THE PROFILE OF PATIENTS PRESENTING WITH ST ELEVATION MYOCARDIAL INFARCTION (STEMI) TO A REGIONAL EMERGENCY DEPARTMENT IN GAUTENG, SOUTH AFRICA.

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A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, in partial fulfillment for the degree of Master of Medicine in Emergency Medicine

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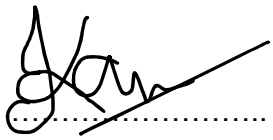
Declaration

I, Jerisha Kannai declare that this research report is my own work. It is being submitted for the degree of Master of Medicine in Emergency Medicine to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.



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The 09 day of November 2023

Dedication

I would like to dedicate this research project to my parents and husband. I am because of you. Thank you for your unwavering love and support that has carried me through all challenges and triumphs.

Acknowledgements:

A tremendous thank you to:

1. God, all things are possible under the protection of your omnipresent hand.

2. Mr. Martin Botha and Dr Pravani Moodley. This has been a long and difficult journey, thank you for your time, belief and consistent encouragement during the last 3 years. I have appreciated your expertise and guidance.

Abstract

Reasons for the research

Cardiovascular disease creates a significant health and socio-economic burden and accounts for 17 million deaths worldwide which equates to 31% of global deaths. (1) In addition, premature deaths from cardiovascular disease in the working population are predicted to increase by 41% by 2030. (2) STEMI is a global concern, with growing morbidity and mortality. (3, 4, 5, 6, 7) The continual increase in STEMI cases will burden our society and the economy. (3) There are few studies in South Africa (SA) on the STEMI population. Further baseline data on our population are required to inform efforts to improve our health system, patient care and to work towards international best practice.

Aims

a. To describe the demographic characteristics of patients presenting with STEMI.

b. To describe the clinical presentation (symptoms, signs, risk factors, time to treatment) of patients presenting with STEMI in a regional public hospital in Gauteng.

c. To determine if age, gender, race, time of presentation and level of prehospital care is associated with adverse outcomes or the need for additional interventions.

d. To compare outcomes of patients (admission to general ward / Cardiac Care Unit (CCU) / Intensive Care Unit (ICU) / death).

Methods

This was a retrospective observational transverse / cross sectional registry study. Data was collected from a STEMI register maintained at the Emergency Department (ED) of Tambo Memorial Hospital (TMH) from June 2018 until 31 July 2020.

Major results

In our study 68% of patients were male. The most common ages at presentation ranged from 40 - 69 years old, with a mean age of 54.4 years. The commonest risk factors included: being a smoker (77%), history of ischemic heart disease (71%), hypertension (55%). The highest prevalence - occurred in the Caucasian race group. Our population group was predominantly transported by private means (52%). Only 10.11% of patients scored red on triage and 30.34% scored orange. The mean duration of symptoms was less than 12 hours. The mean time: from door-to-ECG was 38.5 minutes, door- to- doctor's assessment was 31,4 minutes, door- to-adjuncts was 53,9minutes and door-to-needle was 101.9 minutes. The majority of patients were transferred out of the ED to cardiology (46.87%) and the general ward (40.62%).

Conclusion statement:

Within the public sector, SA does not have sufficient data on the STEMI population. The aim of this study was to shed light on the population at TMH. It is crucial to treat STEMI patients speedily and effectively. The findings of this study suggest that patients presenting with STEMI at TMH are similar to patients in other studies, but the time to treatment is longer than the recommended target times. These findings suggest room for improvement in the management of STEMI at TMH. Due to a small

sample size, we did not have significant results when analyzing the population group requiring special interventions.

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Abbreviations:

ACC: American College of Cardiology

ACS: Acute coronary syndrome

AHA: American Heart Association

ALS: Advanced life support

ANT: Paramedic

BAA: Basic Ambulance Assistant

BLS: Basic life support

CAD: Coronary artery disease

CCU: Coronary Care Unit

ECG: Electrocardiogram

ECP: Emergency Care Practitioner

ED: Emergency Department

EMS: Emergency medical services

HIV: Human immunodeficiency virus

HPCSA: Health Professions Council of South Africa

ILS: Intermediate life support

KZN: Kwa-Zulu Natal

MI: Myocardial infarction

OR: Odds ratio

PCI: Percutaneous coronary intervention

STEMI: ST elevation myocardial infarction

NSTEMI: Non-ST elevation myocardial infarction

ROSC: Return of spontaneous circulation

SA: South Africa

SATS: South African Triage Scale

UA: unstable angina

TMH: Tambo Memorial Hospital

1. Introduction

Cardiovascular disease creates a significant health and socio-economic burden and accounts for 17 million deaths worldwide. (1) This equates to 31% of global deaths, in addition, premature deaths from cardiovascular disease in the working population is predicted to increase by 41% by 2030. (2) In SA the annual cardiovascular mortality rates in the year 2000 reflected the following: 206.9 per 100 000 Indian people, 162.7 per 100 000 white people and 13.1 per 100 000 Black/African people. (8,9) Furthermore, an analysis of the SA Heart Registry data for 2004-2012 showed that 51% of acute coronary syndrome (ACS) were STEMI. The demographic distribution of these patients was as follows: African: 18%, mixed ancestry: 12%, Indian: 11%, Caucasian: 7%. (10) There appears to have been no further national research on the SA STEMI demographic.

Percutaneous coronary intervention (PCI) is the gold standard intervention for STEMI. This option is often not available within the target recommendation of 90 minutes in SA, resulting in many hospitals within SA still opting for thrombolysis. (5, 7, 8, 11) Thrombolysis is often not administered. When it is given, it is seldom within the 30-minute target time. (5, 10, 11, 12) A 2015 study at Steve Biko Academic Hospital in Pretoria revealed that only 37% of STEMI patients received thrombolysis. This study does not clearly comment on a 30 minute target, but states that only 3% of patients received thrombolysis within 60 minutes. Similarly, only 36% of patients in the SA ACCESS registry received thrombolysis from 2007-2008. (10) This was a prospective observational multinational registry consisting of 12 068 ACS patients from 134 sites in 19 countries in Africa, Latin America and the Middle East. A 2012

study in three Western Cape state EDs found that 43% of STEMI patients received thrombolysis. Unfortunately only 20.5% of these patients received thrombolysis within 30 minutes. (11)

Complications of STEMI include clinical instability, shock, cardiac dysrhythmias and death. (12) These complications lead to the need for additional interventions such as defibrillation, cardiopulmonary resuscitation (CPR), cardioversion, intubation, non-invasive ventilation (NIV) and the use of inotropes. (12 - 15) This subgroup would form the most critical portion of the STEMI population. There are no SA studies on this cohort.

Once diagnosed and managed, a patient should be admitted to a CCU for monitoring of complications such as dysrhythmias, cardiac failure and re-occlusion. (13, 14) In this environment complications can be detected timeously and prompt specialist intervention can be arranged. (13, 14)

The continual increase in STEMI cases will burden societies and economies internationally and begs further research. (3, 8, 14) The aim of this study was to retrospectively assess a STEMI register at a regional public hospital in Boksburg, Gauteng, SA. This primary investigation focused on STEMI patient demographics, time to thrombolysis and significant patient presenting factors. A further goal was to ascertain if these characteristics have changed compared to previous SA data or to international studies and standards. In contrast to previous studies, I have also focused on location of infarct, atypical presentations, the use of additional

interventions and patient disposition. I have found no current SA data on these elements.

2. Literature review

ACS comprises of STEMI, Non- ST elevation myocardial infarction (NSTEMI) and unstable angina (UA). (12, 14, 16, 17, 18) STEMI is diagnosed on an electrocardiogram (ECG) with 1mm ST elevation or greater in contiguous leads with reciprocal changes. (14, 19, 20) There are 6 types of STEMI that are described - this study focuses on type 1. (3, 14, 20, 21) Type 1 ischemia results from atherosclerotic plaque rupture leading to decreased blood flow within the coronary arteries. (3, 14, 16, 17, 21) The key principles in managing a STEMI are based on pathophysiology and the time to irreversible myocardial injury. (12) Restoring blood flow in the artery as quickly as possible reduces the infarct size and improves clinical outcomes. (5, 7, 10, 12, 13, 21, 22, 23, 24) The fundamental goals of managing an acute STEMI include, minimizing the duration of ischemia, rapidly establishing reperfusion, preventing recurrent ischemia, managing dysrhythmias and mechanical complications, and modifying underlying atherosclerosis for secondary prevention. (12, 13)

2.1 STEMI Demography

2.1.1 Age and gender

In North America, STEMI remains more prevalent in men with the average age of first presentation occurring at 65.6 years in men and 72 years in women. (14) The risk of STEMI increases with age - presentation before 40 years of age is uncommon. (3, 6, 14) Another North American 2016 retrospective study of 3914 STEMI patients demonstrated that 67.9% of STEMI patients were males aged between 60-64 years. (1) A French study in 2015 showed that 76.5% of 1533 STEMI

patients were male with a mean age of 62.7 years. (19, 24) SA studies in Durban, Ladysmith, Cape Town, Tygerberg reported age ranges of 54-64 years. (5, 8, 11, 17)

The high burden of human immunodeficiency virus (HIV) in SA appears to influence presentation. A 2021 Cape Town study revealed that STEMI patients with HIV appear to be predominantly male who present at a younger age (+/- 50 years old) and have fewer traditional medical risk factors. (25) The causes for coronary artery disease (CAD) in the HIV population are thought to arise from: subclinical dyslipidemia, immune dysfunction and persistent chronic inflammation. (26) Along the spectrum of ACS, HIV positive patients were found to be more commonly diagnosed with STEMI. (25) Their pathology often resulted from single vessel disease. (25, 26)

2.1.2 Race

There are few SA data based on the STEMI demographic which makes analysis and comparison of racial distribution difficult. A few small registry studies have been conducted at individual hospitals, but this does not provide a complete picture. Each province may vary in racial predominance. The following studies are an example of this. The SA Heart Registry recorded 5747 patients with ACS nationally with the following racial distribution of STEMI: African -18%, Caucasian - 7%, mixed ancestry -12% and Indian -11%. (10) This demographic varies drastically in comparison to the following 2 studies carried out in Kwa-Zulu Natal (KZN). A 2015 registry study conducted in Durban showed the following racial distribution: 60% Indian, 25% white and 15% black. (8) A 2021 Ladysmith ACS study reflected the following racial distribution: 64.4% Indian, 22.5% Black, and 13.1% white. (17)

2.2 STEMI: Clinical presentation

2.2.1 Risk Factors

The risk factors for STEMI can be divided into modifiable and non-modifiable categories. Typical modifiable risk factors include: diabetes, dyslipidemia, hypertension and smoking. (16, 17, 27, 28) Non-modifiable factors comprise age, gender and genetics. (16, 17) The prevention of STEMI rests on the control of modifiable risk factors. (14) More studies are showing a trend towards younger presentation with fewer modifiable risk factors present. (3, 19, 27, 29)

In a 2019 New Delhi study, 33% of STEMI patients were less than 50 years old, with nearly a third of those being under 40. Young patients were more likely to be men, obese, non-vegetarian and smokers and less likely to have any history of typical modifiable risk factors. (29) A 2021 study in Madras found that 20.9% of STEMI patients did not have traditional modifiable risk factors. (27) Individuals who present with STEMI in the absence of typical modifiable risk factors have a significantly increased risk of all-cause mortality at 30 days, compared with those with at least one risk factor. This was particularly evident in women. (28, 30)

2.2.2 Symptoms

While chest pain remains the most common symptom in patients with ACS, this is not always present. (6, 16, 21, 31) Among ACS patients with atypical symptoms, the most common presenting symptom is dyspnea, followed by diaphoresis, nausea/vomiting, and syncope. (6, 18, 31) Other symptoms include changes in mental status, “indigestion” and generalized weakness or fatigue. (18) Early recognition of symptoms is vital for the best outcome. Many patients and bystanders are either unaware, or do not recognize atypical symptoms. (12, 16) A 2012 Cape

Town study found that 11.2% of confirmed ACS patients presented atypically. (11) A 2021 study in Ladysmith reflected that a quarter of the study population presented with atypical chest pain. (17) Longer time delays have been seen in the elderly, women and diabetics likely secondary to atypical symptoms. (13, 16, 18, 23) A high index of suspicion is thus imperative when evaluating these special groups. (18)

2.2.3 The role of Emergency Medical Services (Pre-hospital)

The American Heart Association (AHA) and American College of Cardiology (ACC) promote education of the community and establish networks for hospital referral. (13, 32) This begins with prehospital identification of STEMI patients and early activation of a PCI laboratory. (13, 21) Emergency medical service (EMS) providers should administer aspirin and record a 12-lead ECG. A reperfusion checklist should be reviewed with patients who meet STEMI criteria. (13, 21) The ECG and checklist is presented to the receiving facility. (13) If door-to-balloon time is less than 90 minutes, patients should be transferred directly to a PCI-capable facility. (12, 13, 21, 22) Patients who present to, or are transported to, a non-PCI facility are then secondarily transported to a PCI facility, if a door-to-balloon time of 120 minutes can be achieved. If door-to-balloon time of 120 minutes is not possible, the patient should receive thrombolysis within 30 minutes of first medical contact. (8, 13, 15, 21) Transfer to PCI facility is then considered. (13, 21)

In contrast, SA prehospital resources in relation to the needs of the population are desperately mismatched. (33) Due to these constraints even when an ambulance is called, it may only arrive many hours after onset of symptoms. This leads to a delay in presentation, diagnosis and definitive management. The more prolonged the coronary artery blockage, the more cardiac muscle injury will result. (7, 10, 13, 15,

21, 23) This can also contribute to clinical instability, morbidity and death. (5, 22, 34) Most ambulances are staffed with basic life support (BLS) and intermediate life support (ILS) providers due to scarcity of advanced life support (ALS) personnel. (35, 36) In September 2022, SA had 976 Emergency Care Practitioners (ECPs), 1684 Paramedics (ANT) and 1056 Emergency Care Technicians (ECT) registered with the Health Professions Council of South Africa (HPCSA). (37) This is a far cry from the minimum number of ECPs considered essential to deliver optimal prehospital care. (33, 36) If a Basic Ambulance Assistant (BAA) arrives on scene, aspirin could be given but an ECG would not be done, since this is beyond their scope of practice. The patient is then transferred to nearest facility within that geographical drainage area, and not necessarily to a PCI-capable facility, which would delay definitive intervention. These patients receive thrombolysis at the presenting hospital and are then transferred to a PCI facility. (5, 7, 8, 11) In April 2017, there were a total of 62 PCI-capable facilities in SA, of which 23% were located in the government sector. (7)

2.2.4 Prehospital Thrombolysis

Thrombolytic agents dissolve existing thrombus and should be administered within 30 minutes of first medical contact and within 12 hours of symptom onset. (8, 13, 21, 20, 23, 24) Prehospital thrombolysis requires an ECP or a doctor on board the ambulance to administer the thrombolytic agent and monitor for complications. A well-organized receiving hospital is also important in this chain to stabilize any deterioration and prioritize cardiologist referral for PCI. Initiating thrombolysis as early as possible has demonstrated benefit. (8, 12, 13, 20, 22, 23, 24, 38, 39, 40) A national French registry study showed lower 1 year mortality rate in patients receiving prehospital fibrinolytics. (19, 24)

SA does not have the resources for a medical doctor to staff ambulances. The ECPs are too few to respond to every Priority 1 (P1) call. (35) A P1 patient has a life-threatening condition and requires immediate treatment. Access to thrombolytics for ECPs has not yet been regulated. (39) They may currently administer adjuncts, when available.

2.2.5 The role of triage in the management of ACS

'The purpose of triage is to prioritize patients based on medical urgency in contexts where there is a discord between demand and capacity, for example, when patient load overwhelms the available resources.' (41, 42) 'The aim is to expedite the delivery of critical treatment and procedures for patients with life-threatening conditions, improve patient flow and facilitate movement of less urgent patients.' (41, 42)

SA health care facilities have been making use of the South African Triage Scale (SATS) since 2004. (41, 42, 43) The SATS is a color-coded tool which allows for a total numerical value to be calculated from each category of vital signs. This total value is referred to as the triage early warning score (TEWS). (41, 42) The categories that make up the TEWS are: mobility, respiratory rate, heart rate, systolic blood pressure, temperature, AVPU score and presence of trauma. (41) AVPU, an abbreviated score to represent mental state, identifies the patient as alert (A), responsive to verbal command (V), responsive to pain (P) or unresponsive (U). (41) A TEWS of >7 correlates to Red or Priority 1 and indicates an emergency. (41, 42, 43) The patient needs to be taken to the resuscitation area and attended to immediately. Orange or Priority 2 has a TEWS of 5-6 and is considered very urgent signs and needs to be seen within 10 minutes. (41, 42, 43) Yellow or Priority 3 has a

score of 3-4, is urgent and needs to be seen within 1 hour. (41, 42, 43) Green or Priority 4 has a score of 0-2, is not urgent and should be seen within 4 hours. (41, 42, 43) The SATS score also accommodates a discriminator. Discriminators allow a patient, regardless of their TEWS, to be placed immediately into a higher triage category based on the severity of their pathology. (41, 43, 44) A discriminator acts as a safety net for certain critical conditions where patients may present atypically. (44) Chest pain is a well-known discriminator. Patients with chest pain should be triaged as orange at minimum and are regarded as very urgent. An immediate ECG should be performed and the patient should be attended to by a doctor within 10 minutes. (13, 18, 21, 41) Patients with an atypical presentation may fall through the net, unless the triage personnel have a high index of suspicion and utilize the discriminator. (43)

In many SA hospitals triage is carried out by nursing staff. (42, 44) The reason for this is a higher proportion of nurses in comparison to doctors. (42) Triage time targets are not always met. (3, 44) Demand often exceeds capacity, as is reflected in two SA waiting time studies, one from 2018 in the Northern Cape and other from 2021 in Pretoria revealed time from reception until triage nurse contact was 57 and 55 minutes respectively. (33, 44, 45)

2.2.6 Important adjuncts in the management of ACS

A STEMI patient should receive good analgesia. Pain relief mitigates the sympathetic simulation on the heart, including increases in afterload and development of arrhythmias. (12,13) Intravenous opioids are the most commonly used analgesic. (12, 13) Nitrates may relieve vasospasm thereby reducing pain. They also enhance coronary blood flow via coronary vasodilation and decrease

ventricular preload by increasing venous capacity, although there is no evidence that they influence outcome. (12,13) Antiplatelet and anticoagulant therapy are important to reduce the extension of thrombus or re-occlusion. (12, 13, 14, 21, 23, 46) Aspirin is an antiplatelet agent that irreversibly inactivates platelet cyclooxygenase and also reduces the formation of prostacyclin by endothelial cells. (46) In a 2019 North American study of a STEMI cohort patients, 97% of patients received aspirin therapy, 25% received clopidogrel, 86% received a statin and 77% received a beta-blocker within the first 48 hours of hospitalization (19)

2.2.7 Infarct territory

An American study showed that 42.5% of patients presented with anterior STEMI and 57.5% inferior STEMI. (4) Anterior STEMI, reflects occlusion of the left anterior descending coronary artery and causes larger myocardial damage compared with inferior or lateral infarctions. (47) A similar predominance in infarction pattern on ECG was seen in a 2012 Cape Town study: inferior STEMI presented in 55.9% of the cohort, followed by anterior STEMI in 38.5%. (11) However, there are few SA studies focusing on infarct location.

2.2.8 Thrombolysis

Door-to-needle time denotes the time it takes from when a patient with STEMI enters the emergency room until the onset of thrombolytic therapy, the accepted goal being 30 minutes or less. (5, 8, 11, 12, 13, 19, 20, 21, 24). In SA it is a difficult target to meet. (5, 8, 11) A 2016 KZN study reflected an average door-to-needle time of 43 minutes. (8) A 2012 Cape Town study revealed a door-to-needle time of less than 30 minutes in 20.5% patients and a median door-to-needle time of 54 minutes. (11) A 2020 Tygerburg study found a median thrombolysis time of 67 minutes. (5)

Performing thrombolysis does not guarantee success, and may on occasion fail, with ensuing partial re-occlusion. (8, 38) Thrombolytic therapy was once the mainstay of reperfusion therapy in STEMI, but timely primary PCI is the currently recommended reperfusion strategy. (8, 13, 15, 21, 39, 40, 48) However, many patients with STEMI do not have access to primary PCI within the critical time interval, which emphasizes the continued importance of thrombolytic therapy in the management of STEMI. (8, 12, 13, 15, 20, 38, 39, 40)

2.3 Factors that affect patient outcomes and the need for additional interventions

2.3.1 Demographic

STEMI presents more commonly after the age of 40 in men and 50 in women. (3, 14) The risk of death increases dramatically after every decade of life above that age. (18) Women have a higher mortality. (16, 30, 49, 50)

There are no recent SA studies demonstrating clinical outcomes based on race. A few hospital (single center) studies have been done, with varying results depending on the predominant racial distribution of that area. (8, 17)

2.3.2 Time to presentation

Restoring blood flow in the occluded artery as quickly as possible reduces infarct size and improves clinical outcomes in patients with STEMI. (5, 12, 13, 15, 21, 24) A 2019 North American study found that, 12% of STEMI patients presented very late (≥ 12 h) after symptom onset. (12, 22, 24) Late presenters were more commonly female, diabetic and hypertensive. (12, 13, 22, 24, 40) At first medical contact, very

late presenters had higher heart rates and lower systolic blood pressures. (22) Those who presented very late were less likely to report chest pain as their presenting symptom and had lower left ventricular ejection fractions on the initial echocardiogram. (22, 24) During the index hospitalization, they were also more likely to develop acute heart failure, cardiogenic shock and have longer lengths of stay. (22, 24) There was also a lower rate of long-term survival in the late presenters. (23) In the LATE (Late Assessment of Thrombolytic Efficacy) study, thrombolysis showed no benefit in patients with STEMI when administered after 12 hours from the onset of chest pain. This led to the time limit of 12 hours from the onset of symptoms until administration of a thrombolytic agent, beyond which defines late presentation in STEMI. (13, 20, 21, 22, 23, 24)

2.3.3 Pre-hospital care and STEMI management

Complications may arise when the patient is not transferred directly to a PCI capable facility. (13) Atypical presentations may not be promptly recognized by BLS/ILS providers, who do not have 12 lead ECG interpretation included in their competencies and often do not have the resources for ECG monitoring. (39, 43) This may result in transportation to a lower-level healthcare facility.

2.4 Patient outcomes

STEMI patients often need to be admitted to a CCU where they can receive continuous monitoring, with prompt access to specialist care, defibrillators, and definitive interventions such as catheterization laboratory, aortic balloon pumps or ventricular assist devices, should clinical deterioration occur. (13)

In the SA setting, we do not have the capacity to admit all STEMI patients to a hospital with a CCU. Most hospitals have a limited number of CCU and ICU beds. Therefore, only those patients with severe complications or those who require organ support are transferred. This is not optimal, as patients are often poorly monitored in the ward due to high patient-to-nurse and doctor ratios. STEMI patients can easily deteriorate due to arrhythmias, cardiogenic shock, pericarditis or complications from thrombolysis, leading to poor outcomes. (12, 13, 14)

2.5 Methods

2.5.1 Study population

This study was carried out at TMH which is based in Boksburg, Gauteng and has 540 beds. TMH has a specialist run ED and is part of the University of Witwatersrand academic circuit for both registrars and medical students. Although it is a regional hospital, it does not have a cardiac catheterization unit to offer PCI. The referral cardiologist specialist center for TMH is Charlotte Maxeke Johannesburg Academic Hospital. Data collection took place from the date the STEMI registry was started (1 June 2018) until 31 July 2020. The registry was created by the emergency physicians in the ED to obtain data on the STEMI population presenting to TMH. It includes categories of patient demographic, signs and symptoms, adjuncts and thrombolytics administered, additional interventions needed, and patient outcomes. The purpose of the registry is to collate baseline data to evaluate and in turn to ultimately to improve the quality of management and outcomes of STEMI patients managed at TMH.

2.5.2 Measurements

This was a retrospective observational transverse/cross sectional registry study.

Data was collected from the TMH STEMI register from 1 June 2018 until 31 July 2020.

The registry is quality approved: forms submitted are reviewed and audited by the Emergency Medicine consultants based at TMH, including diagnosis and management.

The diagnosis of a STEMI is confirmed by the Emergency Medicine registrar or senior medical officer on a shift. The diagnosis is based on history, clinical examination and dynamic ECG changes of 1mm ST elevation in contiguous leads with reciprocal changes. Leads V2 and V3 are exceptions: a 1.5mm elevation in females, or a 2mm elevation in males older than 40 years old or 2.5mm in males less than 40 years old. (14, 19, 20)

The attending medical practitioner may consult the Emergency Physician telephonically to clarify any doubt, with images being sent via social media platforms such as WhatsApp.

The data collection sheet is filled in by the doctor assigned to monitor the patient.

No patient identifying information is used when collecting data and compiling statistics.

All data was transcribed from the register onto an MS Excel spread sheet by researcher (Dr Kannai) after clearance was obtained from the University of Witwatersrand the Human Research Ethics Committee.

Data points: Please see Appendix A

Spreadsheets are stored on a password protected computer to which only the researcher and supervisors had access.

All patients documented in the STEMI register are included. These comprise adult patients of both genders, with ECGs meeting the definition of STEMI.

No entries in the register were excluded.

2.5.3 Data analysis

Data analysis was done comparatively.

Variables**:** see data collection sheet (Appendix A)

Confounding variables**:** Nil

Statistical analysis: results are presented as total numbers, means, standard deviations, medians, ranges, ratios and percentages.

Statistical package*:* Statistical Product and Service Solutions SPSS, version 20 (IBM Corp., Armonk, N.Y., USA)

Statistical tests for each objective:

Descriptive statistics are presented as frequencies and percentages for categorical variables and as mean and standard deviation, or median and interquartile range for continuous variables, depending on normality of distribution. Patient outcomes were compared by demographic and other factors using Pearson's chi-square test and the Fishers exact test as appropriate.

To determine factors associated with adverse outcome, logistic regression modelling was done. Initially, univariate analysis was done for each possible risk factor, followed by multivariate (adjusted) logistic models. The choice of covariates to be included in the multiple adjusted models as based on the stepwise variable selection setting a liberal p-value at 10%. Interpretation of the logistic regression results is based on odds

ratios (OR) for an adverse outcome. Statistical significance testing was set at the 95% confidence level and p-value <0.05.

3. Results

This study was carried out at TMH. The sample size is 95 patients.

3.1 Patient demographics

3.1.1 Gender: 68% of patients were male.

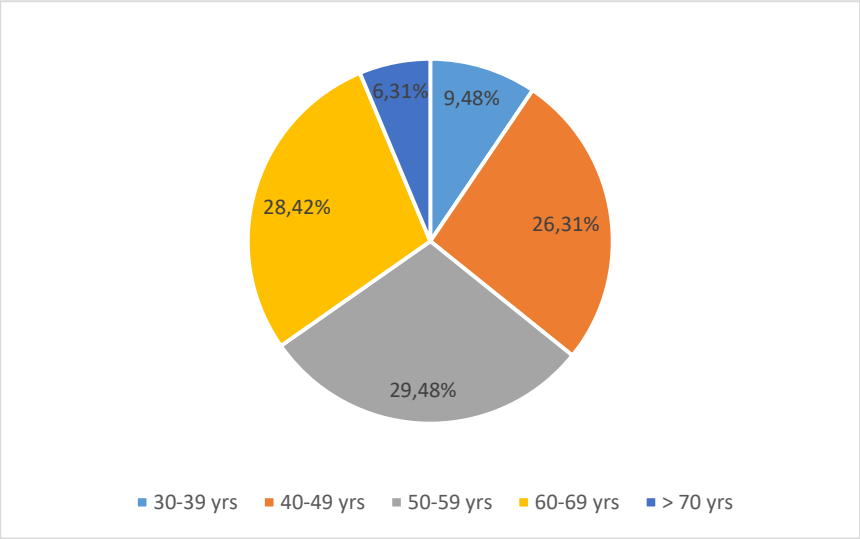

Figure 1: Age distribution of STEMI patients.

The most common ages at presentation ranged from 40- 69 years old. The mean age was 54.4 years (SD: 10.7, CI: 52.2- 56.5).

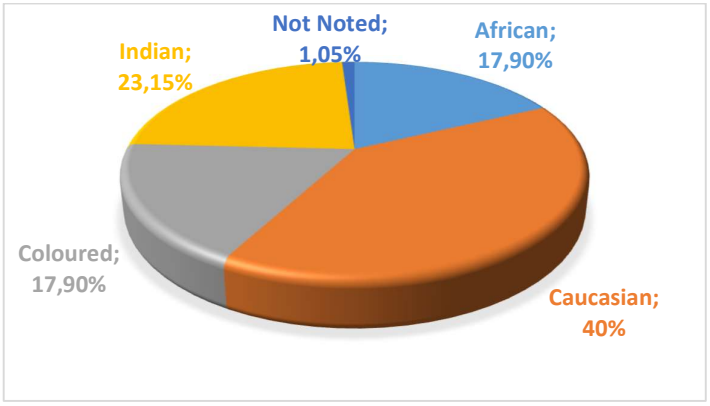

Figure 2: Racial distribution of STEMI patients.

The highest prevalence occurred in the Caucasian race group (40%), followed by Indian race (23.15%).

3.2 Patient Profile

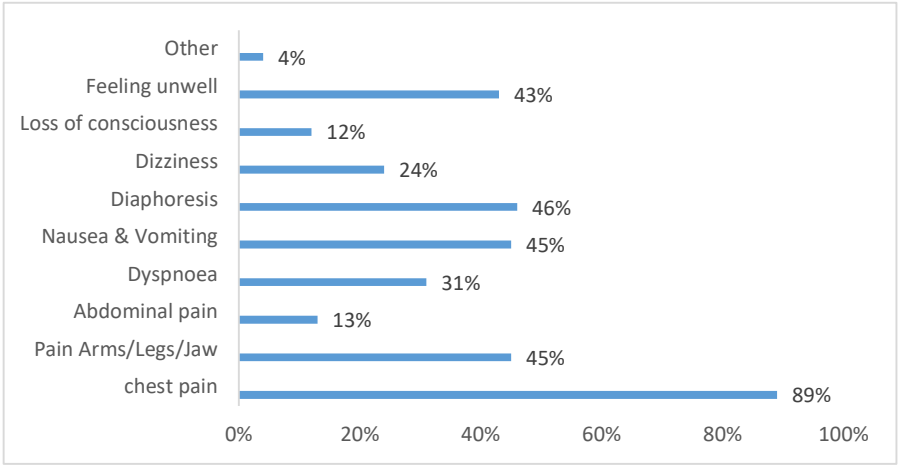

Figure 3: Common symptoms experienced by STEMI patients.

The most commonly experienced symptoms were: chest pain (89%), diaphoresis (46%), nausea and vomiting (45%) and feeling unwell (43%).

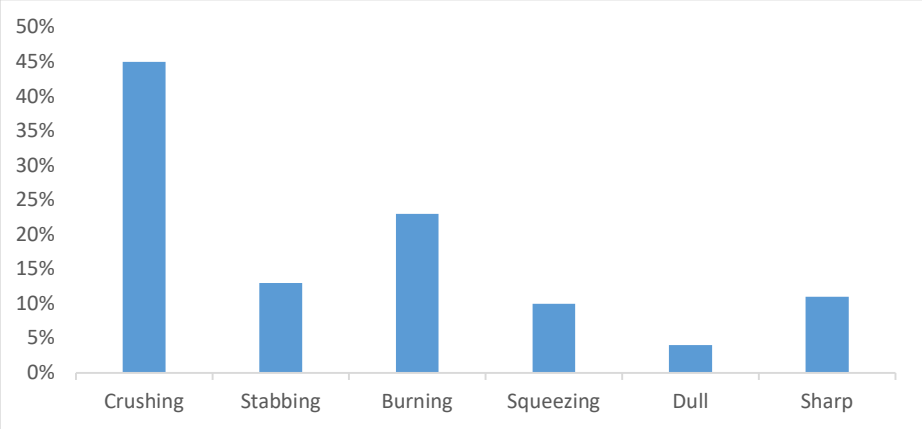

Figure 4: Nature of chest pain

The most frequent nature of chest pain experienced was: crushing (45%) and burning (23%).

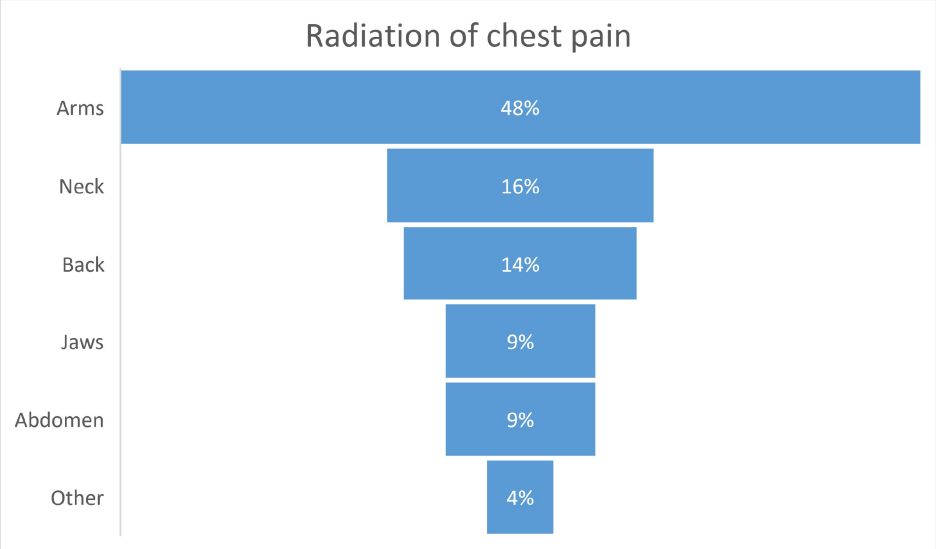

Figure 5: Radiation of chest pain

It was found that 48% of chest pain radiated to the arms, 16% to the Neck and 14% to the back.

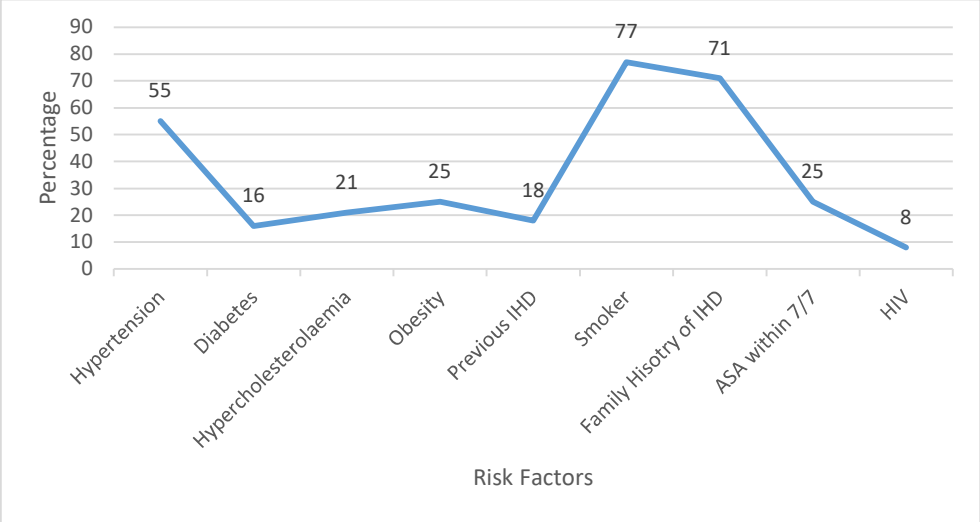

Figure 6: Risk factors of STEMI patients

The commonest risk factors included: being a smoker (77%), history of ischemic heart disease (71%), hypertension (55%).

3.3. Pre- Hospital

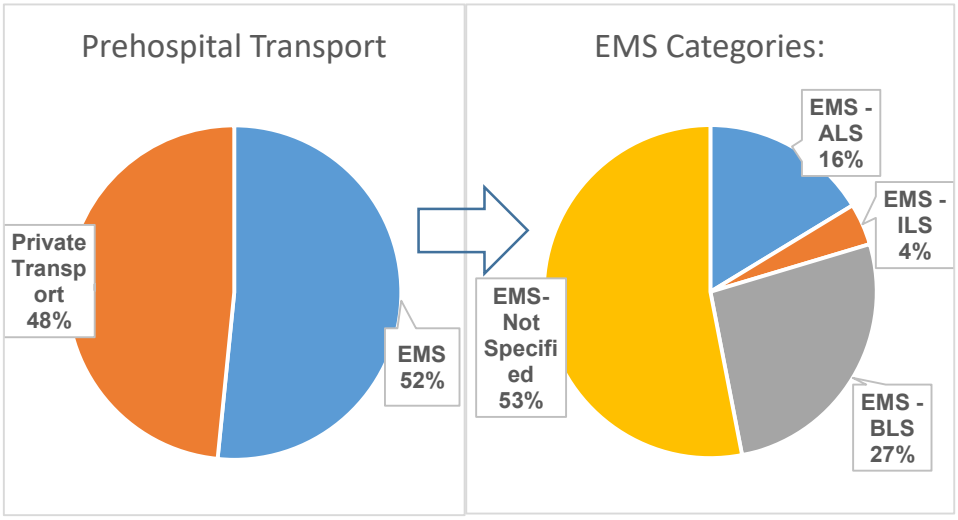

Figure 7: Pre-hospital transport.

48% of patients were transported by EMS, of which 16% were brought in by ALS. The EMS category was unknown in 53% of patients.

3.4. In- Hospital

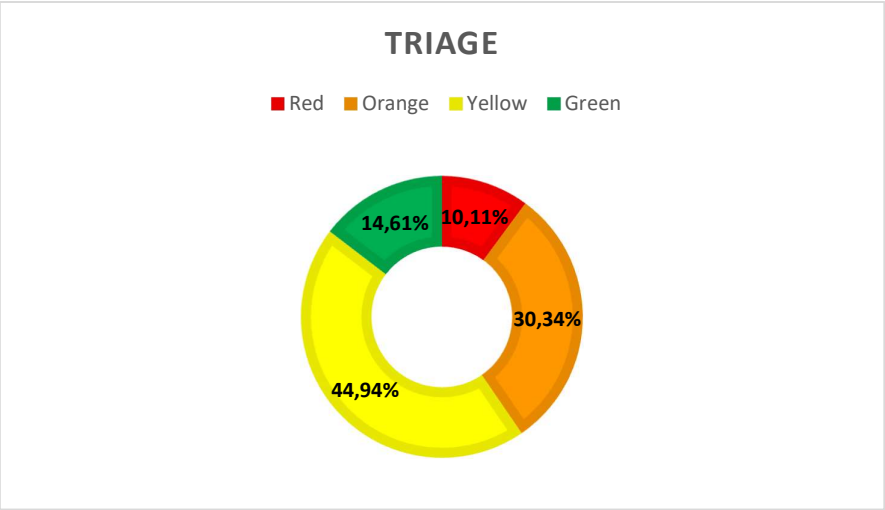

Figure 8: SATS Triage Score.

Only 10,11% of patients scored Red on triage and 30,34% scored orange.

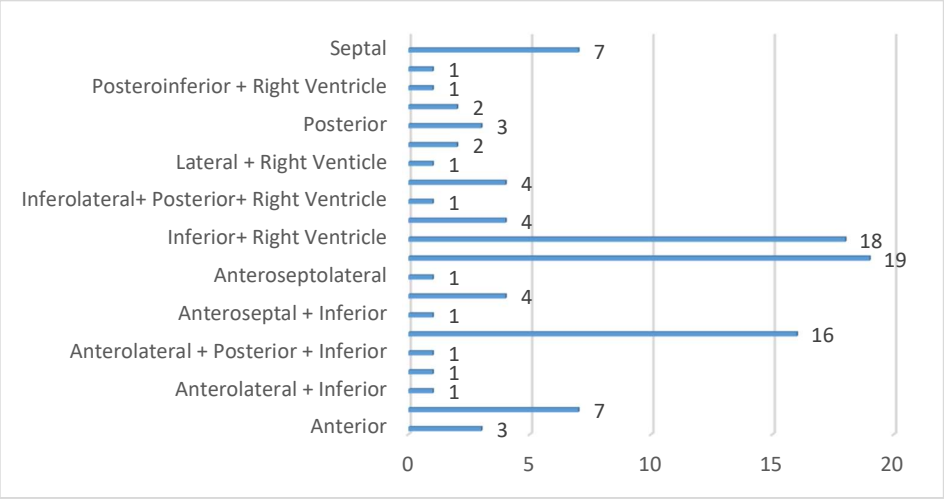

Figure 9: STEMI locations

The most predominant infarct locations were distributed as follows: Inferior (19%), Anteroseptal (16%) and Inferior with Right Ventricular involvement (18%).

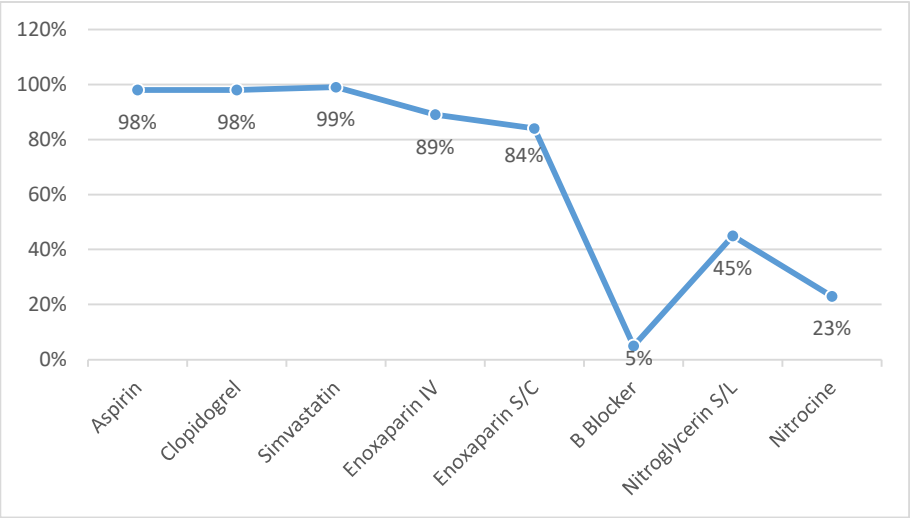

Figure 10: Adjuncts received

The mostly frequently received adjuncts were: Aspirin (98%), Clopidogrel (98%) and Simvastatin (98%)

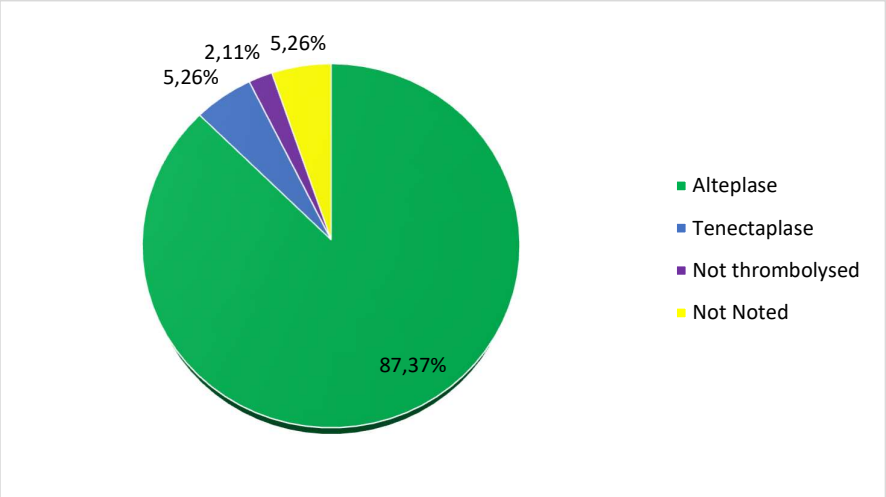

Figure 11: Thrombolytic agents used

Alteplase was predominantly administered (87.37%).

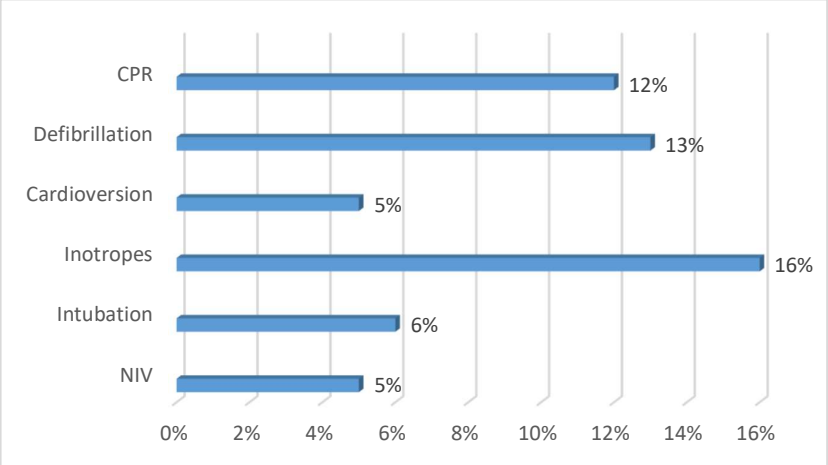

Figure 12: Additional intervention.

The most frequent additional interventions needed were: Inotropes (16%), Defibrillation (13%) and CPR (12%).

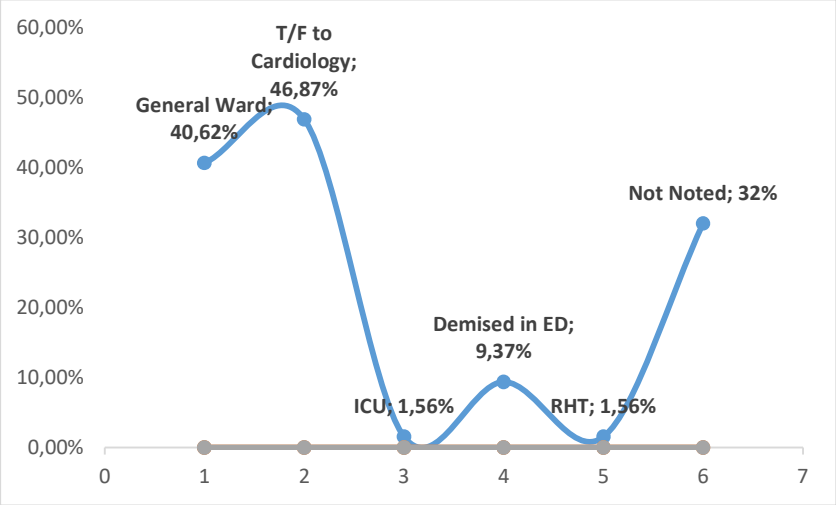

Figure 13: Outcomes and disposition

The majority of patients were transferred out of the ED to Cardiology (46.87%) and the General ward (40.62%).

Table 1: Time Targets

	Times		
	Range:	**Mean**	**SD**
Duration of symptoms	0- 72 hours	5.6 hrs	9.4 hrs
Door- ECG	0 - 759 min	38.5 min	85.9 min
Door- Doctor	0- 753 min	31.4 min	83.9 min
Door-Adjuncts	0-773 min	53.9 min	91.8
Door-Needle	0- 813 min	101.9 min	120.1

The mean duration of symptoms was less than 12 hours. The target time for door-to-ECG within 10 minutes was not met, with a mean of 38.5 minutes. The door- to-needle time of 30 minutes was not met, with a mean of 101.9 minutes.

Table 2: Patient outcomes based on additional outcomes

Interventions		***Outcomes***					
		General Ward	**ICU**	**Cardiology**	**RHT**	**Demised**	**Total**
	Count	0	0	1	0	1	2
NIV	Percentage	0,0%	0,0%	50,0%	0,0%	50,0%	100,0%
LR: 4,37							
	Count	0	0	5	0	0	5
Intubation	Percentage	0,0%	0,0%	100,0%	0,0%	0,0%	100,0%
LR: 8,75							
	Count	2	0	5	0	3	10
Inotropes	Percentage	20,0%	0,0%	50,0%	0,0%	30,0%	100,0%
LR: 7,61							
	Count	0	0	3	0	0	3
Cardioversion	Percentage	0,0%	0,0%	100,0%	0,0%	0,0%	100,0%
LR: 4,8							
	Count	2	0	4	0	2	8
Defibrillation	Percentage	25,0%	0,0%	50,0%	0,0%	25,0%	100,0%
LR: 3,45							
	Count	0	0	4	0	4	8
CPR	Percentage	0,0%	0,0%	50,0%	0,0%	50,0%	100,0%
LR: 19,25							

The mortality per additional intervention were demonstrated as: 50% of patients on NIV, 30% on inotropes, 25% who received defibrillation and 50% of patients who received CPR.

Table 3: Patient outcomes based on demographic, time until presentation and level of prehospital care.

Demographic		Outcomes						
			General Ward	ICU	Cardiology	RHT	Demised	Total
Age	30-39 years	Count	5	0	3	0	0	8
		Percentage	62,5%	0,0%	37,5%	0,0%	0,0%	100,0%
	40-49 years	Count	5	0	5	1	1	12
		Percentage	41,7%	0,0%	41,7%	8,3%	8,3%	100,0%
	50-59 years	Count	9	1	10	0	1	21
		Percentage	42,9%	4,8%	47,6%	0,0%	4,8%	100,0%
	60-69 years	Count	5	0	10	0	3	18
		Percentage	27,8%	0,0%	55,6%	0,0%	16,7%	100,0%
	70 years+	Count	2	0	2	0	1	5
		Percentage	40,0%	0,0%	40,0%	0,0%	20,0%	100,0%
Gender	Male	Count	20	1	23	1	2	47
		Percentage	42,6%	2,1%	48,9%	2,1%	4,3%	100,0%
	Female	Count	6	0	7	0	4	17
		Percentage	35,3%	0,0%	41,2%	0,0%	23,5%	100,0%
Race	African	Count	7	0	4	0	1	12
		Percentage	58,3%	0,0%	33,3%	0,0%	8,3%	100,0%
	Caucasian	Count	12	0	12	1	3	28
		Percentage	42,9%	0,0%	42,9%	3,6%	10,7%	100,0%
	Coloured	Count	2	0	5	0	1	8
		Percentage	25,0%	0,0%	62,5%	0,0%	12,5%	100,0%
	Indian	Count	4	1	9	0	1	15
		Percentage	26,7%	6,7%	60,0%	0,0%	6,7%	100,0%
Time	< 12 Hours	Count	24	1	24		4	53
		Percentage	45,3%	1,9%	45,3%		7,5%	100,0%
	> 12 hours	Count	1	0	3		1	5
		Percentage	20,0%	0,0%	60,0%		20,0%	100,0%
Prehospital	EMS	Count	16	1	15	0	3	35
		Percentage	45,7%	2,9%	42,9%	0,0%	8,6%	100,0%
	Private	Count	10	0	15	1	3	29
		Percentage	34,5%	0,0%	51,7%	3,4%	10,3%	100,0%

The highest mortality rate was in: patients aged more than 60 years, female gender, colored race, symptom duration of more than 12 hours and patients using private transport to hospital.

Table 4: Requirements of additional interventions based on demographic, Time until presentation and level of prehospital care.

Demographic			Additional Interventions					
			NIV	Intubation	Inotropes	Cardioversion	Defibrillation	CPR
Age	30-39 years	Count	0	0	0	0	2	0
		Percentage	0,0%	0,0%	0,0%	0,0%	25,0%	0,0%
	40-49 years	Count	0	2	3	0	1	2
		Percentage	0,0%	10,0%	14,3%	0,0%	5,0%	10,0%
	50-59 years	Count	2	2	5	2	3	3
		Percentage	9,1%	8,3%	20,8%	9,5%	13,6%	13,0%
	60-69 years	Count	2	0	4	2	2	3
		Percentage	8,3%	0,0%	16,7%	8,3%	8,3%	12,5%
	70 years+	Count	0	1	1	0	2	2
		Percentage	0,0%	25,0%	33,3%	0,0%	33,3%	33,3%
		LR	3,95	6,01	3,42	4,47	4,41	4,01
Gender	Male	Count	1	5	10	3	6	7
		Percentage	2,1%	9,6%	18,9%	5,7%	11,1%	12,7%
	Female	Count	3	0	3	1	4	3
		Percentage	11,1%	0,0%	11,5%	4,2%	15,4%	11,5%
		LR	2,6	4,36	0,72	0,08	0,29	0,02
Race	African	Count	1	0	1	1	2	1
		Percentage	7,1%	0,0%	7,1%	7,7%	14,3%	7,1%
	Caucasian	Count	1	2	7	2	4	4
		Percentage	3,0%	5,7%	20,0%	6,1%	11,8%	11,8%
	Coloured	Count	0	0	0	0	1	1
		Percentage	0,0%	0,0%	0,0%	0,0%	7,1%	6,7%
	Indian	Count	2	3	5	1	3	4
		Percentage	15,4%	18,8%	29,4%	5,9%	17,6%	23,5%
		LR	3,79	6,50	7,82	1,59	0,85	2,55
Time	< 12 Hours	Count	3	3	10	4	7	6
		Percentage	4,6%	4,4%	14,7%	6,0%	10,3%	8,7%
	> 12 Hours	Count	1	0	1	0	0	1
		Percentage	20,0%	0,0%	20,0%	0,0%	0,0%	16,7%
		LR	1,34	0,44	0,00	0,59	1,05	0,35
Prehospital	EMS	Count	1	3	7	4	5	5
		Percentage	2,5%	7,0%	16,7%	9,1%	11,4%	11,1%
	Private	Count	3	2	6	0	5	5
		Percentage	8,8%	5,6%	16,2%	0,0%	13,9%	13,9%
		LR	1,48	0,07	0,00	4,64	0,12	0,14

The categories in each demographic that had the highest requirement for additional interventions were: age 50–59, male gender, Caucasian race, less than 12 hours of symptoms until presentation to the ED and patients who used EMS transport to the hospital.

4. Discussion

4.1 Demographic characteristics

As with local and international studies, our study found that STEMI occurred more frequently in the male gender. (5, 6, 8, 11, 12, 14, 16, 19, 22, 30, 38, 48, 51) A higher incidence of STEMI was found in the age groups of 40- 69 years. The mean age of 54.4 years was similar to ranges in other local and international studies. (4, 5, 8, 11, 12, 14, 17, 18, 22, 30, 51, 52) However, 9.48% of STEMI occurred in 30-39 age category. Studies in India have found that STEMI may occur in younger age groups with fewer risk factors. (29) In my study we found a racial predominance towards the Caucasian population. This is in contrast to other small SA studies, where STEMI was more prevalent in the Indian population. (8, 11) However, these results could be skewed by the dominant population groups residing in each province, as well as the hospital feeder areas of Boksburg and Benoni.

4.2 Clinical Presentation

4.2.1 Symptoms

The most frequent symptoms experienced in this study were chest pain, radiation to arms/neck/jaw, diaphoresis, nausea and vomiting and feeling unwell. (51) In a 2014 Indian ACS study, the positive likelihood ratio (LR) and positive predictive value (PPV) were highest for chest pain with sweating, followed by sweating in STEMI patients. (34) These symptoms should create a high index of suspicion, especially in high-risk groups. In this study, a minority (9%) presented without chest pain. (31) Patients with atypical symptoms have a higher mortality rate. (16, 18, 23, 31) This was not reflected in our study, as the patients that demised had experienced typical

symptoms. Our study comprised of a small sample size of 95 patients of which 6 patients had demised in the ED, therefore making these results difficult to extrapolate.

4.2.2 Risk factors

Risk factors are composed of modifiable and non-modifiable categories. (16, 17) Modifiable risk factors can be controlled with medication, diet and exercise for example hypertension, diabetes, obesity and smoking. (16, 17, 26, 27) Non-modifiable risk factors cannot be managed and include age, gender, race and family history. (16, 17) The commonest risk factors in this study included: smoking, family history of IHD and hypertension. This constellation of findings correlates with multiple international studies. (4, 5, 8, 14, 16, 17) All modifiable risk factors combined account for more than 90% of the population-attributable risk of acute MI globally. (52) The majority of patients in our study had an average of two risk factors (modifiable or non-modifiable). The lifetime risk of CAD for a 45-year-old with 2 major risk factors is 50% for men and 31% for women. (21) Studies have found that approximately 80% or more of patients have modifiable risk factors. (21, 51)

4.2.3 Time until treatment

The mean duration of symptoms was 5.6 hours (SD: 9.4) until presentation. This is within the 12-hour window for thrombolysis. (48) A STEMI patient should be triaged as category “orange” at minimum and should be seen immediately or within 10 minutes. Incorrect triage occurred in 53.9% of our registry patients, this may be attributed to inappropriate triage as “yellow’’ and “green’’ in patients who experienced chest pain, or due to incorrect calculations of the TEWS. These patients did not have atypical symptoms. This is reflected in another Johannesburg based single centre ED study, where no discriminator was used in 60% of atypical presentations. (42)

Furthermore, time until ECG did not meet the global standard of 10 minutes and was done within a mean time of 38.5 minutes (SD: 85.9). (10, 11, 52) Other studies have reflected time delays were likely due to: increased patient load and staff shortages. (3, 5, 33, 44) In my study, we could not state the reasons for time delays with certainty as the data collection form was not tailored to include reasons for time delays. The mean time from arrival until first medical contact with a doctor was 31.4 minutes (SD: 83.9). (44) This is a further consequence of inadequate triage and will influence the door-to-needle time. Adjuncts were given to 98% of STEMI patients within a mean time of 53.9 minutes. A target door-to-needle of 30 minutes was only met for 7 patients (7.3%) in our cohort. A further 29 patients (30%) received thrombolysis within 1 hour. The mean door-to-needle time was 101.9 minutes. (SD: 120.1) The inability to meet the target door-to-needle time has been reflected in other SA studies based in Tygerberg and Cape Town. (5, 11) The reasons reported for delays are as follows: lack of senior doctors, difficulties in interpreting ECGs, atypical presentations, and system delays. (11)

4.3 Factors associated with adverse outcome or additional interventions

4.3.1 Age

The Emergency Medicine clinics of North America have found that older patients with ACS have higher associated mortality, with 80% of all deaths related to MI occurring in people aged 65 years and older. (18) Acute heart failure at presentation occurs in approximately 9% of STEMI patients with 98,3% of patients being older than 65 years. Myocardial ischemia impairs left ventricular relaxation, which leads to an increase in left ventricular end-diastolic pressure (LVEDP). This increased

LVEDP, superimposed on age-related decreases in left ventricular compliance, frequently results in heart failure. (40) For older patients with acute myocardial infarction (MI) complicated by cardiogenic shock, AHA guidelines now recommend early revascularization across all age groups. (40) The age distribution of STEMI patients in this study was in keeping with other local and international studies, however, the data regarding age in association with adverse outcome or the need to additional interventions - was not significant. This may be attributed to the small sample size of this study.

4.3.2 Race

Data regarding race as an independent risk factor for mortality or additional interventions is scarce and variable in different populations**.** A 2011 American study reflected that white patients had a higher incidence of sustained hypotension and dysrhythmias, compared to African Americans, and thus were more inclined to need additional interventions. (45) A 2021 large North American study reflected an approximate in-hospital mortality rate of 40% in both white and black women, and 33% in white and black males. (51) Another 2018 North American study reflected that Asians had the highest in-hospital mortality rate compared to African Americans. (53) Further SA studies are needed to establish external validity and ascertain if these results are reproducible within our population. The statistics regarding race as a cause for adverse outcome or the need to additional interventions - was not statistically significant. This may be attributed to a small sample size.

4.3.3 Gender

In the past, considerable effort on ACS research was concentrated on men. Studies have demonstrated that acute MI has a higher prevalence in men. (5, 6, 8, 11, 12, 14, 16, 17, 22, 30, 38, 48, 51) Overall, women have higher rates of cardiovascular risk factors and mortality. (15, 30, 49, 50) Women also have an increased likelihood of having microvascular disease that results from endothelial dysfunction and abnormalities in vascular smooth muscle spasticity. Additionally, risk factors associated with pregnancy, including gestational diabetes and pregnancy-induced hypertension, are added lifetime risks for developing ACS in women. (16) The data regarding gender in relation to adverse outcome or the need to additional interventions, was statically insignificant. This may be attributed to the small sample size of my study.

4.3.4 Character and radiation of pain

In this TMH study the most frequent nature of chest pain was crushing (45%) and burning (23%). This is in keeping with a 2020 American single centred ED study were 569 (49%) of 1167 ACS patients experienced pressing chest pain. (54) Their data was collected via a convenience sample, which excluded patients with severe communication barriers. These elements may allow for bias. The most common sites of radiation noted in our study were 48% to the arms, 16% to the neck and 14% to the back. In contrast, the American study reported 464 (40%) patients had no radiation of pain, followed by 391 (34%) patients who experienced radiation to the left arm. (54)

4.3.5 Prehospital transport

Our study found that 52% of patients opted to be brought to hospital via private transport. Of the patients transported by EMS, only 16% were transported by ALS. However, it is difficult to comment accurately as 53% of the patients transported by EMS had not been further categorized on the data collection sheets. The national response time target is that 90% of P1 incidents be responded to within 15 minutes in urban areas. All other incidents may be responded to within 60 minutes. (55) Annual reports for Gauteng, Western Cape and KZN have revealed that these targets are not met. (55) This may be a contributing factor in the patient's choice of private transport.

4.3.6 Location of infarct

The most predominant infarct locations were distributed as follows: inferior (19%), anteroseptal (16%) and inferior with right ventricular involvement (18%). (4, 11, 30) Other local and international studies have similarly reflected a predominance of non-anterior STEMI. (11, 47) Anterior STEMI is however associated with a higher mortality. (15, 47)

4.3.7 Choice of thrombolytic agents

The patients in this study predominantly received alteplase (83,4%) as opposed to tenecteplase (5.68%). Studies have found no significant mortality benefit between the two agents. However, alteplase was associated with more major adverse cardiac events. (21, 23)

4.4 Additional ED interventions and patient disposition

The most common interventions needed were, inotropes, CPR and defibrillation. The results were not statistically significant with regards to adverse outcomes or the requirement of additional interventions. This could be attributed to a small sample size of patients requiring additional interventions. STEMI patients are prone to arrythmias and at minimum should be monitored in a high care setting, if not by cardiology. (12, 13, 14, 15) This was achieved in 48% of our cohort. Interestingly, two patients on inotropes and two patients post defibrillation were admitted to the general ward. Three of five patients who were defibrillated and/ or received CPR achieved and maintained return of spontaneous circulation. Patients requiring inotropes should be admitted to a high care area for monitoring of cardiogenic shock and other post STEMI complications. (12, 13, 14, 15) In our study, only three of twelve patients requiring inotropes were admitted into a high care setting (CCU).

5. Conclusion

STEMI continues to place a burden on society internationally. It is paramount that treatment is timeous and reflects evidenced-based practice. Currently, TMH is not meeting this benchmark, with several factors affecting this outcome still needing attention. None of the patients on the registry received primary PCI, reinforcing the fact that thrombolysis is still a vital part of STEMI management in non-PCI facilities in Gauteng. The patient profile at TMH consisted of a similar demographic, risk and symptom profile as other local and international studies. The sample size of this study was too small to reflect statically significant results for our objectives regarding additional interventions and future studies will have to be carried out to determine this. Only 46,87% of patients were transferred to a cardiology center, and 40% were admitted to the general ward at TMH. This further accentuates the need for a systems-thinking approach and enhanced resources to manage this critical condition better.

6. Recommendations

1. Doctors and nurses should have ongoing training on the SATS triage tool with emphasis on the use of discriminators and time targets for the acquisition of an ECG and thrombolysis.

2. There is growing evidence for simulation draining as an educational tool. STEMI drills can be valuable in achieving important time targets.

7.Appendices

Appendix A

TMH Thrombolysis in STEMI Data Collection Sheet

Hospital number: _____

Date:_____

Age: _____ **Date of birth**:_____

Male □ Female □

African □ Caucasian □ Indian □ Coloured □

Area of residence:

_____

Mode of transport:

Private □

EMS □ BLS □ ILS □ ALS □

Time of onset of symptoms: _____ **Duration of symptom**s:

_____

Symptoms

Chest pain		Diaphoresis	

Pain in arms/back/jaw		Dizziness	
Abdominal pain		Loss of consciousness	
Dyspnoea		General feeling of being unwell	
Nausea and vomiting		Other :	

Nature of chest pain **Radiation of pain**

Crushing		Neck	
Stabbing		Jaw	
Burning		Arms	
Squeezing		Back	
Dull		Abdomen	
Sharp		Other:	

Severity of worst pain : (0-10) _____ **Severity of pain at presentation** :

(0-10) _____

Risk factors

Hypertension	□ Yes □ No □ Unknown
Diabetes	□ Yes □ No □ Unknown

Hypercholesterolaemia	□ Yes □ No □ Unknown
Obesity	□ Yes □ No
Previous Ischaemic Heart Disease	□ Yes □ No □ Unknown If yes, when: _____
Smoker	□ Yes □ No □ Never □ Current □ Former Pack year history _____
Family history of Ischaemic Heart Disease	□ Parent □Unknown □ Sibling

Aspirin use in past 7 days	□ Yes □ No □ Unknown
HIV	□ Yes □ No □ Unknown

Current Medications

Name	Dose

Time of triage: _____ **Triage Score**:

_____

Triage Vitals:

BP _____ HR _____ RR _____ Sats

_____

HGT _____

Time seen by doctor: _____

Time of ECG: _____

Infarct location	**Tick if present**	**Leads displaying ST elevation**
Anterior		
Inferior		
Septal		

Lateral		
Posterior		
Right ventricle		

Medications Administered		**Prehospital** (Tick if given)	**Time**	**Dose**
Aspirin	□ Yes □ No			
Clopidogrel	□ Yes □ No			
Simvastatin	□ Yes □ No			
Enoxaparin	□ Yes □ No			

β-Blocker	□ Yes □ No			
Sublingual Nitroglycerine	□ Yes □ No			
Intravenous Nitrocine	□ Yes □ No			

Time of initiation of thrombolysis: _____ **Door to needle time**: _____

Pre-Thrombolysis Vitals:

BP _____ HR _____ RR _____ Sats _____

THROMBOLYTIC AGENT		**DOSE**
TPA/Alteplase (Actilyse®)		

Tenecteplase (Metalyse®)		

Reason for choice of thrombolytic agent:

_____

_____

_____

_____

Post Thrombolysis Vitals:

BP _____ HR _____ RR _____ Sats

_____

Other interventions

NIV □ Yes □ No

Intubation □ Yes □ No

Inotropes □ Yes □ No

Adrenaline □ Max dose?

_____

Dobutamine □ Max dose?

_____

Cardioversion □ Yes □ No If yes, cardiac

rhythm?_____

Defibrillation □ Yes □ No If yes, cardiac rhythm?

_____

CPR □ Yes □ No If yes, duration?

_____

Outcome?

_____

Outcome

Admitted to general ward □

Admitted to ICU □

Transferred to Cardiology (from ED) □

Demised in ED □

Reason for transfer to Cardiology :

Cardiogenic shock □

Persistent arrhythmia □

Rhythm?_____

Persistent chest pain □

Summary of important times

Duration of symptoms before presentation to ED	

Triage until assessment by doctor	
Door to needle time	
Time to administration of adjuncts	

Appendix B

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

Office of the Deputy Vice-Chancellor (Research and Postgraduate Affairs

TO: Dr J Kannai
School of Clinical Medicine
Department of Medicine
Division of Emergency Medicine
Medical School
University

E-mail: jeribelle@rocketmail.com

CC: Supervisor: Dr P Moodley and Mr M Botha
<moodley.pravani@gmail.com>
and <HREC-Medical Research Office@wits.ac.za>

FROM: Mr Iain Burns
Human Research Ethics Committee (Medical)
Tel: 011 717 1252

E-mail: Iain.Burns@wits.ac.za

DATE: 2021/01/06

REF: R14/49

PROTOCOL NO: **M201122** (This is your ethics application reference number. Please quote it in all enquiries, oral or written, relating to this study.)

PROJECT TITLE: The profile of patients presenting with ST Elevation Myocardial Infarction (STEMI) to a Regional Emergency Department (ED) in Gauteng, South Africa (SA)

Please find attached the Clearance Certificate for the above project. I hope it goes well and that an article in a recognized publication comes out of it. This will reflect well on your professional standing and contribute to Government funding of the University.

MSWorks2000/Iain0007/Clearscan.wps

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R49 Dr J Kannai

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M201122

NAME: (Principal Investigator)	Dr J Kannai
DEPARTMENT:	School of Clinical Medicine Department of Medicine Division of Emergency Medicine Medical School University
PROJECT TITLE:	The profile of patients presenting with ST Elevation Myocardial Infarction (STEMI) to a Regional Emergency Department (ED) in Gauteng, South Africa (SA)
DATE CONSIDERED:	2020/11/27
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr P Moodley and Mr M Botha
APPROVED BY:	Dr N Naran, Co-Chairperson, HREC (Medical)
DATE OF APPROVAL:	2021/01/06

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **November** and therefore reports and re-certification will be due in the month of **November** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

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