	69	57	2.27(1.30-3.96)*	2.20(1.06,2.89)**
	Female	31	58	1	1
Having cardiac diseases	Yes	24	18	1.51(.77-2.97)*	
	No	76	97	1	
Admission category	Red	70	55	2.48(1.27-4.83)*	
	Orange	12	25	.93(.38-2.28)	
	Yellow & green	18	35	1	
Cause of admission	Gastrointestinal	6	6	1.57(.36,6.88)	
	Trauma	14	22	1.00(.31,3.19)	
	Respiratory	21	9	3.67(1.10,12.52)*	
	Renal	11	13	1.33(.38,4.60)	
	Neurologic	11	19	.91(.27,3.03)	
	Cardiovascular	29	17	2.68(.87,8.22)*	
	Sepsis	1	18	.08(.01,.81)*	0.05(.01,.68)**
	Others	7	11	1	1
Variables	Category	Patient status		COR (95%CI)	AOR (95%CI)
		Survived	Died		
Cause of IHCA	Fatal arrhythmia	23	19	3.63(.86-15.34)*	
	Hypotension	3	44	.21(.04-1.18)*	

	Respiratory failure (hypoxia)	33	21	4.71(1.14-19.44)*	15.04(2.34,95.13)**
	Metabolic(electrolyte, acidosis)	21	15	4.20(.97-18.18)*	
	MI	17	7	7.29(1.51-35.21)*	
	Trauma	3	9	1	1
Given electric shock	Yes	45	15	5.12(2.07,10.24)*	12.09(4.15,35.21)**
	No	55	100	1	1
IV medication	Amiodarone	6	1	5.13(.60-44.13)*	
	Calcium	11	7	1.34(.48-3.74)	
	Glucose	6	1	5.13(.60-44.13)*	
	Magnesium	6	6	.86(.26-2.83)	
	Bicarbonate	7	5	1.20(.36-4.02)	
	Fluid	4	44	.07(.02-.22)*	
	Others	5	1	4.26(.48-37.88)*	
	None	47	55	1	
ECG monitor	Yes	66	64	1.54(1.00,2.99)*	4.94(1.59,15.39)**
	No	34	51	1	1
Initial rhythm	Ventricular fibrillation	23	7	4.49(1.70,11.83)*	37.93(2.20,655.58)* *
	Pulse less v.tach.	22	8	3.78(1.47,9.56)*	25.64(5.08,129.47)* *
	Asystole	25	59	.58(.30,1.13)*	
	PEA	30	41	1	1
Timing of cardiac arrest	Office hour	69	35	1	
	Non-office hour	31	80	.20(.11,.35)*	
*indicates variables having P-value <0.25 in bivariate analysis and ** indicates variables having P-value <0.05 in multivariable analysis					

6.0. Discussion

This study assessed the immediate survival rate among IHCA who received CPR and its associated factors. In multivariable analysis, male gender, respiratory failure as the cause of arrest, patients on ECG monitor, initial shockable rhythms and receiving electrical discharge were factors associated with survival rate. Majority of patients with admission diagnosis of sepsis were less likely to survive.

The survival rate after CPR among cardiac arrest patients was 46.5 %. This was better in outcome than a cohort study done in Aga Khan University Hospital, Nairobi, Kenya in which immediate survival rate was 36 %. This large difference may be due to varieties in patient group (more septic, malignancy and RVI patients who had poor outcome in resuscitation); patients with different place of cardiac arrest (ward patients) or less number of patients having shockable rhythm(17) .similarly the result was higher than that of prospective analysis done in UK, Derriford Hospital, Plymouth, PL6 8DH (41%); there was a wide age range in the study with a significant proportion (39%) in their 70s effect of age on survival may be confounded by selection bias: patients aged 70 years or over are less likely to receive CPR than younger persons. Setting an age limit on resuscitation would be inappropriate, but combined with other factors it is a guide to survival. Previous studies reported IHCA distribution of shockable rhythms around 20% are associated with better outcomes (up to 40%) compared to 80% of non-shockable rhythms (around 12%) (2,18). But its less than that of review done in US among studies of members of GWTG)-R (56%) likely due to improvement in trends in earlier recognition of cardiac arrest (i.e., shorter response times), quality of acute resuscitation (e.g., greater availability of trained personnel

and provision of high-quality chest compressions with fewer interruptions) which were not assessed in this study(19).

More than half of patients are younger in age (<59years) this could be due to patients admitted with trauma-associated injuries and There is evidence to suggest that young men are more likely to be involved in trauma such as road traffic accidents(4).

Being male gender had more likely to develop IHCA and high likelihood of survival. This may be because of men in the study area also have poor health-seeking behaviors and often seek medical care when critically ill and at risk of CA confounding with age (cardiovascular diseases are common in men and women in their 50s and 60s), because these patients are more likely to be monitored with cardiac telemetry and because patients with a primary cardiovascular diagnosis may be more likely to have rhythms amenable to resuscitation(4,9).

If the triggering causes of arrest are recognized by the in-hospital emergency team, this may have crucial consequences for survival. In this study the most common causes of IHCA include, acute respiratory failure(25.12%) and hypotension(21.86%) substantial number of cases may be secondary to respiratory insufficiency and may respond to targeted therapy and have more chance of survival(AOR: 15.04; 95% CI: (2.34,95.13). likewise result of prospectively observational study done in St Olav University Hospital, Norway also show similar relation in which 1-hour survival according to the causes were recognized as non- cardiac, non-shockable rhythm like PEA were (63%) which is higher than cause not recognized in non-cardiac, non-shockable rhythm(33%). IHCA in which the underlying cause carries a very poor prognosis will, even if recognized and properly treated, weaken the relation between recognition of causes and survival, e.g. septic shock (AOR: 0.05; 95% CI: (.01,.68). This is based on information about underlying critical condition, co

morbidity some clinical diagnoses such as sepsis are associated with worse prognosis after IHCA. These diagnoses are used as morbidity variables in pre-arrest predictive models such as the Pre-Arrest Morbidity score (score range 0–25) and Prognosis After Resuscitation score (score range 2–31). These models have been developed to predict failure to survive after cardiac arrest in an attempt to avoid futile resuscitation (2,20,21).

Patient who were monitored with ECG have more likely to survive (50%) compared to non-monitored patients (40%). This could be due to monitored patients have higher chance to have witnessed cardiac arrest to whom rapid response would taken. Such figure little down in comparison with a cohort study done in US from large data base of CPR registry; Patients who are witnessed and/or monitored at the time of cardiac arrest demonstrate a significantly higher rate of survival (ROSC >20min 52% for both witnessed and monitored, 50% for only monitored and 47% for only witnessed) compared to those patients who are neither monitored nor witnessed (33%) this could be because they include patients at ICU , where higher number of staffs per patient than ED patients and the chance being witnessed also not similar. Times to initiation of CPR greater than 2 min were associated with a survival of 14.7% as compared with 17.1% if CPR was begun in 2 min or less(22,23).

Majority of detected initial rhythm was non-shock able (PEA and asystole), 71(33%) and 80(39.1%) respectively; whereas more than one fourth were shock able (Ventricular fibrillation and Ventricular tachycardia) 30(14%) each in which all of were shocked. The number of shock able rhythm relatively larger than that of prospective multicenter observational registry analysis of IHCA and resuscitation reports on patients from 253 US and Canadian medical and surgical hospitals (23%). A main reason for the high prevalence of shock able rhythms in our study could be the inclusion of patients who are highly monitored only in the ED, the male predominance,

relatively larger patients with cardiovascular disease in admission diagnosis and finally the low numbers of IHCA. Shockable rhythms (ventricular fibrillation or ventricular tachycardia) were associated with higher odds of survival because they are more likely to accompany a primary cardiac cause, and because of the effectiveness of early defibrillation. In the out-of-hospital cardiac arrest literature, survival from a shockable rhythm greatly exceeds survival after pulseless electrical activity or asystole; our results for IHCA also show this trend; survival rate was also higher in shockable rhythm compared to non-shockable (AOR: 12.09; 95% CI: 4.15,35.21), But was also relatively higher than comparative finding of the US and Canadian study could be due to failure to recognize and timely manage the underlying cause of non-shockable rhythm IHCA because of the busy ED environment, patient may arrest before collection of pending investigations that may lead detection of cause of non-shockable rhythm IHCA and after all the ED our study might not have necessary medications needed to manage the cause during resuscitation. However there was no available well documented data that used to explain timing of initiation of CPR after detection of IHCA, timing of delivery of shock in shockable rhythm, provision of vasoactive agents in non-shockable rhythm IHCA (9,24,25).

7.0. Limitation of the study

Since the study was a cross sectional study; by its nature it did not indicate the causal and temporal relationship. Similarly, this study only assesses the immediate effects of CPR, which does not assess the patient's later status.

Study population only includes patients admitted to ED and difficult to represent outcome in other area of hospital (ICU, ward, OR, recovery, CAT LAB).

Single center and low sample size.

Most patients with co morbidity like CKD, malignancy, age > 80 years did not resuscitated which may affect outcome as in the other studies.

We did not have comprehensive data on other resuscitation process factors, such as quality of chest compressions and extent of interruptions of cardiopulmonary resuscitation and we have post resuscitation treatment like PCI, fibrinolysis, TTM and ECMO.

We did not reevaluate neurological status after hospital discharge or throughout the hospitalization; therefore, our risk score was only able to prognosticate in hospital outcomes at the time of return of spontaneous circulation.

8.0. Conclusion and recommendations

8.1. Conclusion

The immediate survival rate among IHCA was high. Despite this, investigator failed to analysis survival at discharge and prolonged survival. In addition outcome with neurologic status was not investigated; this is due to lack proper documentation of resuscitation care and post resuscitation care. Male gender, having ECG monitor, respiratory failure, initial rhythm of Ventricular fibrillation and Pulse less v.tachycardia, electric shock during CPR, were the independent factors associated with survival rate of patients with cardiac arrest. Patients with sepsis as the cause of admission should trace the essential treatment modalities to minimize the risk of mortality.

8.2. Recommendations

Structured and standardized resuscitation registration and checklist format should be adopted and practiced not only in ED but also in all area of care. This study will used as entry to do it with multicenter bases and in different area of care.

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Assurance of Principal Investigator

I undersigned agreed to accept all responsibilities for the scientific and ethical conduct of the research project. I seek the necessary advice and approval from my primary advisors in the course of the research. I communicated stakeholders involved in the study including any source of funding for this research.

Name of the student: _____

Signature: _____

Date: _____

Approval of the Primary Advisor

Name of the primary advisor: _____

Signature: _____

Date: _____

Approval of the Co-Advisor

Name of the primary advisor: _____

Signature: _____

Date: _____

Annexes

APPENDIX 1. INFORMATION SHEET AND INFORMED CONSENT

Hello, today we, Investigators, are here to collect data on the assessment of survival rate of IHCA in emergency department from May, 2022 to Dec, 2023 in your hospital. The Name, MRN and Address of the patient will not be recorded. In addition, we would like to confirm to you that all the data are confidential and used for research purpose only.

Are you willing to continue in this study?

Sign-----

Thank you for spending your precious and valuable time.

APPENDIX 2: DATA ABSTRACTION TOOL

Good morning/afternoon? We are academicians and health care professionals. We need to collect data regarding “ the survival rate of in hospital cardiac arrest patients among those admitted in emergency department of the SPHMMC between May 2022 and dec, 2023 in Addis Ababa, Ethiopia” using data abstraction sheet collected by the principal investigator.

Thank you.

Table 4: Data abstraction sheet

Section 1. Socio demographic		
1	Age	_____years
2.	Sex	Male Female
3.	Co morbidity	HTN DM Hyperlipidemia Cardiac diseases Renal diseases

		Others
Section 2. Clinical Characteristics		
2.1.	Patient admission category	Red Orange Yellow/green
2.2.	Reason for hospital admission	Gastrointestinal Trauma Respiratory Renal Obs/gynecology Neurological Cardiovascular Sepsis of unknown focus others
2.3.	Causes of IHCA	Fatal arrhythmia Hypotension Respiratory failure Metabolic MI Trauma others
2.4	Does the patient gets ACLS	Yes No
2.5	ACLS items	Chest compression Electrical shock Airway management Vaso active agents Anti arrhythmic drugs
2.6	What kind of treatment/procedure before ACLS	IV medication EGG Monitor Ventilator Intracardiac pacemaker/defibrillator None
2.7	Initial arrest rhythm	Ventricular fibrillation Pulse less ventricular tachycardia Asystole Pulse less electrical activity
2.8	Duration of CPR	< 5 mins 5-9 mins > 10-14 mins 15-29 mins >29 mins

Section 3: Health care profession related factors		
3.1.	Timing of Cardiac arrest	Office hour Non office hour
4.1	Outcome of resuscitations	Died Survived