ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE

EMERGENCY AND CRITICAL CARE NURSING DEPARTMENT

IN-HOSPITAL MORTALITY AND ITS PREDICORS AMONG ST- SEGMENT ELEVATION MYOCARDIAL INFARCTION PATIENTS AT GESUND CARDIAC AND MEDICAL CENTER, ADDIS ABABA, ETHIOPIA, 2025.

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A RESEARCH THESIS TO BE SUBMITTED TO ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCES DEPARTMENT OF EMERGENCY AND CRITICAL CARE NURSING IN PARTIAL FULFILMENT FOR THE REQUIREMENT OF MASTERS DEGREE IN EMERGENCY AND CRITICAL CARE NURSING.

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MAY 2025

THESIS APPROVAL SHEET

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ACKNOWLEDGEMENTS

I want to begin by expressing my genuine gratitude to Addis Ababa University for the valuable opportunity of carrying out this research. The contribution of the university has been instrumental in navigating my academic journey and availing me with the ability to explore major health care issues. My great appreciation goes to Rehoboth Harme College for sponsoring me to undertake this MSc program.

I appreciate the Emergency and Critical Care Nursing Department, whose advice have served as the foundation of my research, allowing me to immerse myself in emergency care and its impact on patient outcomes.

I am also greatly thankful for my advisors' guidance and mentoring, Achamyeleash Tadele (MSc), Lemlem Beza (PHD,Asst.Prof) and Dr.Bekele Alemayehu (MD,Internist, Interventional cardiologist, and Associate professor). Their counsel and experience have been greatly helpful, guiding me through the complexities of my research thesis in confidence and intelligible understanding.

LIST OF ACRONYMS AND ABBREVIATIONS

ACEIs:	Angiotensin-Converting Enzyme Inhibitors
ACS:	Acute Coronary Syndrome
CABG:	Coronary Artery Bypass Grafting
CAD:	Coronary Artery Disease
CHD:	Coronary Heart Disease
CI:	Confidence Intervals
CMS-TH:	College of Medical Sciences Teaching Hospital
DM:	Diabetes Mellitus
FMOH:	Federal Ministry of Health
GBD:	Global Burden of Disease
GCMC:	Gesund cardiac and medical center
HDL-C:	High-Density Lipoprotein Cholesterol
IHD:	Ischemic Heart Disease
LDL-C:	Low-Density lipoprotein Cholestrol
LVEF:	Left Ventricular Ejection Fraction
MI:	Myocardial Infarction
MOH:	Ministry of Health
PCI:	Percutaneous Coronary Intervention
STEMI:	ST-segment Elevation Myocardial Infarction

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ABSTRACT

Background: ST-segment elevation myocardial infarction (STEMI), which is a severe form of myocardial infarction (MI), results from complete coronary artery occlusion and is characterized by high morbidity and mortality. Although STEMI accounts for increased mortality, little evidence that points to in-hospital mortality and predictors in Ethiopia exists. This study tries to address this gap.

Objective: To assess in-hospital mortality and its predictors among ST-segment elevation myocardial infarction patients at Gensund Cardiac and Medical Center, Addis Ababa, Ethiopia 2025.

Methods: Retrospective cross-sectional study was conducted from February 2024 to January 2025. And sample size was determined using a single population proportion formula to obtain a total of 229 STEMI patients. Data were collected from patients' Medical records with a structured checklist. Binary Logistic regression was used in order to identify predictors of STEMI in-hospital mortality, with statistical significance set at $p < 0.05$ and 95% confidence level.

Results: Of 229 STEMI patients, the majority were men (86.5%), with a mean age of 59.27 ± 8.93 years. Surprisingly, (13.1%) thirty were Killip class III&IV and (7.9%) eighteen had ejection fraction (LVEF) of <30% In-hospital mortality was (7.4%, n=17). Killip class III & IV (COR = 6.8; [95% CI: 3.2–14.5; P < 0.001], AOR = 6.2; [95% CI: 2.9–13.1; P = 0.001]) and LVEF <30% (COR = 4.7; [95% CI: 2.0–10.8; P = 0.002], AOR = 4.1; [95% CI: 1.8–9.2; P = 0.004]) were independent predictors of in-hospital mortality among STEMI patients.

Conclusion: Taken together, the in-hospital mortality rate among STEMI patients in this study was relatively low; however, advanced Killip class and markedly reduced left ventricular ejection fraction emerged as independent predictors of adverse outcomes. Tackling these critical predictors through early risk identification and implementation of effective preventive measures remains essential to minimizing this burden.

Keywords: STEMI, risk factors, Killip class, Gensund cardiac and medical center, Ethiopia

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

Myocardial infarction, or heart attack, happens whenever there is reduction or total cessation of blood supply to the myocardium(1). This is due to the plugging of clotted blood in the area of rupturing of atherosclerotic plaque in the coronary artery. The formed clotted blood interferes with perfusion and will result in insufficiency of oxygen (Ischemia) supply to the myocardium (2). By chronic and severe infarction, there will be scar tissue replacement of dead myocardium in such a way that the myocardium is no longer able to contract. To suggest that the contractility force of the myocardium will cease in an infarcted area permanently (3).

Thus, failure of contractility decreases the heart's capability to eject and hence leads to a fall in cardiac output, serious myocardial insult, and consequently cardiogenic shock (4). Globally, MI prevalence is 3.8% in persons under the age of 60 years and 9.5% in the age group of 60 years and older (5). And it is accountable for causing more than 15% of yearly deaths(6).

In suspected and proved cases of myocardial infarction, acute coronary syndrome could be the optimum term describing this disease. And it is typically classified as ST-elevation myocardial infarction (STEMI), Non- ST-elevation myocardial infarction (NSTEM) and unstable angina(7). ST- segment elevation Myocardial infarction-, the most common type of myocardial infarction, is a time-dependent and fatal disease, and it will manifest by the time when the coronary artery is totally blocked by clotted blood due to rupture of atherosclerotic plaque and endothelial lesions (8-10).

A long year has been counted as STEMI continues to be a striking burden of death and illness globally (11). Figures also show that more than 3 million patients experience the problem every year(12). Precipitous treatment start for STEMI patients is essential, since precipitous start of treatment will have a great impact in lowering STEMI-induced death (14). And saying "Time is muscle" remains the principal principle for STEMI patient treatment (15).

Generally, ST-segment elevation myocardial infarction(STEMI) patients have greater in-hospital mortality (16). And STEMI patient outcomes, such as death, are determined by a set of significant clinical predictors like age, treatment delay, and prior history of myocardial infarction, Hypertension and diabetes. The other outcome determinants include Killipclass, a clinical classification that is employed in the recognition of the stage of heart failure after myocardial infarction and Left ventricular ejection fraction (LVEF), which is a critical parameter that is applied in a bid to quantify the systolic function of the left ventricle (17-19).

To the researcher's knowledge, limited studies have reported the overall mortality of STEMI patients in Ethiopia, and none have specifically examined both in-hospital mortality and its predictors. Most existing data focus on general acute coronary syndrome (ACS) populations without identifying in-hospital mortality predictor's specific to STEMI. Therefore, this study aims to fill this important gap by assessing in-hospital mortality and its predictors among STEMI patients at the private Gezund Cardiac and Medical Center in Addis Ababa, Ethiopia.

1.2 STATEMENT OF THE PROBLEM

ST-segment elevation myocardial infarction (STEMI) is a medical emergency and accounts for 25% to 40% of hospitalized myocardial infarctions patients (20-22). Despite early reperfusion through primary percutaneous coronary intervention (PPCI), ST-segment elevation myocardial infarction (STEMI) remains the leading cause of morbidity and mortality across the globe (23, 24). Evidence for this includes that from Pakistan sources records in-hospital mortality of 28%(25). The Romanian ST-segment elevation myocardial infarction registry studies also denote the severity of MI outcomes by determining in-hospital mortality rate of 7.1% among patients with STEMI (26). In Tanzania, an African country, ST-segment elevation myocardial infarction (STEMI) contributes to 5.7% of in-hospital mortality(27).

Data from other nations offer valuable insights into the predictors and outcomes of STEMI. For example, from an Italian study, it indicates that late presentation among STEMI patients has worse outcomes compared to those presenting early for care (28). In addition, an International Survey of Acute Coronary Syndromes in Transitional Countries study revealed that young women with STEMI had increased mortality and a poorer prognosis than their male counterparts(29).

Up to this point, as much as existing knowledge permits, no specific study in Ethiopia has been conducted on in-hospital mortality and predictors among patients with ST-segment Elevation Myocardial Infarction. Existing evidence is largely an extrapolation of larger Acute Coronary Syndrome (ACS) trials, which could not able to determine predictors of in-hospital mortality specifically for STEMI patients. Therefore this study aims to bridge that knowledge gap by investigating in-hospital death and its determinants among STEMI patients at Gesund Cardiac and Medical Center and generating local and specific findings.

1.3 SIGNIFICANCE OF THE STUDY

This study is of tremendous significance since it addresses an important research gap by assessing in-hospital mortality and its determinants among STEMI patients treated at Gesund Cardiac and Medical Center, Addis Ababa, Ethiopia. By focusing on this prominent but under-explored area, the study will generate apposite evidence to inform healthcare stakeholders—policymakers and Health care institutions—to develop intervention-specific programs to reduce in-hospital mortality in STEMI patients. It will also serve as an important point of reference for subsequent studies, offering baseline data not only on short-term outcomes but also for determining long-term outcomes of STEMI patients.

CHAPTER TWO

LITERATURE REVIEW

ST-segment elevation myocardial infarction (STEMI), a type of acute coronary syndrome, is one of the foremost causes of morbidity and mortality worldwide (30). ST-segment elevation myocardial infarction (STEMI), a type of acute coronary syndrome, is one of the foremost causes of morbidity and mortality worldwide (38). Given the significant global burden of STEMI, understanding its in-hospital mortality and outcome predictors is crucial. Therefore, this literature review critically examined socio-demographic characteristics, laboratory investigations, ejection fraction, Killip classification, management approaches, in-hospiital mortality and outcome predictors of STEMI patients. The review was conducted by systematically searching Google Scholar and PubMed, selecting over 60 relevant articles based on their quality, relevance, and data completeness. Findings were thematically synthesized to provide a comprehensive understanding of STEMI, including in-hospital mortality and outcome predictors of STEMI patients.

2.1 Socio demographic Characteristics

Most studies conducted to assess the demographics of STEMI patients reveal that the majority are males, typically in the age group of 50 to 60 years. For instance, in the study from the North India ST-Segment Elevation Myocardial Infarction (STEMI) Registry, 84% of the participants were male (3,053 patients), while 16% were female (582 patients), with the median age of 55 years(31). Another study conducted in a similar region reported a mean age of 54.23 years, with 81.69% of the cases being male and 18.31% female, emphasizing the higher prevalence of STEMI among men(32).

Additionally, a study conducted in Bali, Indonesia, reported a mean age of 58.3 ± 11.79 years, with 75.7% of the participants being male and 24.3% female(33). A systematic review conducted in Bangladesh also highlighted a similar trend, with a mean age of 55.75 ± 12.5 years, and the majority of participants being male (75%)(34).

Furthermore, a retrospective study on the clinical profile of patients and predictors influencing STEMI mortality in an Asian population reported a mean age of 53.6 ± 12.1 years, with 89.4% (n=769) of the participants being male and 10.6% female(35). Moreover, a study from Tanzania conducted at the Aga Khan Hospital Dar- es-Salaam (AKHD) found that 83.5% of STEMI patients were male, with 16.5% female and a median age of 55 years(36). Consistent with these findings, a study from Tunisia demonstrated that 82.3% of STEMI patients were male(37).

2.2 Laboratory Investigations

Initial lab investigations on admission for STEMI patients were recorded in different study areas. For instance, a study from Taiwan reported mean values as follows: creatinine 1.26 mg/dl, total cholesterol 181.25 mg/dl, triglycerides 135.78 mg/dl, HDL-C 43.15 mg/dl, and LDL-C 118.35 mg/dl(38).Another study conducted in Iran reported the following mean laboratory values with standard deviations among STEMI patients: early creatinine level was 1.15 ± 0.36 mg/dl, LDL-C was 98.00 ± 28.59 mg/dl, HDL-C measured 41.03 ± 8.62 mg/dl, total cholesterol was 171.04 ± 40.05 mg/dl, and triglycerides were 131.70 ± 78.62 mg/dl(39). In the African context, a study from Somalia reported mean laboratory values among STEMI patients as follows: creatinine 1.1 ± 3.65 mg/dl, total cholesterol 197.6 ± 42.8 mg/dl, triglycerides 145.1 ± 33.3 mg/dl, HDL-C 66.1 ± 24.1 mg/dl, and LDL-C 81.3 ± 31.8 mg/dl(40).

2.3 Ejection fraction

Ejection fraction outcomes differ among populations studied. At Hamad General Hospital in Doha, Qatar, for instance, 19.5% of patients presented with an ejection fraction less than 25%(41).Similarly, a study conducted in Saudi Arabia assessing clinical presentation and outcomes in younger and older patients found that among younger patients, 24% had an ejection fraction less than 35%, while the remaining 76% had values above 35%(42).

Another study from tertiary care centres in Delhi, India, reported that 13% of patients had a preserved ejection fraction (LVEF >50%), 41% had mildly reduced LVEF (40–49%), 38% had moderately reduced LVEF (30–39%), and 8% had severely reduced LVEF (<30%)(43).Likewise, findings from the NORIN registry in India revealed that mild to moderate left ventricular (LV) dysfunction (LVEF = 30–50%) was present in 83.7% of patients, whereas severe LV dysfunction (LVEF <30%) was observed in 6.7% of cases(44).

Furthermore, a study in Senegal found that 36% of patients had a preserved ejection fraction (VEF ≥50%), 40% had mildly reduced LVEF (50% > LVEF ≥ 40%), and 24% had severely reduced LVEF (LVEF <35%)(45).

2.4 Killip classification

Various studies have reported the distribution of Killip classification among STEMI patients; for example, a finding from Italy shows that Killip class III–IV occurred in 15% of patients(46). Another study from Spain shows that 88.8% of STEMI patients were in Killip class I–II, while 11.2% were in class III–IV (47). Similarly, research from a tertiary care center in Saudi Arabia reported that 10% of older adult patients presented with Killip class III–IV(42).

A single-center retrospective study conducted at the Aga Khan Hospital Dar-es-Salaam (AKHD), Tanzania, revealed that 79.9% of STEMI patients were classified as Killip class I and II, whereas 20.1% were in Killip class III and IV(27).

2.5 Reperfusion and medical management approaches

Medical management plays a vital role alongside reperfusion therapies such as PCI and thrombolysis in improving outcomes for STEMI patients. For instance, data from the RO-STEMI registry among conservatively treated patients showed high use of dual antiplatelet therapy (90.8%), clopidogrel (90.2%), aspirin (90.1%), statins (87.5%), beta-blockers (73.2%), and unfractionated heparin (36.5%)(26).Other study from Abu Dhabi, the capital of the United Arab Emirates (UAE), reported high usage of statins (94.7%), beta blockers (90.7%), clopidogrel (85.3%), and ACE inhibitors (70.7%), while nitrates (20.0%) and aspirin (12.0%) were less frequently used(48). Moreover, a study from Sri Lanka reported high usage of aspirin (91%), clopidogrel (95%), statin (91%), angiotensin-converting-enzyme inhibitor (ACEI) or angiotensin-receptor blocker (ARB) (95%), and nitrates (60%) among STEMI patients(49).

In the NORIN-STEMI study, PCI was performed in 66%, and 13% were candidates for thrombolytic(31).One study from Morocco, based on the Moroccan Registry of ST-Elevation Myocardial Infarction (STEMI), reveals that thrombolytic were administered to 23.4% of patients, while 26.2% underwent percutaneous coronary intervention (PCI)(50).

2.6 In hospital mortality

Mortality rates for ST-elevation myocardial infarction (STEMI) vary significantly across different regions. In high-income countries, studies report relatively similar in-hospital mortality rates. For instance a multicenter retrospective observational study in Australia reported a 30-day mortality rate of 7.9%(51).

Similarly, the Romanian ST-Elevation Myocardial Infarction registry documented an in-hospital mortality rate of 7.1%(26).and a retrospective study in the United States of ED-diagnosed STEMI patients found an in-hospital mortality rate of 7.8%(52). These findings suggest comparable STEMI outcomes across high-income settings. In contrast, lower-middle-income countries show more variability.

A study in Pakistan reported a notably higher in-hospital mortality rate of 28.0%(53).Meanwhile, in Africa, an in-hospital mortality rate of 5.7% was observed in Tanzania(27).With similar rates reported in Morocco (5.2%) and South Africa (6.2%) (50, 54).

2.7 In hospital mortality predictors of STEMI patients

Numerous studies have pinpointed critical predictors of adverse outcomes in STEMI patients. For example, a study conducted in International Survey of Acute Coronary Syndromes in Transitional Countries identified sex as an independent predictor of outcomes. The results show that women younger than 60 years with STEMI had a significantly higher 30-day mortality rate compared to men of the same age(29).

A study from the Arabian Gulf registries found higher in-hospital mortality in women, especially those aged 46–65, with significantly greater odds compared to men.(55). Supporting this, a study in Tunisia found higher in-hospital mortality in women than men (12.8% vs. 7.3%, $p=0.001$), indicating greater risk among female STEMI patients (56).

In a retrospective study conducted in Italy, the main predictors of outcomes associated with mortality were age (HR 1.12, $p < 0.001$), lower left ventricular ejection fraction (LV-EF) (HR 0.97, $p = 0.02$), and Killip class ≥3 at admission (HR 2.29, $p = 0.04$). These factors were strongly linked to increased mortality, highlighting their significance in predicting patient outcomes.(57)

In a subsequent study conducted within the same clinical setting, but in a different year, several independent predictors of poor outcomes among STEMI patients were identified. These included a left ventricular ejection fraction (LVEF) of less than 40% (HR = 3.70; 95% CI: 1.30–7.87; P = 0.0001), increasing age (HR = 1.13; 95% CI: 1.04–1.23; P = 0.007), failure of primary percutaneous coronary intervention (PPCI) (HR = 2.93; 95% CI: 1.44–5.98; P = 0.0001) and Killip class III or higher (HR = 2.29; 95% CI: 1.03–5.4; P = 0.04) (58).

Other findings from an Asian population identified six key predictors of mortality in STEMI patients: age ≥75 years (AOR 4.784, p < 0.001), female gender (AOR 2.869, p = 0.001), pre-existing hypertension (AOR 1.623, p = 0.046), anterior STEMI (AOR 1.947, p < 0.001), higher Killip class (p < 0.001), and heart rate ≥100 bpm at admission (AOR 1.823, p = 0.016)(35).

Building on previous findings, data from the Romanian ST-Elevation Myocardial Infarction (RO-STEMI) registry identified key predictors of poor outcomes in STEMI patients. These included Killip class II-IV at admission (OR: 9.2; 95% CI: 6.2-13.6; p < 0.0001), a left ventricular ejection fraction (LVEF) below 35% (OR: 3.8; 95% CI: 2.6-5.4; p < 0.0001), age over 65 years (OR: 2.2; 95% CI: 1.5-3.2; p < 0.0001), and anterior location of ST-elevation myocardial infarction(OR: 2.1; 95% CI: 1.5-3.0; p < 0.0001). These factors consistently emerged as strong predictors, reinforcing their crucial role in forecasting STEMI patient outcomes.(26).

Alongside the above findings, the study in İstanbul, Turkey, identified key predictors of STEMI patients' mortality, including age (OR = 1.07, p<0.001), diabetes mellitus (DM) (OR = 1.83, p<0.001), chronic kidney disease (CKD) (OR = 1.91, p<0.001), Killip score (OR = 1.67, p=0.002), left ventricular ejection fraction (LVEF) (OR = 0.95, p<0.001)(59).

Other findings from the Tabba Heart Institute, a private healthcare facility in Pakistan, revealed that multivariate logistic regression analysis identified age over 60 years (p = 0.05), diabetes (p < 0.01), and a left ventricular ejection fraction below 40% (p = 0.01) as independent predictors of in-hospital mortality(60). Likewise, findings from a retrospective, single-center hospital-based registry in Japan identified ejection fraction (EF) < 40% (aOR, 4.446; p < 0.001), Killip class > II (aOR, 7.438; p < 0.001), chronic kidney disease (CKD) (aOR, 4.056; p < 0.001), and hypertension (aOR, 0.449; p = 0.01) as independent predictors of in-hospital mortality(61).

Educational level is another factor affecting patient outcomes. For instance, an Iranian study showed that patients with no education had a higher in-hospital mortality rate (8.11 per 100 person-years) compared to those with primary (6.11), high school (4.85), and academic education (5.81). The adjusted hazard ratio of mortality was also higher among illiterate patients (HR: 1.27) compared to those with academic education, indicating a clear association between lower education and worse outcomes(62).

Similarly, findings from the GUSTO-III trial, which included countries enrolling over 500 patients, demonstrated that each additional year of education was independently associated with a lower risk of 7-day mortality (HR: 0.86; 95% CI: 0.83–0.88), further supporting the link between lower educational attainment and poorer short-term outcomes(63).

In addition to educational level, area of residence also plays a significant role in patient outcomes. For instance, data from South Korea's National Health Insurance Service revealed that patients residing in rural areas had a 1.49 times higher risk of death within 7 days (95% CI: 1.18–1.87) compared to urban patients(64). Supporting this finding, a meta-analysis of 37 studies (including 29 retrospective, 4 cross-sectional, and 4 prospective designs) reported that patients from rural areas experienced a higher follow-up mortality rate (15.5%) compared to urban patients (13.4%), with an odds ratio of 1.18 (95% CI: 1.13–1.24; $I^2 = 97\%$)(65).

Furthermore, a registry-based study conducted in Scandinavia found that STEMI patients with diabetes mellitus (DM) had a significantly higher all-cause mortality rate (9.0% vs. 4.9%; $p < 0.001$) compared to STEMI patients without DM(66). Moreover, the International Study of Acute Coronary Syndromes in STEMI (ISACS-STEMI) registry, encompassing 109 centers across four continents, found that hypertension independently predicted in-hospital mortality rate of STEMI patients (OR = 1.673 [95% CI 1.389–2.014], $p<0.001$)(67).

Elevated serum creatinine levels have been identified as key outcome predictors in STEMI patients. For example, a study done in china found that creatinine ≥115 µmol/L on admission was linked to poor outcomes, with a hazard ratio of 3.31 ($P<0.001$)(68). Findings from Ireland also support this, showing that higher creatinine levels (170.7±122.1 µmol/L, $p<0.001$) are strongly linked to increased mortality(69). Similarly, a Bangladeshi study linked higher baseline serum creatinine in STEMI patients to increased mortality (70).

Other studies also highlight that serum troponin levels on admission are crucial in predicting STEMI outcomes. For instance, research from Ireland found that elevated troponin levels of 12,238 ng/L on admission were strongly associated with 30-day mortality ($p=0.004$)(69). A similar USA study found elevated troponin T levels above the median linked to a 9.5% 30-day CV mortality, with an adjusted odds ratio of 5.81 ($P=0.0002$)(71).

Moreover, peak CK-MB levels have also been identified as important predictors of mortality in STEMI patients. Findings from the Netherlands, based on the University Medical Centre Groningen (UMCG) STEMI registry, demonstrated that higher peak CK-MB levels were significantly associated with increased mortality risk, with an adjusted hazard ratio of 1.24 per 100 U/L increase (95% CI: 1.19-1.29, $P<0.001$)(72). Results from Romania also show that CK-MB values at admission had significant predictive power for poor outcomes, with an AUC of 0.740 ($p = 0.027$, 95% CI)(73).

In addition to enzyme markers, lipid profile abnormalities have also shown prognostic value. Lipid profile data from the Korean KAMIR study revealed that patients with very low HDL levels experienced significantly higher in-hospital mortality compared to those with normal HDL levels (4.0% vs. 0.9%; $p = 0.009$)(74).

Another important factor influencing STEMI outcomes is an increased heart rate. A study from Romania demonstrated that an HR ≥80 bpm significantly predicts a higher risk of mortality in STEMI patients ($P = 0.0234$)(75). In line with findings from Denmark, a heart rate ≥100 bpm was independently linked to a higher risk of all-cause mortality (HR 2.39, 95% CI 1.58–3.62, $p<0.001$)(76). Likewise, in Johannesburg, South Africa, non-survivors had a higher baseline ECG heart rate compared to survivors (99 vs. 83 bpm, $p<0.001$)(54).

Low systolic blood pressure on admission was found to be a significant predictor of outcomes in STEMI patients. In a study from a Chinese hospital, an SBP ≤108 mmHg was associated with increased 30-day mortality (HR 1.88, 95% CI 1.46–2.43; $p<0.001$)(77).Similarly, a Romanian study showed that in patients with SBP <105 mmHg at admission, the risk ratio for death from any cause was 4.9 (95% CI 1.977–12.205, $P=0.006$)(75).

A study from Iran also reveals similar findings, showing that systolic blood pressure <100 mm Hg is significantly associated with outcomes (HR: 4.92, 95% CI: 3.43–7.04, p <0.001)(78).Cardiogenic shock is one of the predictors of in-hospital mortality for STEMI patients. For instance, in a study conducted in China, patients presenting with CS on admission had a hazard ratio (HR) of 1.948 (95% CI: 1.164–3.261**,** p = 0.011), indicating a nearly twofold increased risk of major adverse cardiac events (MACE) compared to those without cardiogenic shock(79).

Similarly, data from the Malaysian National Cardiovascular Database (NCVD) registry showed that STEMI patients with cardiogenic shock had a significantly higher in-hospital mortality rate of 34.1% compared to 5.6% in non-cardiogenic shock patients (adjusted risk ratio: 7.143, p < 0.001), with 30-day mortality reaching 36.2% (adjusted risk ratio: 8.863, p < 0.001)(80). Likewise, findings from Denmark reveal that cardiogenic shock on admission is associated with poor outcomes, with a mortality rate of 47% (log-rank p < 0.0001)(81).

Alongside other predictors, the site of infarction emerged as a significant factor influencing STEMI patient outcomes. Specifically, anterior STEMI was associated with worse outcomes, as reported by the Cleveland Clinic in the United States (HR 1.62, 95% CI 1.23 to 2.12, p<0.001)(82).

Similarly, studies from Germany reported comparable trends. Among the various predictors influencing STEMI patient outcomes, the infarction site played a crucial role. Notably, patients with anterior STEMI experienced higher mortality rates (<28 days) compared to those with inferior STEMI (27% vs. 11%, p<0.001)(83).

Another study conducted in Pakistan found a significantly higher death rate among STEMI patients with obesity (p<0.001)(84). In contrast, a study from the USA found that obesity does not show any association with poor outcomes. Mortality was lower in patients with obesity, with an adjusted odds ratio of 0.606 [95% CI 0.502–0.733] (85).

Other notable predictors of outcomes in STEMI patients include smoking, which has shown varying impacts across different regions. For instance, a study conducted in Israel identified smoking as a notable predictor, revealing that smokers tend to experience worse clinical outcomes compared to non-smokers(86). In contrast, a study from Iran revealed that smoking was associated with a reduced risk of in-hospital mortality in men, according to the unadjusted model (HR = 0.49, 95% CI: 0.31 – 0.78, P = 0.002)(87).

Conversely, data from Singapore showed that smokers exhibited better clinical outcomes following STEMI, with a significantly lower 30-day mortality rate compared to other groups, highlighting a contrasting trend in this region(88). However, findings from East Africa (Tanzania) present a stark contrast, where cigarette smoking was identified as a significant predictor of poor in-hospital outcomes, emphasizing its harmful effect on recovery(36).

Time to ED arrival is another significant factor contributing to poor outcomes in patients with ST-elevation myocardial infarction. In a retrospective observational study conducted in Victoria, Australia, emergency medical service delay time was found to be independently associated with 30-day mortality in the general population. For each 30-minute increase in delay, the adjusted odds ratio (AOR) was 1.20 (95% CI 1.02 to 1.40, p=0.025). Among the total population, 234 (7.9%) patients died within 30 days of undergoing primary percutaneous coronary intervention (PPCI). Patients who did not survive had a longer median emergency medical service delay time (59 minutes, interquartile range [IQR] = 11–74) compared to those who survived (51).

This pattern of delayed treatment leading to worse outcomes is further supported by research from Germany, which examined 20,005 PCI-treated STEMI patients. In this study, patients with symptom-to-contact times between 1 and 2 hours had the lowest mortality rate (4.9%). However, as the duration from symptom onset to medical contact increased (2–24 hours), mortality rates rose (6.0%–7.3%)(89).

In addition, door-to-balloon (D2B) time has emerged as a crucial factor influencing the outcomes of STEMI patients. For example, a large study conducted in Korea, involving 5243 STEMI patients treated with primary PCI, found that reducing D2B time had a profound impact on 1-year mortality.

The median D2B time was 59 minutes, and 92.2% of patients had D2B ≤90 minutes. Longer D2B time was independently linked to higher mortality (adjusted hazard ratio, 1.90; P<0.001). Patients with D2B ≤45 minutes had the lowest 1-year mortality (4.6%), while mortality increased with longer D2B times: 6.3% (46–60 min), 7.5% (61–90 min), and 17.5% (>90 min) (P<0.001). Reducing D2B time to ≤45 minutes significantly improved survival(90).

In a separate Japanese study involving 527 STEMI patients, the impact of door-to-balloon (D2B) time on in-hospital mortality was assessed. The study showed that patients with D2B ≤30 minutes had the lowest in-hospital mortality rate at 0.7%, compared to 5.0% for those with D2B between 31–60 minutes, 11.7% for D2B between 61–90 minutes, and 12.5% for D2B >90 minutes. The study concluded that shorter D2B times were significantly associated with better clinical outcomes, with those treated in ≤30 minutes showing notably improved survival rates(91).

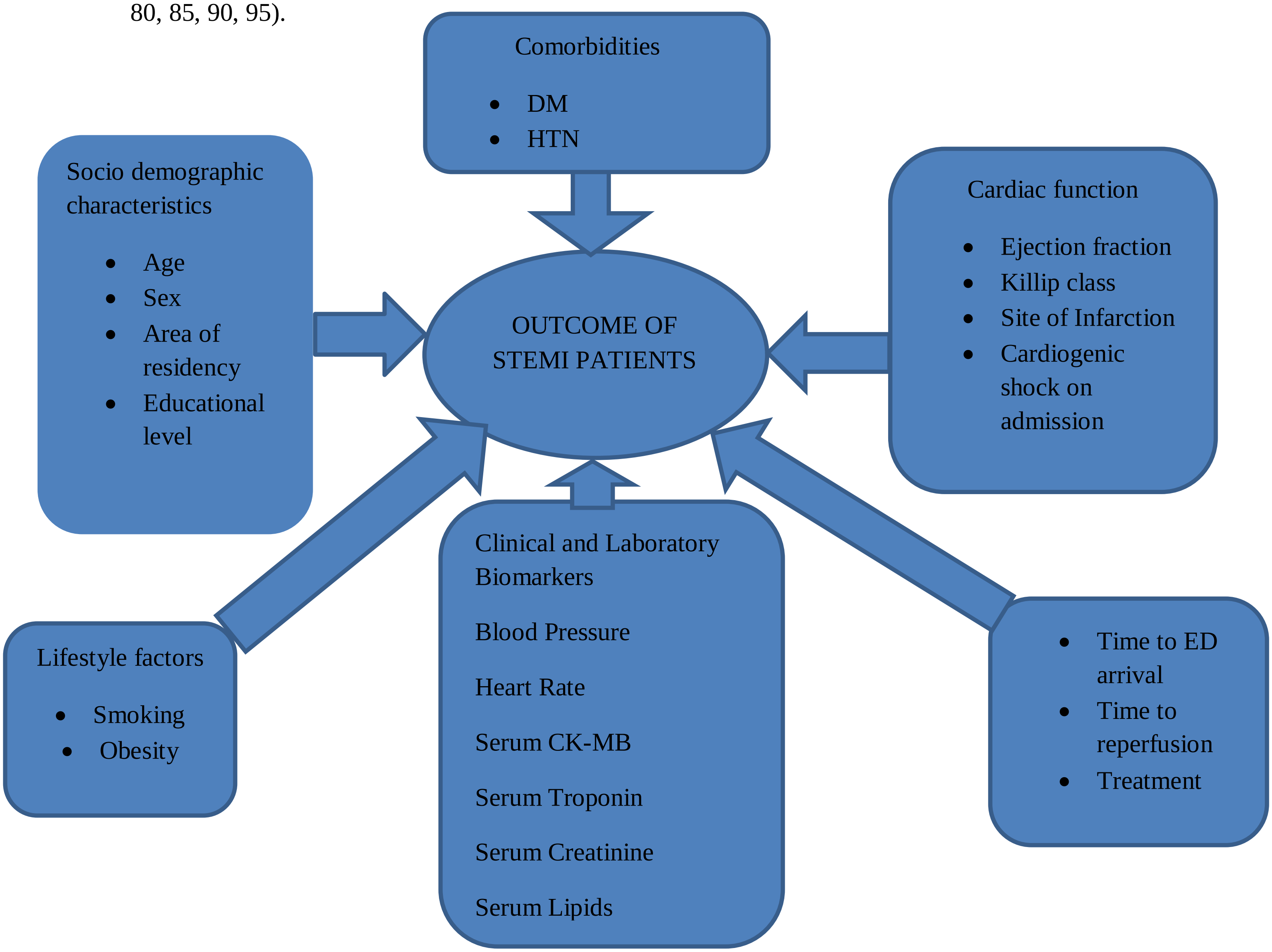
Moreover, a parallel study in Korea, conducted in a different year, found that late presenters (D2B >12 hours) experienced a higher in-hospital mortality rate of 8.0%, compared to 5.3% for early presenters (D2B <12 hours; P = 0.006), further underscoring the vital role of timely treatment in optimizing patient outcomes(92). In addition, a study from Somalia's largest PCI center, the Mogadishu Somali Turkish Training and Research Hospital, highlighted the significant impact of door-to-balloon (D2B) time on patient outcomes. The median D2B time was reported at 169 minutes, with a substantial number of patients experiencing delays of more than 90 minutes. Such delays were strongly correlated with a poor prognosis, reflected in a high mortality rate of 24%(93).

Timely fibrinolysis is a key determinant of STEMI outcomes. In this context, a Canadian study found that 21.4% of patients received fibrinolysis, with a 30-day mortality rate of 3.3% for those treated within 30 minutes and 8.6% for those with a door-to-needle time exceeding 30 minutes(94). In a complementary finding, a study in South San Francisco demonstrated that shorter door-to-needle times were linked to lower in-hospital mortality: 2.9% for ≤30 minutes, 4.1% for 31–45 minutes, and 6.2% for >45 minutes ($p<0.001$). Adjusted odds ratios for death were 1.17 for 31–45 minutes and 1.37 for >45 minutes ($p<0.001$)(95).

These reviewed studies provide valuable insights into in-hospital mortality and its predictors among STEMI patients worldwide, identifying in-hospital mortality and key outcome predictors of STEMI patients. However, there is limited data addressing in-hospital mortality and its predictors in the Ethiopian context. This study aims to fill this by investigating in-hospital mortality and its predictors at Gesund Cardiac and Medical Center.

2.8 CONCEPTUAL FRAMEWORK

This conceptual framework is developed after reading different literatures (58, 60, 63, 65, 68, 73, 80, 85, 90, 95).



This conceptual framework shows that factors such as socio demographic characteristics, comorbidities, lifestyle factors, cardiac function, clinical and laboratory biomarkers, time to ED presentation, and time to reperfusion are predictors that can influence the outcome of STEMI patients.

Figure 1: Conceptual framework showing the relationship between independent variables and outcome of STEMI patients.

CHAPTER THREE: OBJECTIVES

3.1 General objective

- To assess in-hospital mortality and its predictors among ST- segment elevation myocardial infarction patients at gesund cardiac and medical center, Addis Ababa, Ethiopia, 2025.

3.2 Specific objective

- To measure in-hospital mortality of ST-segment elevation myocardial infarction patients at Gesund cardiac and medical center Addis Ababa, Ethiopia 2025.
- To identify outcome predictors of ST-segment elevation myocardial infarction patients at Gesund cardiac and medical center, Addis Ababa, Ethiopia 2025.

Research Questions

- ✓ What is the in-hospital mortality rate among patients diagnosed with ST-segment elevation myocardial infarction (STEMI) at Gesund Cardiac and Medical Center, Addis Ababa, Ethiopia, in 2025?
- ✓ What are the predictors of in-hospital mortality among STEMI patients treated at Gesund Cardiac and Medical Center in 2025?

CHAPTER FOUR: METHODOLOGY

4.1 study area and period

The study was conducted at Gesund Cardiac and Medical Center (GCMC), a private cardiac center in Addis Ababa, Ethiopia. Established in 2017 G.C. in Lemi Kura Sub-city, GCMC soon became one of the prime choices for specialized cardiovascular services, having served more than 33,520 patients to date. Although quite new in the health care service, the center has made an overnight change through the provision of quality and essential cardiac services.

It provides the full range of diagnostic and interventional care, including echocardiography, stress testing, cardiac catheterization, MRI, CT scan, ultrasound, and nuclear medicine. It also provides specialty interventions like artificial heart valve implantation; pacemaker implantation, vascular surgery, and cardiac arrest management. Curiously enough, GCMC provided intensive care for patients with myocardial infarction. The hospital operates with 32 beds for inpatients and its own complement of two cardiologists, three specialists, and over 25 other nurses and medical professionals, thereby making it a significant cardiovascular treatment hospital in Ethiopia. The study was conducted among ST-segment elevation myocardial infarction patients diagnosed at Gesund Cardiac and Medical Center in the emergency room from February 2023 to January 2025 G.C.

4.2 Study design

An institution-based retrospective cross-sectional study design was executed

4.3 Population

4.3.1 Source of population

All MI treated patients at the adult ED of Gesund Cardiac and medical Center.

4.3.2 Study Population

All STEMI treated patients at the adult ED of Gesund cardiac and medical center from February-2023 to January 2025 G.C.

4.3.3 Study unit

Selected individual medical record cards of STEMI patients drawn from the final sample size at the adult ED of Gesund Cardiac and Medical Center from February-2023 to January 2025 G.C.

4.4 Sample size determination

The sample size for this study was determined using the single population proportion formula.

$$n= \frac{Z^2 p(1-p)}{D^2}$$

Where n = Sample size needed for the study.

z = Z-value corresponding to the desired confidence level (1.96 for 95% confidence).

p = prevalence

q = Proportion not having the condition (1 - p).

d = margin of error taken as 5%

To calculate the sample size, the prevalence (P = 16.156%) was taken from previous systematic review study conducted here in Ethiopian on ACS patients. Even though the study did not assess predictors, it reported the overall mortality among STEMI patients to be 16.156%, making it the most relevant available estimate for calculating the sample size.(96).

$$n= \frac{1.96^2 0.162(1-0.162)}{0.05^2}$$

n=208

The final sample size was determined to be 208 participants. To account for a projected non-retrieval rate of 10%, an adjustment was made, resulting in a final sample size of 229 participants.

4.5 Sampling Technique and Method

For the current study, 229 eligible patients were randomly selected by lottery method from 1680 STEMI cases treated between 2023 and 2025 (sampling frame).

4.6 Inclusion and exclusion criteria

4.6.1. Inclusion criteria

- Age >= 18yrs old.
- All patients with a final diagnosis of STEMI.

4.6.2 Exclusion criteria

- Incomplete medical records (Incomplete medical charts are patient records missing crucial clinical data).
- Patients with end stage renal disease patients
- Cancer patients
- Patients who died before hospital arrival
- Death before STEMI diagnosis confirmation

4.7 Variables

Dependent variable

- Outcome of STEMI patients

Independent variable

- Age
- Sex
- Area of residency
- Educational level
- Cardiogenic shock on admission
- Clinical and Laboratory biomarkers
- Lifestyle factors like Smoking and Obesity
- Presence of chronic conditions like DM and HTN
- Time from symptom onset until ED presentation
- Time to Reperfusion
- Clinical parameters like Killip class, EF and Site of infarction

4.8 Operational definitions

- Any death occurring within hospitalization following a STEMI event is defined as in-hospital mortality (97).

- In-hospital mortality was assumed by maintaining the denominator as all STEMI patients who comprised the study and the numerator as the patients dying in the hospital.

- In-hospital mortality and discharge alive are the outcomes for this study.

- ST-elevation myocardial infarction (STEMI) is the most critical type of acute coronary syndrome, which involves almost complete or complete blockage of the coronary arteries(98).

- Left ventricular ejection fraction (LVEF) refers to a ratio of blood expelled from the ventricle during systole (stroke volume) to the volume of blood inside the ventricle at the end of diastole (end-diastolic volume) (18).

- Serum creatinine was elevated when it was >1.2 mg/dl(70).

- The Killip classification of the patient at hospital admission was defined as follows(99).

Killip class I: is no indication of heart failure (HF).

Killip class II: is evidence consistent with moderate to mild HF.

Killip class III: is evident pulmonary edema.

Killip class IV: is cardiogenic shock.

4.9 Data collection procedure and management

The data collection checklist was derived from a previously validated tool that had been utilized previously within Ayder Comprehensive Specialized Hospital and took care to ensure it was carefully tailored to the local STEMI patient context through expert review among cardiologists alongside literature consultation pertinent to the subject matter (66, 100). It covered significant domains like socio-demographic details, clinical presentations, diagnosis, treatment, reperfusion therapies and in-hospital events.

A pretest on 5% of the charts helped in clarifying ambiguous items; e.g., Killip classes I, II, III, and IV were originally entered separately, but after consultation with cardiologists—since cardiogenic shock represents Killip class IV, Killip class I and II were grouped together and class III and IV were combined to avoid duplication. Expert opinion guaranteed content validity and internal consistency was adequate (Cronbach's alpha = 0.78). Three master's level emergency and critical care nurses collected the data under the direction of two trained coordinators to ensure quality and protocol adherence. Twenty-eight incomplete charts were excluded after thorough review.

4.10 Data quality control

To ascertain data quality, a pretest was carried out on 5% of the respondents in Black Lion Specialized Hospital. Following the pretest, the unclear and inappropriate questions were rephrased for improved clarity and appropriateness. Data collectors were also trained to assure completeness of response to the checklist before actual data collection began. The principal investigator routinely monitored the process of data collection and cross-checked the data for accuracy and completeness. Upon finalization of data collection, completed checklists were collected and carefully examined for conformity.

4.11. Data analysis

After data cleaning, data were entered into EpiData 4.6 and analyzed with SPSS version 27. Descriptive statistics summarized patient characteristics. The outcome was in-hospital mortality versus discharge alive. Bivariate logistic regression was used to assess associations with independent variables: age, sex, area of residence, educational level, cardiogenic shock at admission, smoking status, obesity, diabetes mellitus, hypertension, time from symptom onset to emergency department presentation, time to reperfusion, Killip class, ejection fraction, site of infarction, and relevant laboratory biomarkers. Variables with $p < 0.25$ and strong clinical relevance were included in the multivariable model, considering the limited events ($n = 17$) and EPV guidelines. Multicollinearity was checked (VIF < 10), and model fit was confirmed with the Hosmer–Lemeshow test ($p = 0.76$). AORs with 95% CIs and $p < 0.05$ were reported. Missing data were minimized through careful record review.

4.12. Ethical consideration

Ethical approval was received from the Addis Ababa University, Department of Emergency and critical care nursing research committee, under protocol number 14/CHS/2025.Furthermore, approval was also requested from the emergency service director at Gesund Cardiac and Medical Center to view patient information. During the process, confidentiality was maintained at all costs by steering clear of personal identifiers and employing anonymous codes. The Kobo server was also kept secure with access only granted to the principal investigator. Kobo data exported were stored on a password-protected computer, and confidentiality and data privacy training was done for all data handlers.

4.13 Dissemination of the result

The main findings, conclusions, and recommendations of the study will be systematically presented and reported to relevant stakeholders. This information will be disseminated to the Department of Emergency Medicine and Critical Care Nursing at Addis Ababa University, the Gesund Cardiac and Medical Center, the Addis Ababa Health Bureau, and the Federal Ministry of Health (FMOH). Furthermore, the research paper will be submitted to national and international peer-reviewed scientific journals for possible publication.

CHAPTER FIVE: RESULTS

5.1 Socio-demographic characteristics

A two-year retrospective study was conducted from 2023-2025 among 229 STEMI patients. Out of those patients, the majority of patients were male (n=198, 86.5%), with a mean age of 59.27 years (SD ± 8.93), ranging from 43 to 85 years. Urban residents and self-referrals were found to be 165 patients (72) and 156(68%) respectively. With respect to educational level, 30(13.1%) patients did not attend formal education and 69 patients had a degree or higher (30.1%).

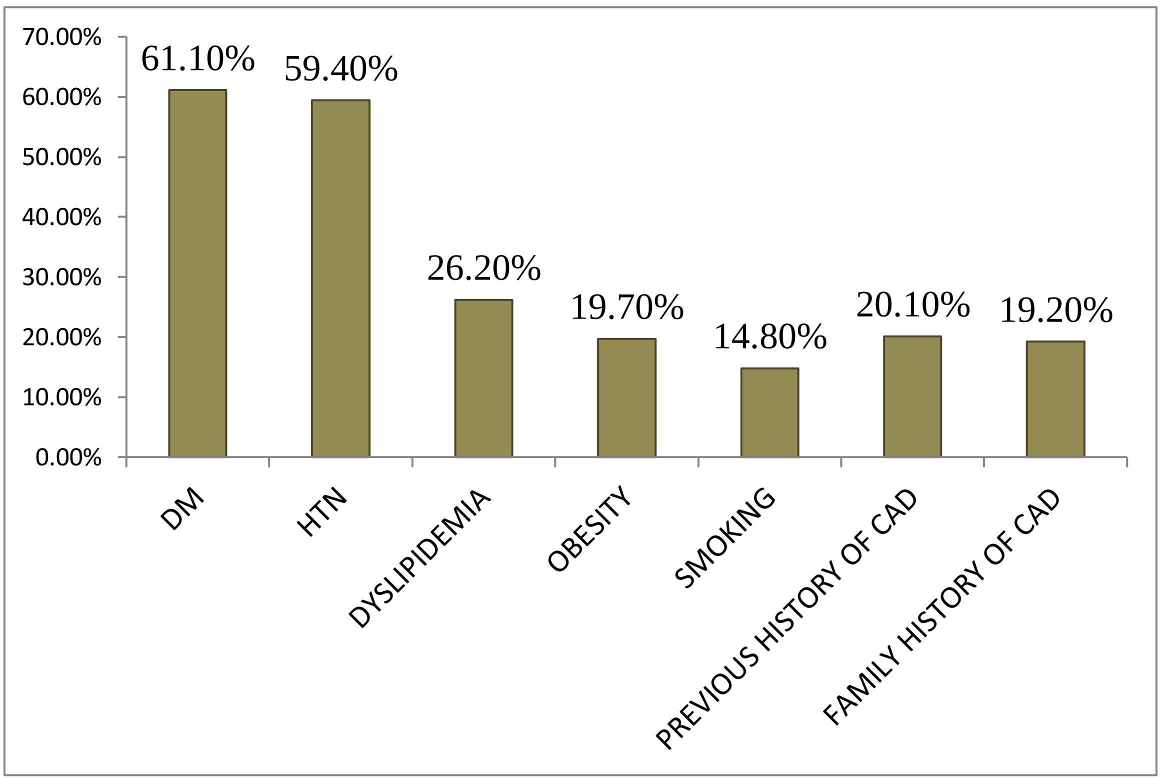
Table1:-Socio-demographic distribution of ST-segment elevation myocardial infarction patients at Gezund cardiac and medical center, Addis Ababa, Ethiopia from 2023-2025 G.C

Variable	**In-hospital mortality**		**Total frequency (%)(n=229)**
	Yes Freq(%)	No Freq(%)	
Sex			
Male	5(2.6)	193(97.4)	198(86.5)
Female	12(38.7)	19(61.3)	31(13.5)
Total	17(7.4)	212(92.6)	229(100)
Age			
<55	1(1.4)	69(98.6)	70(30.6)
55-65	8(10.4)	69(89.6)	77(33.6)
>65	8(9.8)	74(90.2)	82(35.8)
Total	17(7.4)	212(92.6)	229(100)
Residence			
Urban	7(4.2)	158(95.8)	165(72)
Rural	10(15.6)	54(84.4)	64(28)
Total	17(7.4)	212(92.6)	229(100)
Referral Status			
Self-referral	6(3.8)	150(96.2)	156(68)
Referred from another HCI	11(15.1)	62(84.9)	73(32)
Total	17(7.4)	212(92.6)	229(100)
Educational level			

No formal education	6	24	30(13.1)
Primary	4	33	37(16.2)
Secondary	3	40	43(18.8)
College diploma	2	48	50(21.5)
Degree & above	2	67	69(30.1)
Total	17(7.4)	212(92.6)	229(100)

5.2 Comorbidities and Life style factors

Diabetic mellitus was the most common (n = 140, 61.1%), and this was followed by hypertension (n = 136, 59.4%).



Keys: DM= Diabetes Mellitus, HTN=Hypertension, CAD= Coronary Artery Disease

Figure 2: Comorbidities and Life style factors of ST-segment elevation myocardial infarction patients at Gezund cardiac and medical center, Addis Ababa, Ethiopia from 2023-2025 G.C.

5.3 Clinical characteristics and Time to ED presentation

The mean heart rate, diastolic blood pressure and systolic blood pressure were 79.5 bpm (±14.1), 74.2 mmHg (±7.3), 109.8 mmHg (±12.6) respectively; only six patients (2.6%) had SBP of <90mmhg and DBP <60mmhg. Chest pain was the most common presenting symptom (n=197, 86%).

Table2: Clinical characteristics and Time to ED presentation of ST-segment elevation myocardial infarction patients at Gezund cardiac and medical center, Addis Ababa, Ethiopia from 2023-2025 G.C

Variable	**In-hospital mortality**		**Total Frequency (%) (n=229)**
	Yes Freq(%)	No Freq(%)	
HR			
≤60	0(0)	4(100)	4(1.8)
61-100	15(7.3)	190(92.7)	205(89.5)
>100	2(10)	18(90)	20(8.7)
Total			229(100)
SBP			
<90	1(16.7)	5(83.3)	6(2.6)
90-119	9(6.5)	130(93.5)	139(60.7)
120-129	4(6.9)	54(93.1)	58(25.3)
130-140	2(8.7)	21(91.3)	23(10)
>140	1(33.3)	2(66.7)	3(1.4)
Total			229(100)
DBP			
<60	2(33.3)	4(66.7)	6(2.6)
60-69	3(18.8)	13(81.2)	16(7)
70-79	3(3)	98(97)	101(41.1)
80-90	8(8.1)	91(92)	99(46.2)
>90	1(14.3)	6(85.7)	7(3.1)
Total			229(100)

Presenting symptoms			
Chest pain			
Yes	5(2.5)	192(97.5)	197(86)
No	12(37.5)	20(62.5)	32(14)
Total			229(100)
Shortness of breath			
Yes	4(3.1)	126(96.9)	130(56.8)
No	13(9.1)	86(60.1)	143(43.2)
Total			229(100)
Sweating			
Yes	3(2.5)	115(97.5)	118(51)
No	14(12.6)	97(87.4)	111(49)
Total			229(100)
Easy fatigability			
Yes	2(2.4)	80(97.6	82(35.8)
No	15(10.2)	132(89.8)	147(64.2)
Total			
Palpitation			
Yes	1(5.3)	18(94.7)	19(8.3)
No	16(7.6)	194(92.4)	210(91.7)
Total			
Nausea/Vomiting			
Yes	1(4.3)	22(95.7)	23(10)
No	16(7.8)	190(92.2)	206(90)
Total			
Abdominal pain			
Yes	1(3.6)	27(96.4)	28(12)
No	16(8)	185(92)	201(88)
Total			229(100)

Time to ED presentation			
<1 hrs.	0(0)	0(0)	0(0%)
1-12 hrs.	5(5.7)	83(94.3)	88(38.4)
13-72 hrs.	5(6.8)	69(93.2)	74(32.3)
>72 hrs.	7(10.4)	60(89.5)	67(29.3)
Total			229(100)

Keys**:** HR – Heart Rate, SBP – Systolic Blood Pressure, DBP – Diastolic Blood Pressure ED=Emergency department

5.4 Laboratory and diagnostic investigations

Up on presentation 70 (30.6%) patients had elevated creatinine levels (>1.2 mg/dl), with a mean creatinine value of 2.4 mg/dl, a finding with significant clinical implications. The lipid profile reveals the mean total cholesterol, LDL, HDL, and triglycerides to be 176.10mg/dl (±34.81), 92.62mgdl (±20.056), 41mg/dl (±8.111) mg/dl, and 131.00(±21.401) respectively. Eighteen patients (7.9%) had LVEF of ≤30%.

Table 3: Laboratory and diagnostic investigations of ST-segment elevation myocardial infarction patients at Gezund cardiac and medical center Addis Ababa, Ethiopia from 2023-2025 G.C(n=229)

Variable	**In-hospital mortality**		**Total Frequency (%) (n=229)**
	Yes freq(%)	No freq(%)	
Creatinine			
≤1.2	5(3.1)	154(96.9)	159(69.4)
>1.2	12(17.1)	58(52.9)	70(30.6)
Total			229(100)
CK-MB			
>=5	2(6.9)	27(93.1)	29(12.7)
<5	0(0)	0(0)	0(0)
Total			29(12.7)

Troponin			
>=5000	17(7.4)	212(92.6)	229(100)
<5000	0(0)	0(0)	0(0)
Total			229(100)
TC			
≤200	14(9.5)	134(90.5)	148(73.3)
>200	3(5.6)	51(94.4)	54(26.7)
Total			202(100)
LDL			
≤100	131(90.3)	14(9.7)	145(71.8)
>100	3(5.3)	54(94.7)	57(28.2)
Total			202(100)
HDL			
>40	8(5.1)	148(94.9)	156(77.2)
≤40	9(19.6)	37(80.4)	46(22.8)
Total			202(100)
TGs			
≤150	14(9.6)	132(90.4)	146(72.3)
>150	3(5.4)	53(94.6)	56(27.7)
Total			202(100)
LVEF			
≤30%	12(66.7)	6(33.3)	18(7.9)
>30%	206(97.6)	5(2.4)	211(92.1)
Total			229(100)
Killip class			
I&II	2(1)	197(99)	199(86.9)
III&IV	15(50)	15(50)	30(13.1)
Total			229(100)

Key: LVE
F=Left Ventricular Ejection Fraction

5.5 Site of infarction

More than half of patients presented with anterior infarction (n=139, 60.7%), followed by inferior infarction in 69 patients (30.1%).

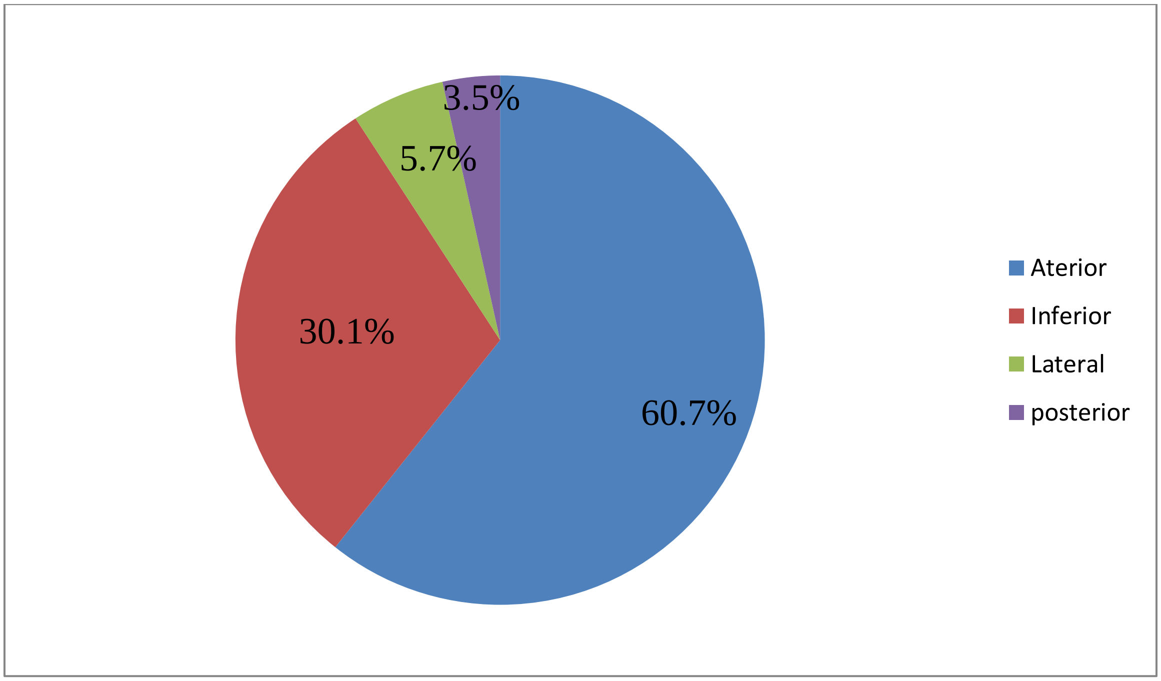


Figure 3: Site of infarction for ST-segment elevation myocardial infarction patients at Gezund cardiac and medical center, Addis Ababa, Ethiopia from 2023-2025 G.C.

5.6 Treatments provided during hospitalization

On admission, 227 patients (99.1%) received DAPT, 226 (98.7%) Clopidogrel, 225 (98.3%) Morphine, 225 (95.6%) Beta blockers, 218 (95.2%) Nitroglycerin, and 136 (59.4%) ACE/ARBs. In contrast, anticoagulants were given to only 90 patients (39.3%). Thrombolytic were given to 85 patients (37.1%), with 69 patients received within the recommended door-to-needle time (<30 minutes). And most patients (144, 62.9%) benefited from PCI.

Table 4: Treatments provided during hospitalization for ST-segment elevation Myocardial Infarction Patients at Gezund Cardiac and Medical Center Addis Ababa, Ethiopia from 2023-2025 G.C (n=229)

Reperfusion therapy With Timeline	**In-hospital mortality**		**Total frequency (%) (n=229)**
	Yes freq(%)	No freq(%)	
Thrombolytic	5(5.9)	80(94.1)	85(37.1)
Door to needle time			
<30mn	1(1.4)	68(98.6)	69(30.1)
30-45mn	1(9.1)	10(90.9)	11(4.8)
>45mn	3(80)	2(20)	5(2.2)
Total			85(37.1)
PCI	12(8.3)	132(91.7)	144(62.9)
Door to balloon time			
<90 mn	5 (10.4)	43(89.6)	48(21.0)
90-120mn	5(8.1)	57(91.9)	62(27.1)
>120mn	2(5.9)	32(94.1)	34(14.8)
Total			144(62.9)
CABG	0(0)	0(0)	(0)

Keys: GABG= Coronary Artery Bypass Grafting, PCI=Percutaneous coronary intervention.

5.9 In hospital mortality and complications

The overall in-hospital mortality was (7.4%, n=17) and the most common STEMI-related complication was heart failure, which was in about (10.5%, n=24) of patients.

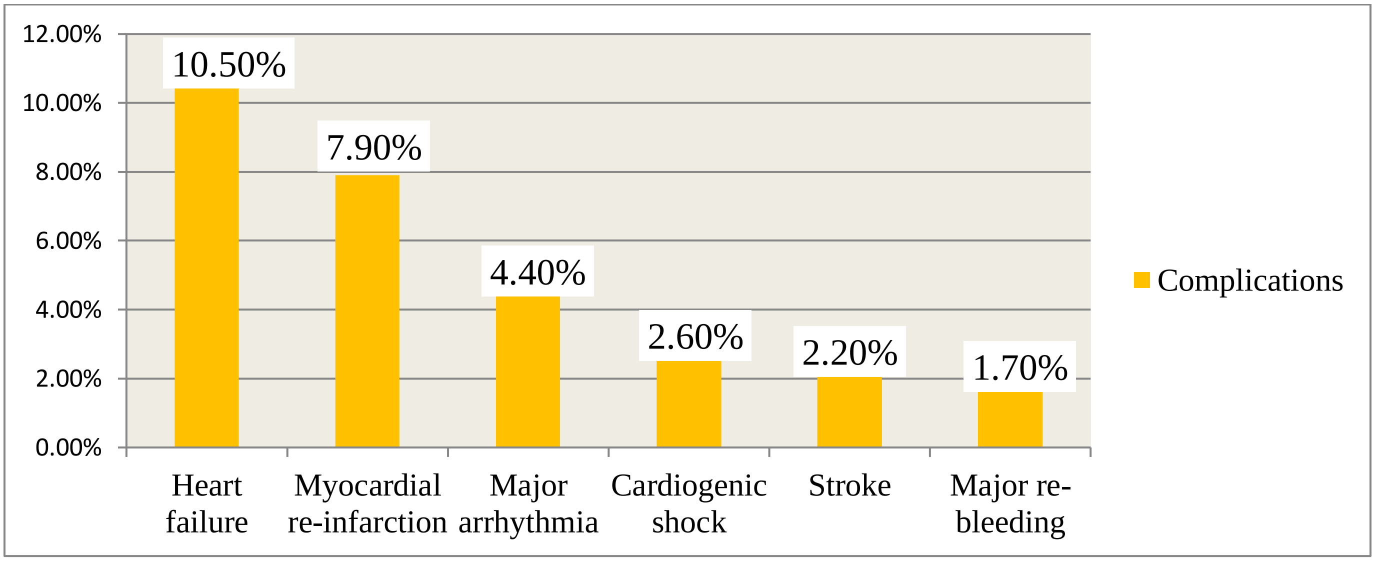


Figure 5: In hospital Mortality and complications of ST-segment elevation myocardial infarction patients at Gezund cardiac and medical center Addis Ababa, Ethiopia from 2023-2025 G.C.

5.11 Factors affecting outcome of STEMI patients

The outcome of interest was in-hospital mortality versus being discharged alive. Associations between independent variables and the outcome were initially assessed using bivariate logistic regression. Variables with a p-value <0.25—including age, sex, area of residence, educational level, cardiogenic shock on admission, clinical and laboratory biomarkers, lifestyle factors such as smoking and obesity, comorbidities like diabetes mellitus and hypertension, time from symptom onset to emergency department presentation, time to reperfusion, and clinical parameters such as Killip class, ejection fraction, and site of infarction—were considered as candidates for multivariable analysis. Due to the limited number of events (n=17), to avoid over fitting, only variables with p <0.25 in bivariate analysis and strong clinical relevance were included in the final multivariable model, in line with standard statistical guidelines for events-per-variable (EPV) considerations. Accordingly, Killip class III&IV (COR = 6.8; AOR = 6.2; 95% CI: 2.9–13.1; p = 0.001) and reduced ejection fraction (COR = 4.7; AOR = 4.1; 95% CI: 1.8–9.2; p = 0.004) remained as independent predictors of in-hospital mortality.

Table 5:In-hospital mortality predictors of STEMI patients at Gezund cardiac and medical center Addis Ababa, Ethiopia from 2023-2025 G.C (n=229)

Variables		In hospital mortality		**COR(95%CI)**	P-Value	**AOR(95%CI)**	P-Value
		Yes Freq(%)	No Freq(%)				
Killip class	I&II	15(7.1)	197(92.9)	1		1	
	III&IV	15(88.2)	2(11.8)	6.8 (3.2–14.5)	**<0.001****	6.2 (2.9–13.1)	**0.001****
LVEF (%)	<30	12(66.7)	6(33.3)	4.7 (2.0–10.8)	**0.002****	4.1 (1.8–9.2)	**0.004****
	>=30	5(2.4)	206(97.6)	1		1	

Statistically significant at P-value < 0.05

Keys: Keys: AOR= Adjusted odds ratio; COR= Crude odds ratio; LVEF=Left Ventricular Ejection fraction

CHAPTER SIX: DISCUSSION

This study was conducted to investigate the in-hospital mortality and its predictors among patients diagnosed with ST-segment elevation myocardial infarction (STEMI) at Gesund Cardiac and Medical Center in Addis Ababa, Ethiopia. The findings revealed an in-hospital mortality rate of 7.4% (n = 17). Advanced Killip class (III & IV) was significantly associated with mortality (COR = 6.8; 95% CI: 3.2–14.5; $p < 0.001$, AOR = 6.2; 95% CI: 2.9–13.1; $p = 0.001$). Similarly, reduced left ventricular ejection fraction (<30%) was an independent predictor of mortality (COR = 4.7; 95% CI: 2.0–10.8; $p = 0.002$, AOR = 4.1; 95% CI: 1.8–9.2; $p = 0.004$).

From a total of 229 ST-segment elevation myocardial infarction (STEMI) patients, the majority of participants in this study were male (n = 198, 86.5%), representing a higher proportion compared to findings from Indonesia (75.7%), Bangladesh (75%), Tanzania (83.5%), and Tunisia (82.3%) (27, 33, 34, 37). On the other hand, our finding is lower than that reported in an Asian population, where the male proportion was 89.4%(35).

The mean age distribution of ST-elevation myocardial infarction (STEMI) in Gezund cardiac and medical center was 59.27 years (SD ± 8.93).Which is higher than that reported in most studies, including North India (55 years), Bangladesh (55.75 years), and the broader Asian population (53.6 years) (31, 34, 35).

In the current study, the mean TC (176.10 mg/dl), LDL (92.62 mg/dl), HDL (41.00 mg/dl), and TG (131.00 mg/dl) were lower than in Taiwan (TC=181.25, LDL=118.35, HDL=43.15,TG =135.78 mg/dl) and Somalia (TC=197.6, LDL=81.3, HDL=66.1, TG=145.1 mg/dl) (38, 40). This variation may be attributed to differences in sample size, study design, and population characteristics. In the current setting, 30.1% of participants had attained higher education, which may promote healthier lifestyle choices. Additionally, the high prevalence of diabetes mellitus (61.1%) and hypertension (59.4%) may have led to earlier clinical intervention and lipid-lowering therapy, contributing to improved lipid control at the time of hospital presentation.

On the other hand, this finding is comparable to Iran's, where the mean TC was 171.04 mg/dl, LDL 98.00 mg/dl, HDL 41.03 mg/dl, and TG 131.70 mg/dl (39). This may be due to similar lifestyle factors, such as diet and physical activity.

Left ventricular ejection fraction (LVEF) is a key marker of heart function and prognosis after myocardial infarction (MI). In our study, 7.9% of patients had a severely reduced LVEF (<30%), a critical indicator of compromised cardiac function. This finding is comparable to the 8% reported in India(43). The rationale behind this could be attributed to delays in pre-hospital emergency care, which hinder timely management and contribute to poorer left ventricular function. However, this proportion is lower than that observed in some regional studies. For instance, Hamad General Hospital in Qatar reported 19.5% of patients with LVEF <25%(41), Saudi Arabia recorded 24% of younger patients with LVEF <35%(42), and Senegal also noted 24% with LVEF <35% (45). The relatively lower rate in our study may reflect differences in sample size and study area.

The Killip classification is a valuable clinical tool for evaluating heart failure severity in patients with ST-elevation myocardial infarction (STEMI). In our study, 13.1% of patients were classified as Killip class III–IV. This finding is lower than the15% in Italy and 20.1% reported in Tanzania (27, 46). This variation may be attributed to differences in sample size, study setting, and population characteristics, as well as early presentation to healthcare facilities and pre-hospital management. In the current setting, a considerable proportion of patients arrived within the early hours of symptom onset, potentially limiting the progression to severe heart failure. Additionally, differences in diagnostic thresholds, healthcare infrastructure, and triage protocols may also influence the reported distribution of Killip classes across studies.

However, our result is higher than the 11.2% reported in Spain (47)and the 10% observed in Saudi Arabia (42). This could be explained by the fact that a significant proportion (7.9%) of our patients had a left ventricular ejection fraction (LVEF) of less than 30%, which reflects severe systolic dysfunction and is strongly associated with a higher Killip class at presentation. A higher incidence of anterior wall infarction, which typically involves larger myocardial damage, may also explain the increased proportion of patients in advanced Killip classes.

Regarding the medical management and reperfusion strategies for STEMI patients, our findings show notable variations when compared with other international studies. The use of Dual Antiplatelet Therapy (DAPT) in our study was 99.1%, which is higher than the 90.8% in the RO-STEMI registry and 85.3% reported in Abu Dhabi(26, 48). Similarly, Clopidogrel was used in 98.7% of patients—exceeding rates from both Abu Dhabi (85.3%) and Sri Lanka (95%) (48, 49). These higher rates may reflect strong adherence to current STEMI management guidelines in our setting.

Beta-blockers were prescribed to 95.6% of patients, which is also higher than the 73.2% in the RO-STEMI registry and slightly higher than 90.7% in Abu Dhabi(26, 48). This suggests a strong emphasis on medical treatment protocols. However, anticoagulant use was lower at 39.3%, in contrast to 94.7% in Abu Dhabi and 91% in Sri Lanka(48, 49). This difference may stem from variations in institutional protocols, concerns about bleeding risks in certain patients, and differences in drug availability or cost.

Likewise, ACE inhibitors/ARBs were prescribed in 59.4% of cases, which is lower than in Sri Lanka (95%) and Abu Dhabi (70.7%) (48, 49). This is possibly due to patient-related contraindications. With respect to reperfusion therapy, thrombolytics were administered in 37.1% of cases, which is notably higher than in the NORIN-STEMI study (13%) and the Moroccan STEMI registry (23.4%) (31, 50). This high rate may be attributed to early presentation to the emergency department and the fact that the study was conducted in a cardiac center where patients are more likely to receive timely thrombolytic therapy.

Meanwhile, PCI was performed in 62.9% of patients, closely aligning with the 66% in the NORIN-STEMI study but significantly higher than the 26.2% reported in Morocco (31, 50). The higher PCI rate observed in this study could be attributed to the study setting and sample size.

The in-hospital mortality of STEMI patients in this study was 7.4%. This in-hospital mortality is similar to the finding from the Romanian STEMI registry of 7.1%, USA 7.8% and 7.9% in Australia (26, 51, 52). This similarity could be due to strict adherence to standard treatment protocols, and also the study being conducted in a well-organized cardiac center with access to timely and quality care. These findings are higher than those from Tanzania at 5.7%, Morocco at 5.2% and South Africa at 6.2% (27, 50, 54). This difference could be explained by several factors, including a significant proportion of patients in our study presenting with higher Killip class and severely reduced LVEF on admission. Additionally, differences in sample size, study period, and study design across these countries may have contributed to the observed variations in mortality rates.

In this study, multivariate logistic regression analysis identified that patients with Killip class III and IV had a significantly higher risk of in-hospital mortality compared to those with Killip class I and II (AOR = 6.2; 95% CI: 2.9–13.1; $p = 0.001$). Additionally, a left ventricular ejection fraction (LVEF) below 30% was significantly associated with increased in-hospital mortality (AOR = 4.1; 95% CI: 1.8–9.2; $p = 0.004$).

In the current study, patients presenting with Killip class III and IV had 6.2 times higher odds of in-hospital mortality compared to those with Killip class I and II (95% CI: 2.9–13.1). This finding is consistent with multiple reports. For instance, the Italian retrospective study identified Killip class ≥3 as a significant predictor (HR = 2.29, $p = 0.04$)(57), while the RO-STEMI registry reported an even stronger association for Killip class II–IV (OR = 9.2, 95% CI: 6.2–13.6, $p < 0.0001$)(26). Similar results were found in Japan (Killip class > II: aOR = 7.438, $p < 0.001$)(61).

This strong association between higher Killip class and increased in-hospital mortality in our setting could be due to 10.5% of STEMI patients being complicated by heart failure. Another possible reason is that the majority of patients (60.7%) had anterior infarction, which typically causes more extensive heart muscle damage and leads to worse outcomes.

Furthermore, in the current study, an LVEF of less than 30% significantly predicted in-hospital mortality (AOR = 4.1; 95% CI: 1.8–9.2; $p = 0.004$). This aligns with previous literature emphasizing the prognostic importance of reduced systolic function. A study from Italy found that each unit decrease in EF was associated with higher mortality (HR = 0.97, $p = 0.02$)(57). In a subsequent study from the same setting, LVEF <40% was a key predictor (HR = 3.70, 95% CI: 1.30–7.87, $p = 0.0001$)(58).

The RO-STEMI registry also showed that LVEF of <35% was associated with worse outcomes (OR = 3.8, 95% CI: 2.6–5.4, $p < 0.0001$)(26). In Japan, EF <40% (aOR = 4.446, $p < 0.001$)(61) and in Pakistan, LVEF <40% ($p = 0.01$) were also linked to mortality(60). These consistent findings highlight the significance of severely reduced LVEF in STEMI prognosis. This strong link between low LVEF and mortality in our study could be due to 13.1% of patients presenting with Killip class III & IV. The other explanation could be the high prevalence of diabetes (61.1%) and hypertension (59.4%), which contributes to worse cardiac damage and outcome.

6.1 STRENGTH AND LIMITATIONS OF THE STUDY

This study is the first of its kind in Ethiopia to assess both in-hospital mortality and its predictors among patients with ST-segment elevation myocardial infarction (STEMI), contributing novel and context-specific evidence to the limited national literature. However, since the study was conducted at a single private center in Addis Ababa, the generalizability of the results to public hospitals or other regions of the country may be limited. Moreover, as the study only assessed short term outcomes during hospitalization, it did not capture post-discharge mortality or long-term outcomes, which are also important for understanding the full spectrum of STEMI prognosis.

6.2: CONCLUSION AND RECOMMENDATION

Taken together, the in-hospital mortality rate among STEMI patients was 7.4%. Killip class III–IV (COR = 6.8; 95% CI: 3.2–14.5, $p < 0.001$; AOR = 6.2; 95% CI: 2.9–13.1, $p = 0.001$) and severely reduced left ventricular ejection fraction <30% (COR = 4.7; 95% CI: 2.0–10.8, $p = 0.002$; AOR = 4.1; 95% CI: 1.8–9.2, $p = 0.004$) were independent predictors of poor outcomes. Addressing these critical factors requires coordinated efforts by the Ministry of Health, Addis Ababa Health Bureau, and Gesund Cardiac and Medical Center. Key strategies should include the implementation of rapid triage and risk stratification tools, targeted education and training programs for nurses on early recognition of STEMI symptoms, and policy-level interventions such as public awareness campaigns, enhanced ambulance services, and streamlined emergency department triage protocols. Moreover, future research is warranted to explore long-term outcomes and should involve multi-center studies with larger sample sizes.

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ANNEX: Questionnaires

1. SOCIODEMOGRAPHIC STATUS OF THE PATIENT

1.1Patient MRN_______________

1.2 Age:_______

1.3 Gender

A. Male

B. Female

1.4 Area of residence

A. Urban

B. Rural

C. Outside Ethiopia

1.5 Educational level

A. No formal education

B. primary

C. Secondary

D. College diploma

E. Degree & above

1.6 Referral status

A. Self-referral

B. Referred from another HCI

2. Initial Assessment

2.01 Blood Pressure _____ mmhg

2.02 Heart Rate ____B/min

2.03 Presenting symptoms

A. Chest pain

B. Shortness of breath

C. Sweating

D. Easy fatigability

E. Palpitation

F. Nausea/Vomiting

G. Abdominal pain

3. Laboratory and Diagnostic investigations

3.01Serum CK-MB measured

□ YES

If YES peak value____

□NO

3.02 Serum Troponins measured

□YES If YES peak value____

□NO

3.03 Serum Creatinine measured

□YES If YES peak value_____

□NO

3.04 Serum Lipid measured during admission

Total cholesterol □ YES _____mg/dl

□ NO

LDL cholesterol□ YES _____mg/dl

□ NO

HDL cholesterol □ YES _____mg/dl

□ NO

Triglyceride □ YES _____ mg/dl

□ NO

3.05 Echocardiogram performed □ YES □ NO

If Yes site of MI

A. Anterior Infarction

B. Inferior Infarction

C. Lateral Infarction

D. Posterior Infarction

3.06 Documented Ejection Fraction (EF)

A. <30% (Severely reduced)

B. 30–39% (Moderately reduced)

C.40–49% (Mildly reduced)

D.≥50% (Normal)

4. Comorbidities and lifestyle factors

A. Diabetic mellitus

B. Hypertension

C. Dyslipidemia

D. Smoking

E. Obesity with BMI>=30kg/m2

F. Previous history of MI

G. Family history of coronary artery disease

5. Killip class

A. Killip class I

B. Killip class II

C. Killip class III

D. Killip class IV

6. Duration of illness (time to ED room presentation after symptom onset)___________

7. Medical treatment commenced during hospitalization

A.DAPT

B. Clopidogrel

C. Anticoagulant

D. Beta blocker

E. Morphine

F. Nitroglycerine

G. ACEIs/ARBs

H. Calcium channel blockers

8. Time to ED presentation…....Hr

9. Reperfusion therapy/ revascularization

9.01 Thrombolytic therapy given □ YES □ NO

- If yes, Door to needle time

9.02 PCI performed □ YES □ NO

- If yes, Door to balloon time

9.03 CABG performed □ YES □ NO

10. in hospital Complication

A. Heart failure
B. Myocardial re-infraction
C. Major arrhythmia
D. Cardiogenic shock
E. Stroke
F. Major re-bleeding

11. Hospitalization outcome

A. Discharged alive

B. Death during hospital stay.

Declaration

I, the undersigned, hereby declare that the research titled "Risk factors, in-hospital mortality and factors affecting outcome of ST-segment myocardial infarction (STEMI) patients at gezund cardiac and Medical center, Addis Ababa Ethiopia 2025 G.C. This work has not been presented or submitted to any other university or institution for academic credit or publication".

I affirm that all sources of information and ideas utilized in the development of this thesis have been properly cited and referenced, ensuring due acknowledgment of the contributions of others. This research thesis reflects my independent efforts and commitment to advancing knowledge in the area of diabetes care and health literacy. I take full responsibility for the content of this thesis and assert that it is a product of my own intellectual endeavor.

Petros Melese H/Giorgis	______________	_____________
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Approved by:

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2. Lemlem Beza (PHD, Asst. Prof)	____________	____________

3. Dr.Bekele Alemayehu (M.D, internist, interventional cardiologist, associate professor)

____________ ____________

PLAGIARISM RESULT

IN-HOSPITAL MORTALITY AND ITS PREDICORS AMONG ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION PATIENTS AT GESUND CARDIAC AND MEDICAL CENTER, ADDIS ABABA, ETHIOPIA, 2025.

BY PETROS MELESE

SUBMISSION DATE: 19-JUN-2025 06:47AM (UTC+0300)

SUBMISSION ID: 2702111513

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