

**DOOR-TO-NEEDLE TIME IN PATIENTS WITH ACUTE
MYOCARDIAL INFARCTION REQUIRING THROMBOLYTIC
THERAPY**

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DECLARATION

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ABSTRACT

A heart attack is a medical emergency and a life threatening disease. Patients with chest pain and a possible diagnosis of myocardial infarction require a detailed assessment and prompt medical management. The aim of the study was to determine the in-hospital delay in administering thrombolytic therapy to patients with acute myocardial infarction (AMI)

A mixed method with convergent parallel design was applied to the study. The population consisted of N=63 case notes of adult patients diagnosed with acute myocardial infarction and who had received thrombolytic therapy. The other population included (n=8) registered professional nurses working in the coronary care unit (CCU) of a tertiary hospital in the Western Cape. A record review was done using a data extraction form and semi-structured interview guide was used for data collection purposes. Reliability and validity was tested by the use of a nurse expert and a statistician. The nurse expert evaluated the data extraction form to ensure that all variables are included. A pilot study was done to test the data extraction form for errors.

Ethical approval was obtained from the Health Research Ethics Committee of Stellenbosch University and permission to conduct the study was obtained from the management where the study was conducted. Informed consent was obtained from the participants. Data analysis was done by the researcher and a qualified statistician. Data was presented in the form of tables, histograms and frequencies. Analysis for the qualitative data was done by the researcher and the following themes were identified: cardiovascular nursing care, roles and responsibilities of nurses, scope of practice, perceptions of nurses on DNT and factors influencing DNT. Themes were presented in a form of a table and thereafter discussed extensively.

Results: A total of 63 case notes of patients diagnosed with AMI were identified. The case notes were identified from the register kept in the CCU of the tertiary hospital. The case notes were of patients diagnosed with AMI and received thrombolytic therapy between the period of January 2009 to January 2014. A list of identified case notes was sent to Medical Records department for the retrieval of files. Once the files were retrieved, notes were obtained and used for data collection and analysis purposes (record review). Eleven (11) case notes could not be recovered, ten other case notes had incomplete data, two patients were thrombolysed at remote hospitals and one had a negative value after analysis. A total of 24 patients were excluded from the study. Only 39 patients were eligible for the study. The

median door-to-needle time (DNT) of 30 minutes with a range between five to eighty five minutes was achieved. A door-to-needle time of 30 minutes or less was achieved in 23 (59.0%) of the patients; 56.25% of the patients arrived by ambulance and 43.75% used private transport. Of all the patients diagnosed, 24.5% had a pre-hospital ECG; more than 50% (n=30, 76.9%) of the population were smokers and 53.8% of the population had a risk factor of hypertension. The predominant infarct was inferior (61.5%), followed by anterior (38.5%). More than 70% of the patients were assessed by a junior registrar and only (23.1%) by the senior. Furthermore, (n=10, 25.6%) of the population was assessed by the junior registered professional nurse (RPN) and (n=29, 74.4%) by the senior RPN. Population had a median length in hospital of four days. Three patients died due to complications.

The researcher read through all the transcriptions to achieve an overview of the interview. The aim was for the researcher to become immersed with the data. From the data, the researcher created codes and themes qualitatively and counted the number of times they occurred. Similar themes were grouped together and subthemes that emerged from the main themes were identified. The main themes identified were: cardiovascular nursing care, roles and responsibilities, scope of practice, perceptions of nurses on door-to-needle time (DNT) and factors influencing DNT.

Conclusions: The majority of patients (74.4%) were assessed by a senior registered professional nurse (RPN) on presentation, yet (n=16) of the patients were not thrombolysed within 30 minutes. Patient, doctor, personnel, hospital and ECG factors influenced door-to-needle time in this study. Few nurses working in the CCU showed insight into DNT. The majority of the nurses reported that they have never seen a delay in DNT yet not all patients achieved a DNT of 30 minutes or less. No significant relationship was found between DNT and factors associated with DNT. There was no significant relationship between door-to-needle time and length of hospital stay $p=0.40$. Recommendations were made to improve patient care and management.

OPSOMMING

'n Hartaanval is 'n mediese noodgeval en 'n lewensgevaarlike siekte. Pasiënte met borspyn en 'n moontlike diagnose van miokardiale infarksie benodig 'n gedetailleerde assessering en vinnige mediese bestuur. Die doel van die studie was om die in-hospitaal vertraging in pasiënte met akute miokardiale infarksie (AMI) wat trombolitiese terapie benodig, te bepaal.

'n Gemengde metode is gebruik in die studie. Die populasie het bestaan uit N=63 gevalnotas van volwasse pasiënte wat gediagnoseer is met akute miokardiale infarksie en wat trombolitiese terapie ontvang het. Die ander populasie het bestaan uit (n=8) geregistreerde, professionele verpleegkundiges wat in die koronêre sorgeenheid van 'n tersiêre hospital in die Wes-Kaap werk. 'n Data-ontginningsvorm en semi-gestruktureerde onderhoud is gebruik vir data insamelingsdoeleindes. Betroubaarheid en geldigheid is getoets deur 'n verpleegkundige deskundige en statistikus. Die verpleegkundige deskundige het die data-ontginningsvorm geëvalueer om te verseker dat alle veranderlikes ingesluit is. 'n Loodsstudie is onderneem om die data-ontginningsvorm vir foute te toets.

Etiese toestemming is verkry van die Gesondheidsnavorsing-etiekkomitee van Stellenbosch Universiteit en toestemming om die studie uit te voer is van die bestuur van die instansie waar die navorsing uitgevoer is, verkry. Ingeligte toestemming is van die deelnemers verkry. Data-analise is gedoen deur die navorser en 'n gekwalifiseerde statistikus. Data is aangebied in die vorm van tabelle, histogramme en frekwensies.

Resultate: 'n Totaal van 63 gevalnotas van pasiënte gediagnoseer met AMI is geïdentifiseer. Elf (11) gevalnotas kon nie verkry word nie en tien ander gevalnotas het onvolledige inligting bevat, twee pasiënte is getrombolitiseer by afgeleë hospitale en een het 'n negatiewe waarde na analise gehad. 'n Totaal van 24 pasiënte is uitgesluit uit die studie. Slegs 39 pasiënte was in aanmerking vir die studie. Die median deur-tot-naald (DTN) tyd van 30 minute is bereik wat strek tussen vyf tot vyf-en-tagtig minute. 'n DTN tyd van 30 minute of minder is bereik in 23 (59.0%) van die pasiënte, 56.25% van die pasiënte het per ambulans aangekom en 43.75% het privaatvervoer gebruik. Van al die pasiënte gediagnoseer het 24.5% 'n pre-hospitaal EKG gehad, meer as 50% (n=30, 76.9%) van die populasie was rokers en 53.8% van die populasie het 'n risikofaktor vir hipertensie gehad. Die oorheersende infark was minderwaardig (61.5%), gevolg deur anterior (38.5%). Meer as 70% van die pasiënte is deur 'n junior registratateur geassesser en slegs 23.1% deur die senior registrateur. Verder is 25.6% (n=10) van die populasie deur die junior professionele geregistreerde

verpleegkundige geassesseer, en 74.4% (n=29) deur die senior geregistreerde verpleegkundige. Die populasie het 'n median lengte van verblyf van vier dae in die hospitaal gehad. Drie pasiënte is dood as gevolg van komplikasies.

Konklusie: Die meerderheid van pasiënte (74.4%) is geassesseer deur 'n senior geregistreerde professionele verpleegkundige tydens aanbieding, alhoewel (n=16) pasiënte nie binne die eerste 30 minute getromboliseer nie. Pasiënt, dokter, personeel, hospitaal EKG was faktore wat deur-tot-naald tyd in die studie beïnvloed het. Min verpleegkundiges wat in die koronêre versorginseenheid gewerk het, het insig in DTN getoon. Die meerderheid van die verpleegkundiges het gerapporteer dat hulle nog nooit 'n vertraging in DTN gesien hiet nie, tog het nie alle pasiënte DTN in 30 minute of minder behaal nie. Geen beduidende verhouding is tussen deur-tot-naald tyd en lengte van verblyf in die hospital gevind nie (p=40). Aanbevelings is gemaak om pasiënt-behandeling en -bestuur te verbeter.

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DEDICATION

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LIST OF ACRONYMS

ACS	Acute Coronary Syndrome
AHA	American Heart Association
AMI	Acute Myocardial Infarction
CCU	Coronary Care Unit
CHD	Coronary Heart Disease
DNT	Door-to-needle time
ECG	Electrocardiogram
ESC	European Society of Cardiology
NSTEMI	Non-ST Elevation Myocardial Infarction
RPN	Registered Professional Nurse
SANC	South African Nursing Council
STEMI	ST-Elevation Myocardial Infarction
VF	Ventricular Fibrillation
VT	Ventricular Tachycardia
WHO	World Health Organisation

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CHAPTER 1: SCIENTIFIC FOUNDATION OF THE STUDY

1.1 INTRODUCTION

Coronary heart disease (CHD) is a major cause of death and disability worldwide (Maharaj, Geduld & Wallis, 2012:241). Cardiovascular disease (CVD) accounts for 17 million deaths per year (Byrne, Eksteen & Crickhone, 2014:4). In the United States, about 600,000 people die from heart disease every year (Maier, 2014:np).. That is one in four deaths. Over seven million people die annually from CHD accounting for 12.8% of all deaths (Steg *et al.*, 2012:2573). Among CHD's, acute myocardial infarction (AMI) is one of the leading causes of death, with most deaths occurring before hospital admission (Barbagelata *et al*, 2007:257).

In South Africa, CVD is the leading cause of death after HIV/AIDS (Byrne *et al.*, 2014:5). Statistics show that about 130 heart attacks occur daily in South Africa meaning that five people will have a heart attack every hour (Heart and Stroke Foundation South Africa, 2013:np). For every woman that dies of a heart attack, two men die (Heart and Stroke Foundation SA, 2007:2 These deaths are expected to increase to 41% in people of working age (35-64 years) between 2000 and 2030 (Fourie, 2007:2). The negative economic impact will be enormous. In the Western Cape, one in four deaths result from ischemic heart disease (Chopra, Steyn & Lambert, 2007:3). Mortality from ischemic heart disease is higher in males than in females (Maharaj, Geduld & Wallis, 2012:241).

1.2 RATIONALE

Early recognition of the symptoms of myocardial infarction such as chest pain, shortness of breath, nausea, vomiting, anxiety and sweating (Stellenberg & Bruce, 2007:22) and access to emergency services prevents adverse outcomes by limiting the size of the infarct, and improving the function of the left ventricle (Steg *et al.*, 2012:2577).This can be achieved by prompt diagnosis and treatment of all patients presenting with AMI in the coronary care unit (CCU). Early intervention reduces the length of hospital stay, the mortality rate, it improves the quality of life and fewer burdens are placed on the economy of the country.

The researcher, a registered nurse working in the CCU has observed that at times there is a delay in the time of administering thrombolytic therapy and the time that the diagnosis of myocardial infarction has been made. This practice has a negative effect on the prognosis of

the patient. Evidence has shown that the door-to-needle time of 30 minutes or less is crucial in the treatment of AMI's (Steg *et al.*, 2012:2587).

Registered professional nurses (RPNs) are the first medical contact during patient presentation in the CCU. The diagnostic ECG and initial assessment thereof is performed by the RPN. It is crucial that any changes on the ECG suggestive of AMI are reported immediately to the cardiology physician on call. In the researcher's clinical practice, it was observed that some of the nurses do not recognise the importance of prioritising the initial assessment of patients including their roles and responsibilities thereof. This resulted in long waiting period before the acquisition of diagnostic ECG. In the clinical practice, the researcher has also observed that sometimes nurses show a disrespectful behaviour towards patients that present to the hospital without a referral letter and take longer than usual to perform a 12 lead ECG on these patients in resulting in a delay in administering thrombolytic therapy.

Therefore, the researcher wants to determine the door- to- needle time is in the CCU of an academic hospital in the Western Cape. Furthermore determining the factors and perceptions of RPNs related to door- to-needle time. Similar studies have been done which only focussed on the doctor and patients factors.

1.3 RESEARCH PROBLEM

A research problem is defined as an area of concern in which there is a gap or a situation in need of solution, improvement or alteration, or in which there is a discrepancy between the ways things are and the way they ought to be (Brink, Van Der Walt & Van Rensburg, 2006:59). The researcher, a registered professional nurse working in the CCU has observed that most in-hospital delays in door-to-needle time are associated with long hospital stay, morbidity and mortality. This could be as a result of different factors. Junior RPNs working in the CCU lack experience and may not recognise their roles in the management of AMI. This may lead to delay in reporting diagnostic ECG changes suggestive of AMI to the attending physician.

Lack of knowledge of the international guidelines in the management of AMI by experienced nurses might lead to a delay in the administration of thrombolytic therapy. There is limited literature in South Africa on nurses and door-to-needle time. In addition, lack of cardiology experience by a new group of physicians rotating in the CCU on a six-month basis (February and August of each year) and the need to consult the senior registrar, or consultant before

the decision to administer thrombolytic therapy to the patient is made may lead to delay in door-to-needle time.

1.4 SIGNIFICANCE OF STUDY

Door-to-needle time is an important hospital performance measure for the quality of care of AMI patients. Hospitals are considered good performers if they have a door-to-needle time of 30 minutes or less (Tu *et al.*, 2004:np). Results of this study will highlight the level of performance of the institution. The outcome of the study may add vital information on the current situation on door-to-needle time in AMI patients. The results of the study will inform interventions to reduce door-to-needle time to less than 30 minutes by identifying factors associated with the delay in door-to-needle time in emergency departments.

1.5 RESEARCH QUESTION

The research questions for this study were:

- What is the door-to-needle time for adult patients presenting with AMI in the coronary care unit (CCU)?
- What are the in-hospital factors associated with door-to-needle time?
- What are the effects of door-to-needle time on the following outcomes: length of hospital stay in the coronary care unit (CCU), morbidity and mortality?
- What are the perceptions of nurses on the factors that affect door-to-needle time?

1.6 AIM

The aim of this study was to investigate the in-hospital delay in door-to-needle time in patients with AMI requiring thrombolytic therapy.

1.7 OBJECTIVES

The objectives of this study were to:

- Determine the door-to-needle time of patients with AMI requiring thrombolytic therapy.
- Identify factors associated with door-to-needle time.
- Determine the effects of door to needle time on length of hospital stay, morbidity and mortality.
- Explore the perceptions of nurses on door-to-needle time.

1.8 RESEARCH METHODOLOGY

A brief description of the methodology is stated in this chapter and a detailed description of the methodology follows in chapter 3.

1.8.1 Research design

A mixed methods convergent parallel approach was used to determine the current door-to-needle time and factors that affects door-to-needle time. This approach combines quantitative and qualitative research methods in the same inquiry (Venkatesh, Brown & Bala, 2013:21). This approach also provides a better understanding of the research problems than a single approach (Creswell, 2006: 6). According to Venkantesh *et al.* (2013: 21), this method can help develop insights, into various phenomena of interest that cannot be fully understood using only a single method. The researcher used the method to adequately address the research problem. The mix method approach helped to answer questions that could not be answered by qualitative or quantitative approaches alone (Creswell, 2006: 9).

1.8.2 Study setting

The setting is the location in which the study is conducted (Burns & Grove, 2011:40). A natural setting is an uncontrolled, real life situation or environment. Conducting a study in a natural setting means that the researcher does not manipulate or change the environment for the study (Burns & Grove, 2011:40). The study was conducted in a CCU of a tertiary hospital in the Western Cape.

1.8.3 Population and sampling

Population is defined by Brink, van der Walt and van Rensburg (2012:131) as the entire group of people or objects that is of interest to the researcher and meet the criteria for the study. A sample is a subset of a group or individuals, elements from a defined population that is selected to participate in a research study (Brink *et al.*, 2012:131). The total population consisted of 63 case notes (files) of patients diagnosed with AMI who received thrombolytic therapy between January 2009 and January 2014. In addition, eight registered professional nurses (RPNs) were selected purposively for face-to-face interviews.

1.8.3.1 Quantitative sample

For the purpose of the study, a total of 39 case notes of patients who received thrombolytic therapy in the CCU in the past five years were used. For the purpose of the study, no sampling technique was used. All the case notes from January 2009 to January 2014 were included. The researcher made a list of folder numbers from the identified population. The

folder numbers were identified from a register kept in the CCU and sent to the Medical Records department for the retrieval of files. The sample was drawn from the identified population.

The files were retrieved by an officer at the Medical Records and kept in a separate office for the researcher to use them. The researcher then assigned a data extraction form to each file and data needed was obtained from the notes found in the file. The researcher studied the literature prior to review to ensure that important information is obtained for the medical notes and ensured that it met the study objectives.

1.8.3.2 Qualitative sample

The sample size consisted of eight (8) RPNs selected from a population of sixteen (16) RPNs working in the CCU of the tertiary hospital. The researcher selected the participants purposively. According to Brink *et al.* (2012:141), this sampling technique is based on the judgement of the researcher regarding the participant's representative of the study phenomena. The technique allows the researcher to select the sample based on the knowledge of the phenomenon being studied (Brink *et al.*, 2012:141).

For the purpose of the study, the researcher selected the participants based on gender, age, and years of experience.

1.8.4 Inclusion criteria

All health care records of adult male and female patients diagnosed with AMI who received thrombolytic therapy in the CCU in the past five years were eligible for inclusion. RPNs working in the CCU at a tertiary hospital in the Western Cape were included in the study.

1.8.5 Exclusion criteria

All health care records that had incomplete data and those where time of commencement of thrombolytic therapy was not recorded were excluded from the study.

1.8.6 Data collection tools

Data collection is the precise, systematic gathering of information relevant to the research purpose or the specific objective, questions or hypotheses of a study (Burns & Grove, 2011: 52). A data extraction form was designed based on the literature and patient characteristics such as their demographic data, ECG characteristics and factors associated with door-to-needle time. Patient outcomes were also included in the study.

For qualitative data collection, an interview guide was designed based on the objectives of the study. The interview guide consisted of a main question and additional probing questions designed to explore the perceptions of nurses on factors that affects DNT (Burns & Grove, 2011:85). The main question asked was what are your perceptions on DNT? Consent for the use of an audiotape was obtained from the participants.

1.8.7 Pilot study

Brink *et al.* (2012:56) define a pilot study as a small scale version or “dummy run” of the major study. A pilot study was conducted to refine the methodology, to establish the feasibility of the study and where needed, to make adjustments to the instrument (Burns & Grove, 2011:49).

1.8.7.1 Quantitative data

The pilot study tested the tool on six case notes. The first six data extraction forms were reviewed carefully by the researcher after data collection to evaluate the instrument and to ensure that problems with data management are not encountered. This was also done to test the feasibility of the study. Results of the pilot study were included in the final analysis of the study.

1.8.7.2 Qualitative data

The pilot study was conducted using one participant of the chosen population for the study. The researcher listened to the first interview carefully to ensure that the questions asked and the response were enough to answer the research question and to evaluate whether there are any adjustments needed to be made on the interview guide and to evaluate whether the time frame for the interviews is sufficient and will not consume too much of the interviewer and interviewee's time. Results of the pilot study were included in the final analysis of the study.

1.8.8 Reliability

Reliability is concerned with the consistency, stability and repeatability of the informants' accounts, as well as the researcher's ability to collect and record information accurately (Brink *et al.*, 2012:126). The reliability of the data extraction form and the interview guide was tested during the pilot study. Data quality was determined by the availability and accuracy of the case notes.

1.8.9 Validity

According to Burns and Grove (2011:334), validity of an instrument is a determination of how well the instrument reflects the abstract concept being examined. Content-related validity examines the extent to which the measurement includes all the major elements relevant to the contrast being measured (Burns & Grove, 2011:335). Construct validity is the validity that is considered a single broad method of measurement (Burns & Grove, 2011:335). The development of the data extraction form and the interview guide were influenced by the literature and study objectives. The researcher's supervisor assisted in the drafts and review of the data extraction form and the interview guide. Construct validity was ensured.

1.8.10 Rigor

Rigor refers to openness, relevance, epistemological and methodological congruence, thoroughness in data collection and analysis and the researchers understanding (Brink *et al.*, 2012:126). Brink *et al.* (2012:126) identifies four criteria to describe rigor in qualitative research. The principles of credibility, conformability, dependability and transferability were used to ensure the rigor of the qualitative part of the study.

1.8.11 Data collection

Data collection is the precise, systematic gathering of information relevant to the research purpose or the objectives, questions or hypotheses of the study (Burns & Grove, 2011:52). Data collection was conducted using a data extraction form and case notes of all patients with AMI who received thrombolytic therapy. Patients were identified by using the patient register in the CCU. Both electronic and hard copies of case notes were available to the researcher.

Each file was assigned a data extraction form. The researcher accurately extracted the data from the patient files onto the forms. Information required (including age, gender, risk factors etc) was obtained from the notes and carefully entered on the form. On completion, the extraction form was kept in a file. The patient's files were kept in a private room at the Medical Records department and labelled with the researcher's name. The researcher was not allowed to remove the files from medical records.

Interviews were conducted by a trained field worker at the participant's place of employment. Informed consent was obtained before the interviews. Upon completion of the consent forms, participants were requested to place the forms in a sealed box marked "consent forms." On completion of the consent forms, interviews were conducted by trained field workers using an

audio recorder. Interviews lasted for approximately 30 minutes. Data collection took place over approximately six weeks. It occurred in a private room in the medical records department of the tertiary hospital. Interviews were conducted in a private room in the CCU.

Table 1.1 Duration of data collection

Approach	Time frame (dates)
Quantitative data	18 August 2014 -5 September 2014
Qualitative data	26 August 2014 -25 September 2014

1.8.12 Data analysis

Data analysis reduces, organises and gives meaning to the data (Burns & Grove, 2011:52). A qualified statistician from the Centre for Statistical Consultation at Stellenbosch University, Professor M. Kidd was consulted for the data analysis. Data was entered onto a Microsoft Excel© spreadsheet then submitted to the statistician for analysis using the STATISTICA12© program.

Descriptive analyses were performed in this study. Descriptive statistics were used to summarize all demographic and clinical characteristics of patients and were represented in frequency tables and histograms. Median and ranges were used to calculate door-to-needle times. Several factors were correlated with door-to-needle time.

Transcripts and interviews were read carefully. The researcher then noted all the key phrases and the main ideas were noted. The researcher repeatedly read the transcripts until full immersion in the data occurred. The data was then broken into segments and a label was allocated to each part. Codes were used to tag segments of text that had similar content using a symbol. All data coded the same way were compared for similarities and differences. Segments with similar contents were sorted into separate categories for a final distillation into major themes.

1.9 ETHICAL CONSIDERATIONS

Permission to conduct the research was obtained from the Health Research Ethics Committee of the Stellenbosch University (Reference: S14/03/054). Permission to access the case notes and to conduct the interviews was requested and obtained from the hospital managers of the tertiary hospital.

Signed informed consent was obtained before the interviews were conducted. Objectives of the study were explained to the participants. Participants took part in the study voluntarily and anonymously. Pseudonyms were used for participants and the name of the location for the study was not disclosed. Confidentiality and anonymity was ensured by placing informed consent forms in a sealed box and no participant's characteristics were disclosed. Only the researcher and the supervisor had access to the information and audio recorded interviews. Raw data and results were stored in a locked cabinet and will be saved for five years after completion of study.

1.10 LIMITATIONS

Some files could not be found and some case notes had incomplete data.

1.11 DEFINITIONS

Door-to-needle time (DNT) is defined as the time from the first medical contact (hospital arrival) to administration of thrombolytic therapy.

Delay is defined as the period by which something is late or postponed. For this study, delay is the time from symptom onset to emergency department (ED) presentation and initiation of thrombolytic therapy. DNT of greater than 30 minutes is regarded as delayed.

Registered professional nurse is a person who is qualified and competent to independently practise comprehensive nursing in a manner and to the level prescribed and who is capable of assuming responsibility and accountability for such practise.

1.12 CHAPTER OUTLINE

Chapter one outlined the brief overview of the background, methodology, data collection and analysis including the ethical considerations. The methodology will be discussed in detail in chapter three.

1.13 SUMMARY

This study intended to investigate the factors which cause the delay in door-to-needle time in the emergency departments and to explore the perceptions of nurses on door-to-needle time. The researcher therefore intended to provide vital information about the measures that can be implemented to reduce door-to-needle time in the CCU.

1.14 CONCLUSION

The effectiveness of emergency management of AMI's relies on the speed and accuracy of diagnosis and treatment (Barbageleta *et al.*, 2007:258). Therefore, the benefit of reperfusion is directly related to the time to treatment. Early provision of reperfusion therapy is critical to its benefit (Steg *et al.*, 2012:2577). Reducing the time from symptom onset to administration of thrombolytic therapy is critical in reducing mortality and morbidity from AMI (Fukoka, Dracup, Ohno, Koboyashi & Hirayama, 2005:241). Therefore, early intervention and management improves the outcomes and the quality of life.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Cardiovascular disease (CVD) remains the leading cause of death among Europeans and around the world. (Nichols, Townsend, Scarborough & Rayner, 2014:1) The Global Burden of Disease study estimated that 29.6% of all deaths worldwide were caused by CVD in 2010, more than all communicable, maternal, neonatal and nutritional disorders combined, and double the number of deaths caused by cancers (Nichols *et al.*, 2014:1).

The ECG remains of high importance in the diagnosis of cardiac ischemia in general (Hampton, 2008:130). According to Hampton (2008:130), a patient with acute chest pain due to ischemia has an acute coronary syndrome (ACS). This term includes: myocardial infarction, chest pain with ischemic ST segment depression and sudden death due to coronary disease (Hampton, 2008:130).

Among CHD's, acute myocardial infarction (AMI) is one of the leading causes of death, with most deaths occurring before hospital admission (Barbagelata *et al.*, 2007:257). An AMI is a medical emergency requiring immediate intervention (Casale, 2007:49). According to Casale (2007:49), more than 90% of MI's are caused by thrombotic obstruction in a coronary artery and irreversible myocardial necrosis begins within as little as 20 minutes of occlusion. AMI can be classified into ST-segment elevation myocardial infarction (STEMI) and non-STEMI which is distinguished based on the findings from a diagnostic ECG (Kingsbury, 2013:5). In either case, the patient will have a raised plasma troponin level (Hampton, 2008:130).

2.2 LITERATURE REVIEW

A literature review involves finding, reading, understanding and forming conclusions about the published research and theory as well as presenting it in an organised manner (Brink *et al.*, 2012:71). According to Burns and Grove (2011:189), a review of literature provides the reader with the current theoretical and scientific knowledge about a particular problem, enabling the reader to synthesize what is known and not known.

The purpose of the literature review in the study was to:

- Define and understand the pathophysiology of AMI.
- Examine the international and South African guidelines for the management of AMI.
- Explore the assessment of patients with AMI.

- Explore the patient assessment by nurses during presentation to the emergency department.
- Explore the nurse's responsibility during patient presentation.

2.2.1 Acute myocardial infarction

Acute myocardial infarction is defined as myocardial cell death due to prolonged ischemia (reduced/lack of oxygen supply to the heart muscle) (Elliot, Aitken & Chaboyer, 2012:216). Infarction occurs when blood flow to the myocardium is severely impaired for more than 20 minutes and myocardial cell necrosis begins (Elliott *et al.*, 2012:216).

Universal definition of MI

Detection of rise / or fall of cardiac biomarker value (preferably Troponin) with at least one value above 99% percentile of the upper reference limit and with at least one of the following:

- Symptoms of ischemia.
- New or presumably new significant ST-T changes or new LBBB (left bundle branch block).
- Development of pathological Q waves in the ECG.
- Imaging evidence of new loss of viable myocardium, or new regional motion abnormality.

European Society of Cardiology (Steg *et al.*, 2012: 2573)

2.2.2 The coronary circulation

The coronary arterial system consists of the right and left coronary arteries. These arteries branch from the aorta. They are unique in that they fill during diastole when not occluded by valve cusps and when not squeezed by myocardial contraction. The right coronary artery arises from the right coronary sinus and courses through the right side of the atrioventricular (AV) groove, giving off vessels that supply the right atrium and ventricle. The vessel continues as the posterior descending coronary artery and supplies the posterior part of the interventricular septum and the posterior left ventricular wall (Kumar & Clark, 2012:672).

According to Kumar and Clark (2012:672), within 2.5 cm of its origin from the left coronary sinus, the left main coronary divides into the left anterior descending artery and the

circumflex artery. The left anterior descending artery runs in the anterior interventricular groove and supplies the anterior septum and the anterior ventricular wall. The left circumflex artery travels along the left AV groove and gives off branches to the left atrium and the left ventricle.

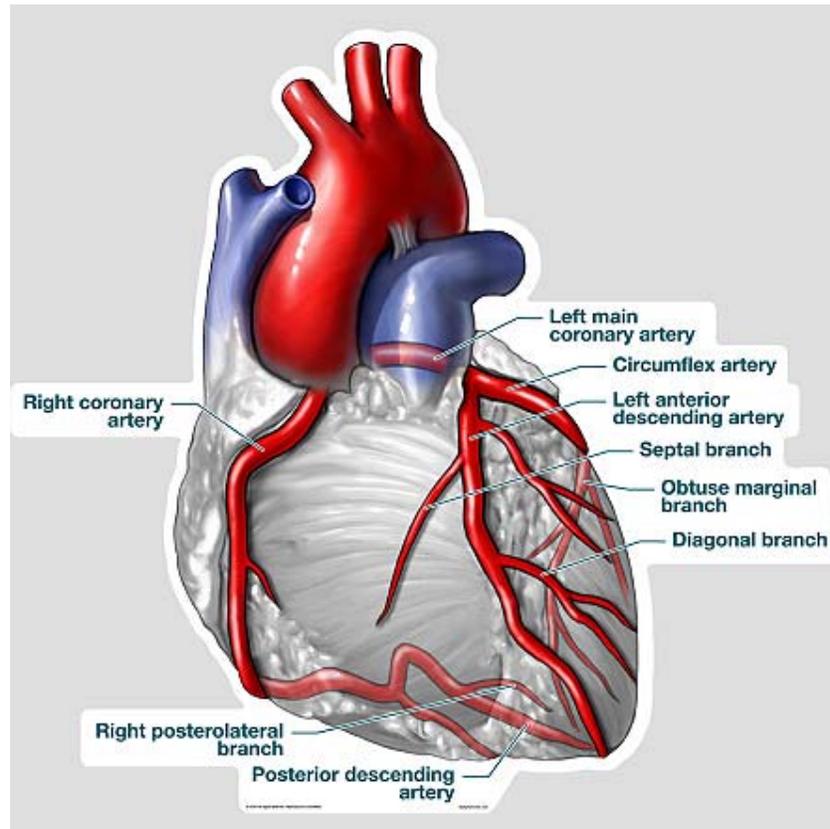


Figure 2.1: Coronary Arteries

Source: cardiachealth.org

2.2.3 Pathophysiology of AMI

Atherosclerotic narrowing of the coronary arteries occurs due to rupture of the atherosclerotic plaque. Formation of thrombus over the plaque occurs resulting in rapid occlusion of the vessel (Jain, Ginks & Al-Obaidi, 2008:77).

Coronary blood flow is impaired leading to myocardial cell necrosis. Plaque rupture occurs, followed by a white thrombus resulting from activation of white platelets. The lesion may lead to thrombin activation, which in turn leads to a mesh of fibrin and red blood cells, leading to a 'red' thrombus (Elliott *et al.*, 2012:216)

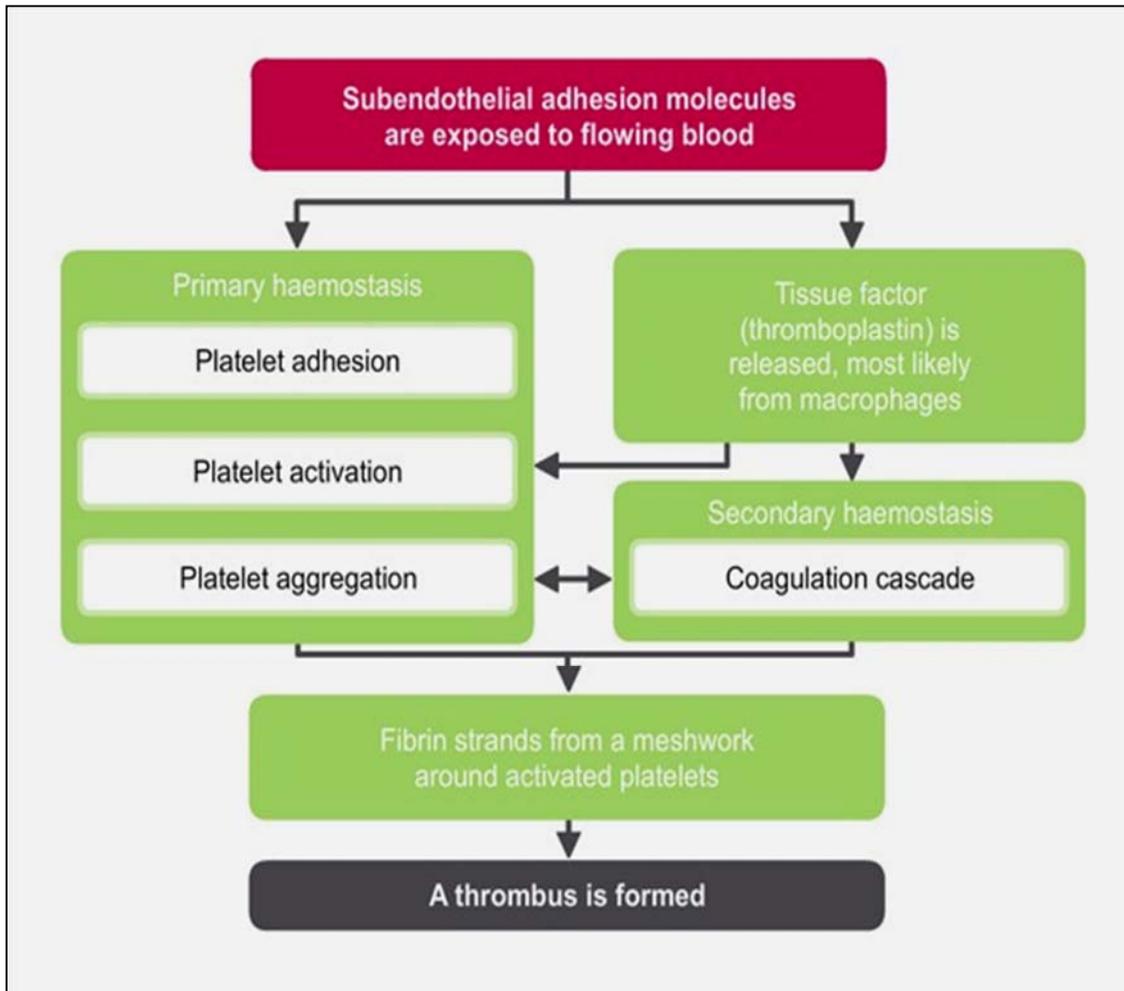


Figure 2.2: Pathophysiology of myocardial infarction

Boehringer Ingerlheim, 2014:np

2.2.4 International standards for AMI management

2.2.4.1 European Society of Cardiology

In 2013, the European Society of Cardiology task team introduced the new guidelines for the management of patients with AMI. According to the European Society of Cardiology, a working diagnosis of AMI must be based on the following:

- A history of chest pain lasting for more 20 minutes or more and not responding to nitroglycerine.
- On a 12-lead ECG, typically ST-segment elevation in AMI should be found in two contiguous leads.

- Blood sampling for serum markers is recommended routinely in acute phases but one should not wait for the results before initiating reperfusion therapy (Steg *et al.*, 2013:2574).

2.2.4.2 American Heart Association

According to the American Heart Association (AHA), medical professionals should play a central role in assessing and evaluating the evidence related to the management and prevention of disease (O'Gara *et al.*, 2013:530). After an organised and directed approach to the review of evidence, the AHA task force developed the following clinical practice guidelines for the management of ST-elevation AMI. Guidelines are as follows:

- A history of chest pain lasting for 20 minutes or more.
- A 12-lead ECG should be performed by the medical emergency services at the first medical contact.
- Reperfusion therapy should be administered to all eligible patients with AMI with symptom onset within the prior 12 hours.
- When thrombolytic therapy is indicated, it should be administered within 30 minutes of hospital arrival.

2.2.4.3 South African guidelines for management of AMI

In South Africa, heart attacks occur in 327, 9 per 100 000 males and 315, 2 per 100 000 females respectively (WHO, 2011:174). One hundred and thirty heart attacks occur daily of which 33 of them results in death (Heart and Stroke Foundation South Africa, 2007). For every woman that dies of a heart attack, two men die (Heart and Stroke Foundation SA, 2007:2). In South Africa, more than half of the deaths caused by chronic diseases, including heart disease occur before the age of 65 years and these are premature deaths which affect the workforce and have a major impact on the economy of the country (Fourie, 2007:3). These deaths are expected to increase to 41% in people of working age (35-64 years) between 2000 and 2030 (Fourie, 2007:2). In the Western Cape, one in four deaths result from ischemic heart disease (Chopra, Steyn & Lambert, 2007:3). Mortality from ischemic heart disease is higher in males than in females (Maharaj, Geduld & Wallis, 2012: 241).

Despite the growing burden of CHD in the country, there has been limited information on the health system with regard to the management of AMI. In 1998, the National department of Health implemented the Standard Treatment guidelines and Essential Drug list for the treatment and management of AMI (Standard Treatment and Essential drug list for South Africa, 1998:40)

2.2.5 AMI assessment

Assessment should be performed when patients present with pain to a health care facility and at the onset of new acute pain (Wuhrman & Cooney, 2011:1). History taking is an important part of assessment as it gives an idea of the severity of the problem (Jain *et al.*, 2008:78). Pain assessment should focus on the nature of the pain and the pain intensity in order to determine treatment and guide further interventions (Wuhrman & Cooney, 2011:1)

A key feature of assessment of the patient with chest pain is the use of guidelines to promote rapid assessment so that procedures such as thrombolysis can be implemented as soon as possible (Elliott *et al.*, 2012:217). According to Elliott *et al.* (2012:17), assessment should occur within 10 minutes of patient arrival.

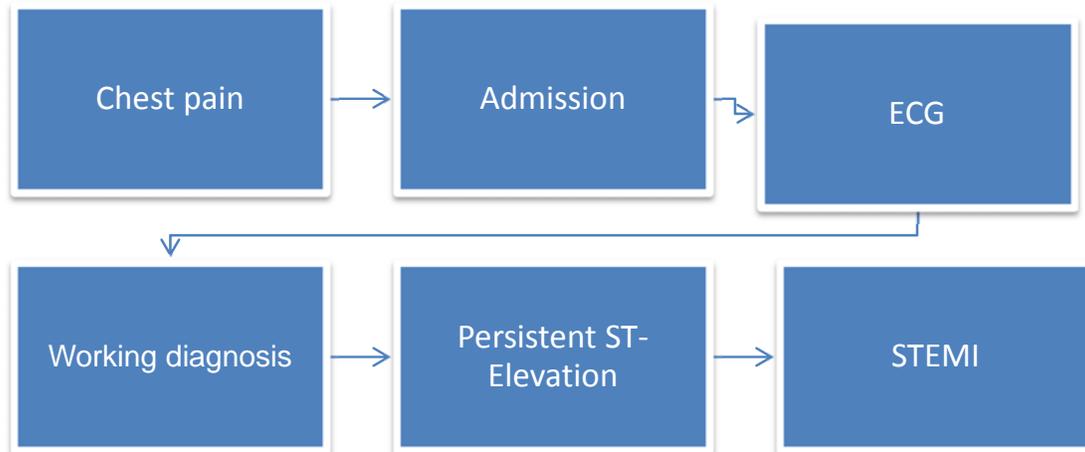


Figure 2.3: Chest Pain Assessment

Source: Hamm *et al.*, 2011:3003

2.2.5.1 Physical examination

Physical examination depends on the impact of chest pain, size and location of the infarction in the individual (Elliott *et al.*, 2012:217). The classic symptoms of STEMI involve chest discomfort. The patient usually complains of chest pain which is severe in nature, lasting for at least 20 minutes (Linton, 2012:694). Pain in AMI is typically heavy or consistent in nature and it may radiate to the jaw, back, arms or neck (Linton, 2012:694). According to Linton (2012:694), the pain may be associated with sweating, dizziness, nausea, vomiting and dyspnoea. The patient's skin is usually cold and clammy and the patient may be anxious and distressed (Linton, 2012:694). Raised blood pressure and heart rate may be seen due to anxiety. Because of the infarction and left ventricular function impairment, patients may

experience dyspnoea (shortness of breath), nausea and low blood pressure (Elliott *et al.*, 2012: 217).

2.2.5.2 Chest pain assessment

Reliable and valid assessment of pain is essential for effective pain management (Breivik, Borchgrevink, Allen, Rosseland, Romundstad & Breivink, 2008:17). Nurses need to assess the pain quality and severity in all the patients presenting with chest pain. Pain qualities can present as follows:

- Intermittent pain. This is the pain that comes and goes and the patients have some moments when they are pain free (www.painedu.org).
- Variable pain. This is the pain that varies in type and severity from one moment to the next but the patient is never pain free. The increase in pain can be severe or lower at times but the patient is never pain free (www.painedu.org).
- Stable pain. This type of pain does not change much from one moment to another but there are no pain free moments (www.painedu.org).
- Referred pain. This is a pain experienced in a location different from its origin (Linton, 2012:223). According to Linton (2012:223), angina pain is a typical type of referred pain and is caused by lack of blood flow to the heart muscle and it may be experienced as pain in the jaw, arm, neck as well as chest.

For patients with chest pain, pain severity is assessed by using the Numerical rating Scales (NRS) (American Pain Society, 2003:np). These scales function best for the patient's subjective feeling of the intensity of pain. The pain intensity levels are assessed at the initial encounter and following treatment. With NRS, patients rate their pain on a 0-10 scale, with 0 representing no pain and 10 representing their worst imaginable pain (Breivik *et al.*, 2008:17).

Linton (2012:697) suggest that the nurse needs to gather the following information regarding the patient's pain (See Table 2.1)

Table 2.1: Pain assessment

Acronym	Factors that need to be assessed	Assessment question
P	Position	Where is the pain? Can you point to it?
	Precipitating factors	What were you doing when the pain started?
Q	Quality	Describe the nature of the pain? Did you experience this kind of pain before?
	Quantity	Has the pain been constant?
R	Radiation	Does the pain spread to other parts of the body?
	Region	Where is the pain located?
S	Severity	On a scale of 0-10, how would you rate your pain?
	Symptoms	Do you have any other symptoms associated with the pain?
D	Duration	How long does the pain last?

Source: Linton, 2012:697

2.2.6 Special investigations

2.2.6.1 Electrocardiographic examination (ECG)

Twelve-lead ECG plays a vital role in the early diagnosis of STEMI (Hartman, Barros & Brady, 2012:1285). As recommended by the European Society of Cardiology and AHA, a 12-lead ECG should be performed within 10 minutes of patient presentation. According to Elliott *et al.* (2012:218), patients with chest discomfort should be assessed by a qualified person and have an ECG recorded within five minutes of arrival at the health care facility. Rapid and accurate interpretation of the ECG is important for diagnosis (Hartman *et al.*, 2012:1285). ECG is essential to determine whether emergency reperfusion is required. ST elevation of 1mm in two contiguous leads indicates myocardial injury and a need for reperfusion therapy (Elliott *et al.*, 2012:218).

2.2.6.2 Biochemical markers (Blood tests)

During an ischemic event, intracellular cardiac enzymes enter the blood. Thus elevated enzyme levels are used to confirm myocardial infarction (Elliott *et al.*, 2012:218).

The following cardiac enzymes are useful for confirming AMI diagnosis:

- Troponin I and T have been found to be sensitive and specific measures of cardiac muscle damage.
- Creatine Kinase-MB (CK-MB) the levels are affected by muscle damage (levels will be raised).

2.2.6.3 Chest x-ray

All patients complaining of typical chest pain of cardiac type should have a chest x-ray as part of their assessment (Jain *et al.*, 2008:78). It is important to look at the following features on the chest x ray:

- Widening of the mediasternum indicates the likelihood of aortic dissection. Aortic dissection is an absolute contraindication for thrombolysis.
- Signs of pulmonary oedema (accumulation of fluid in the pleural space) are an indication for oxygen and nitrate therapy.
- An enlarged heart indicates cardiac failure (Jain *et al.*, 2008:78).

2.2.7 Nurses roles, responsibilities and accountability

Nurse practitioners provide an intermediary role between the patient, other nurses and the physician, thereby improving the aspects of care of the patients with AMI (Wit, Bos-Schaap, Haustvast, Heestermans & Umans, 2011:5). Nurse practitioners therefore need to recognise their role of facilitating the process of improving patient care and safety. In South Africa, the nursing profession is governed by the Nursing Act 33 of 2005 (Republic of South Africa, 2005).

According to Pera and van Tonder (2011:114), the nurse made a choice to nurse, thus accepts the responsibilities associated with nursing practice and develops a set of professional commitment and values. A nurse is must therefore be accountable for her actions (Pera *et al.*, 2011:114). The nurse may be held accountable for any physical and emotional detriment inflicted to the patient due to negligence, disrespect or incompetence (Pera *et al.*, 2012:114).

Stellenberg and Bruce (2007:23) propose that clinical examination by nurses should include:

- Observation of general appearance, posture and facial expression.
- Vital signs: observe the signs of reduced cardiac output. This will be indicated by a reduction in blood pressure. Observation of cardiac dysrhythmias is also important.

2.8 ACUTE MYOCARDIAL INFARCTION (AMI) MANAGEMENT

Recognising the signs and symptoms suggestive of AMI and obtaining an ECG as soon as possible (goal of less than 10 minutes) of patient presentation should be the standard practice to manage patients (Kingsbury, 2013:9).

2.8.1 Nursing management

The goal of nursing interventions are broadly designed to promote healing to the damaged myocardium, prevent complications and facilitates the patient's rapid return to normal health.

Nursing management includes:

Pain control- the nurse administers analgesics as prescribed and monitors pain for relief (Linton, 2012:698). Opiates such as morphine are administered intravenously in small amounts until pain is relieved (Linton, 2012:214). According to Linton (2012:698), oxygen supplementation must be provided and head of bed is elevated to 30 degrees. The nurse reports respiratory alterations (dyspnoea, increased respiratory rate) to the physician (Linton, 2012:698).

Decreased cardiac output- interventions to reduce demands on the heart include assisting the patient to rest, spacing activities and providing adequate oxygenation, pain relieve and maintaining a calm and quiet environment (Linton, 2012:698). Linton (2012:698), suggests that patient's vital signs must be monitored hourly until the patient is stable. ECG is monitored for any changes and for dysrhythmias.

Psychological support- is a vital component as patients may experience fear and anxiety from the pain during the first hours of pain onset (Elliot *et al.*, 2012:224). Therefore, a calm and caring manner during nursing care is essential to reduce stress levels. The nurse must provide easy explanations of the procedures and routines during the acute phase of AMI (Linton, 2012:698). Family members should be informed of the patient's progress.

Cardiac rehabilitation –as soon as the patient is stabilised, rehabilitation is started by teaching the patient and family about lifestyle modifications such as exercise, diet and medication (Linton, 2012:698). According to Linton (2012:698), rehabilitation helps to minimise the risk of repeated adverse cardiac events and it enable the patient to reach the maximum level of wellness and work ability. The program must be individualised in order to attain maximal success (Linton, 2012:698).

2.8.1.1 Best practice recommendations for nurses

Nurse practitioners provide an intermediary role between the patient, other nurses and the physician, thereby improving the aspects of care in the patients with AMI (Wit, Bos-Schaap, Haustvast, Heestermans & Umans, 2011:5). Nurse practitioners therefore need to recognise their role of facilitating the process of improving patient care and safety.

Recommendation 1: all RPNs working at nursing stations are trained in ACLS, ECG interpretation and ACS (acute coronary syndrome) management, to ensure best practices are applied.

Recommendation 2: all nursing stations have a visible ACS Algorithm to ensure patients are managed according to best practices.

Recommendation 3: all nursing stations have thrombolytic therapy readily available to be administered to all eligible STEMI patients within 30 minutes of their arrival in a nursing station.

Recommendation 4: CCU STEMI protocols developed to ensure timely and appropriate diagnosis and management of STEMI patients are adopted as the standard of practice in all nursing stations.

ACS patients' management-triage and first assessment guidelines (Wright *et al.*, 2011 in Kingsbury, 2013:12)

2.8.2 Pharmacological management

The goal of pharmacological management is to relieve the pain, dissolve the clots and prevent further damage to the myocardium. According to European Society of Cardiology guidelines, patients with clinical presentation of ST-elevation MI, pharmacological reperfusion should be performed as early as possible (Steg *et al.*, 2012: 2580). Reperfusion therapy should be considered if there is clinical or electrographic evidence of ongoing ischemia (Steg *et al.*, 2012:2580).

According to Steg *et al.* (2012:2586) the benefit of reperfusion therapy is well established. Treatment is most effective when administered early after symptom onset (Linton, 2012:695).

Banerjee and Kumar (2011:39) have identified the following criteria for initiating thrombolytic therapy:

Criteria for initiating thrombolytic therapy:

- Chest pain lasting for 10 to 20 minutes or more not responding to nitrates.
- ECG changes: ST elevation of 1mm or more in two contiguous precordial leads.
- Absence of contraindications to thrombolytic therapy.

Internationally and in South Africa, the reperfusion drug of choice for the management AMI is streptokinase (1 500 000 I.U vials) administered intravenously.

2.8.2.1 Streptokinase (1 500 000 I.U vials) pharmacological action

Streptokinase acts with plasminogen to produce an activator complex that converts plasminogen to the proteolytic enzyme plasmin. Plasmin degrades fibrin clots as well as fibrinogen and other plasma proteins. When intravenously infused, Streptokinase increases fibrinolytic activity, which decreases plasma fibrinogen levels leading to a decrease in plasma and blood viscosity and red blood cell aggregation (Subbarao, 2012:np). Streptokinase is antigenic and the development of streptococcal antibodies precludes repeated use. Activation of plasminogen is unselective so that both fibrin in clots and free fibrinogen are lysed, leading to low fibrinogen levels and the risk of bleeding (Kumar & Clark, 2012:426).

Although reperfusion therapy is a vital intervention strategy for patients with myocardial infarction, health care providers need to assess patients for thrombolytic therapy (Kingsbury, 2013:9). Although it improves patient outcomes, certain conditions are considered absolute and others relative contraindications. Therefore contraindications must be evaluated prior to thrombolytic therapy administration (Kingsbury, 2013:9).

Table 2.2: Contraindications for Thrombolytic Therapy ESC guidelines

Absolute
Previous intracranial haemorrhage or stroke of unknown origin at any time.
Ischemic stroke in the preceding 6 months
Central Nervous System damage
Recent major trauma
Gastrointestinal bleeding within the past month
Unknown bleeding disorder
Aortic dissection
Relative
oral anticoagulant therapy
Pregnancy or within 1 week post-partum
Refractory hypertension (systolic BP> 180mmHg or diastolic BP>110mmHg)
Advanced liver disease
Prolonged or traumatic resuscitation

Source: Steg *et al.*, 2012:2587

Recommendations for additional therapies to thrombolytic therapy

AHA recommendation: All STEMI patients should receive the following medical therapy in addition to thrombolytic therapy.

Table 2.3: Medical therapy for STEMI patients

Treatment	Indication
Oxygen	Clinically significant hypoxemia Heart failure Dyspnoea
Nitroglycerin	Ongoing chest pain Hypertension and heart failure
Morphine	Pain Anxiety Pulmonary oedema.

Source: O'Gara *et al.*, 2013

ESC recommendation: All patients managed with thrombolytic therapy should receive additional antiplatelet and anticoagulant therapy. These therapies inhibit thrombin and prevent clot formation (Kingsbury, 2013:17). According to Kingsbury

(2013:17), when given in combination, administration of antiplatelet therapy following thrombolytic therapy has shown to improve vessel patency once the clot has dissolved and thus prevent reinfarction.

2.8.2.2 Antiplatelet therapy

Aspirin

- The first dose of 150-300mg orally should be chewed or an IV dose of 250mg if oral ingestion is not possible (Steg *et al.*, 2012: 2587). A lower dose of 75-100 mg orally daily should be given thereafter.

Clopidogrel

- When added to aspirin, clopidogrel reduces the risk of cardiovascular events in patients who had been treated with thrombolytic therapy (Steg *et al.*, 2012:2589). A loading dose of 300mg orally is given, followed by a maintenance dose of 75 mg daily.

2.8.2.3 Anticoagulant therapy

Parenteral anticoagulation should be administered until revascularisation (Steg *et al.*, 2012:2589). Therapy should be given for at least 48 hours for the duration of the hospital stay, up to eight days (Steg *et al.*, 2012: 2589).

Enoxaparin (Clexane)

- A stat dose reduces the risk of in-hospital reinfarction. A bolus dose of 0.5mg/kg is given.
- In patients less than 75 years of age, 30 mg IV bolus is given followed by 1mg/kg subcutaneously every 12 hours until hospital discharge for a maximum of eight days (Steg *et al.*, 2012:2589).

Unfractionated Heparin

- A bolus dose of 60U/kg IV with a maximum of 4000U followed by an IV infusion of 12U/kg with a maximum dose of 1000U/hour for 24 hours is given. A PTT (partial thrombin time) of 50-70 seconds is targeted (Steg *et al.*, 2012:2589).

2.9 SIDE EFFECTS

Side effects are defined as additional undesirable effects (Collins Dictionary, 2005:251).

2.9.1 Hypotension

Hypotension is defined as persistent systolic blood pressure of 90 mmHg or less. Rapid administration of streptokinase may be associated with low blood pressure (Steg *et al.*, 2012:2586).

2.9.2 Bleeding

Bleeding is defined as loss of blood as a result of rupture or severance of blood vessel (Stedman's Medical Dictionary, 2005:188). According to Malik and Khan (2004:107), the most common bleeding is seen at vascular puncture sites and in the gastrointestinal tract. According to Steg *et al.* (2012:2586), major non cerebral bleeds occur in four to thirteen percent of patients after thrombolysis.

2.9.3 Allergic reactions

Patients may develop allergic reactions such as rash, flushing, dyspnoea and bronchospasm. According to Steg *et al.* (2012: 2586), severe allergic reactions are rare.

2.10 REPEAT ECG

According to Kumar and Clark (2012:739) it is important to repeat the ECG at 60 and 90 minutes after thrombolytic therapy in order to determine whether reperfusion is established successfully. Thrombolytic failure may be evident by failure of ST-elevation to resolve within 30 to 60 minutes of thrombolytic therapy and it usually includes persistent symptoms (Davis *et al.*, 2012:32).

2.11 SIGNS OF REPERFUSION

Stellenberg and Bruce (2007:24) have identified the following as reperfusion signs:

- Sudden cessation of chest pain
- Rapid return of the ST segment to normal
- Improvement in left ventricular function
- Reperfusion dysrhythmias and conduction disturbances.

2.12 COMPLICATIONS OF AMI

Myocardial dysfunction frequently occurs during the acute and sub-acute phases following AMI. Rapid improvement is seen following successful early revascularisation of the infarction by interventions such as thrombolysis (Steg *et al.*, 2012:2600).

Complications are defined by Collins Dictionary (2005:54), as something that is made or become complex or difficult to deal with. Complications of AMI include:

2.12.1 Cardiogenic shock

Cardiogenic shock occurs as a complication of AMI in about 5-10% patients and is the most common cause of death in hospitals (Elliott *et al.*, 2012:227). According to Steg *et al.*, (2012:2600), hospital mortality rates for cardiogenic shock are approaching 50%. Cardiogenic shock usually arises from loss of contractile force and occurs when ventricular damage is more than 40% (Elliott *et al.*, 2012:227). Signs of cardiogenic shock include a reduction in cardiac output. The patient may also be pale, clammy and have diaphoresis (Jain *et al.*, 2008:78).

2.12.2 Heart failure

In normal circumstances, the heart is very effective and efficient in pumping with reserve mechanisms available to allow output to meet changing demands (Elliott *et al.*, 2012:227). Heart failure is a clinical syndrome describing the inability of the heart to provide an adequate cardiac output for the body's metabolic requirements (Stellenberg & Bruce, 2007:38). Steg *et al.* (2012:2600), state that the diagnosis of clinical heart failure in the acute and sub-acute phases are based on the typical symptoms such as dyspnoea, tachycardia and audible third heart sound on auscultation.

2.12.3 Cardiac arrhythmias

Arrhythmias and conduction disturbances commonly occur during the early hours after infarction. Patients with acute myocardial infarction, early ventricular fibrillation and ventricular tachycardia (VF/VT), are identified as those at increased risk for 30-day mortality (22% vs 5%) as compared to those without VF/VT (Steg *et al.*, 2012:2601).

Ventricular tachycardia is defined as three or more consecutive beats occurring at a rate greater than 120 beats per minute with abnormal complexes (Jain *et al.*, 2008:100).

Ventricular fibrillation is defined as irregular rapid ventricular depolarization (Jain *et al.*, 2008:102).

According to Steg *et al.*, (2012:2601), arrhythmias after the early reperfusion period may be a manifestation of a serious underlying condition, such as continuing myocardial ischemia, pump failure, altered autonomic tone, hypoxia, electrolyte (e.g. hypokalaemia) and acid-base disturbances, all of which require attention and corrective measures.

2.12.4 Pericarditis

Pericarditis is the inflammation of the visceral and parietal layers of the pericardium that cover the heart (Jain *et al.*, 2008:141). The chest pain of acute pericarditis is usually central or left-sided pain that is sharp in nature and is relieved by sitting forward (Jain *et al.*, 2008:141). Pericarditis occurs in up to 25% of patients between 12 hours and 6 days after an infarction (Jain *et al.*, 2008:142).

2.12.5 Cardiac arrest

Cardiac arrest is defined as the failure of the heart to pump sufficient blood to keep the brain functioning (Stellenberg & Bruce, 2007:30). Brain death occurs due to failure of oxygenation of brain cells associated with either failure in ventilation or failure of the heart to pump oxygenated blood to the brain (Stellenberg & Bruce, 2007:31). Signs of cardiac arrest include:

- Sudden loss of consciousness
- Absence of respirations
- No palpable carotid or femoral pulses.

Complications of myocardial infarction

Dominique Yelle

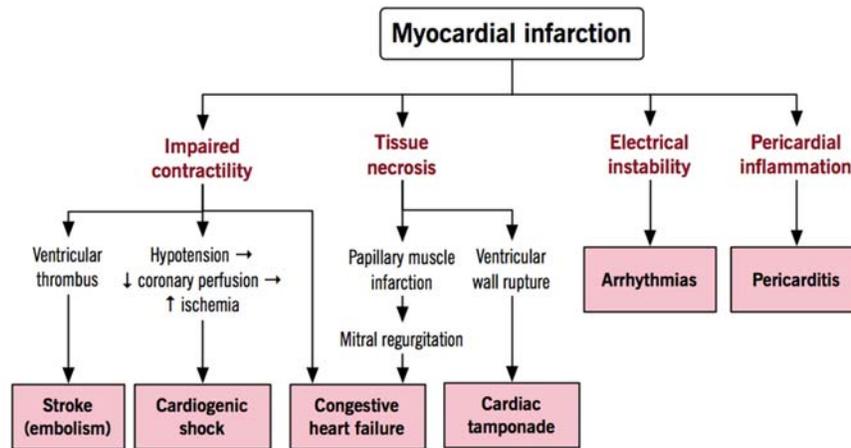


Figure 2.4: Complications of myocardial infarction

Source: McMaster Pathophysiology Review, 2012:np

2.13 NURSING MANAGEMENT OF COMPLICATIONS

Cardiogenic shock. Cardiogenic shock is the most common cause of death after an infarct (Linton, 2012:694). This is usually due to extensive injury to the left ventricle. Cardiogenic shock is marked by hypotension, cool and clammy skin, decreased urine output (Oliguria) and decreased level of consciousness (Linton, 2012:694). According to Linton (2012:694), nursing management requires careful monitoring, recording of vital signs and the patient's response to therapy.

Dysrhythmias. A dysrhythmia is defined as a disturbance of the rhythm of the heart caused by a problem in the conducting system (Linton, 2012:714). Linton (2012:714), states that dysrhythmias are categorised according to the location and origin. Those originating from the atria are called atrial dysrhythmias and those originating below the AV node are called ventricular dysrhythmias. According to Linton (2012:693), dysrhythmias occur in about 80% of all patients with AMI. Continuous cardiac monitoring is vital in AMI patients as this allows early detection and prompt treatment of the specific dysrhythmia thereof (Linton, 2012:693).

Pericarditis. Pericarditis is an inflammation of the pericardium (Linton, 2012:705). Nursing care involves rest and reduction of activity and cardiac workload (Linton, 2012:705). Analgesics, antipyretic agents and anti-inflammatory agents are administered as prescribed. The nurse monitors the vital signs and auscultate for a pericardial rub during inspiration

(Linton, 2012:706). Emotional support from the nursing staff and family members is vital in improving care (Linton, 2012:706).

Heart failure. AMI may cause the heart to fail if the left ventricle is unable to meet the body's circulatory demands (Linton, 2012: 693). The nurse assesses the patient's heart sounds, rate and rhythm (Linton, 2012:701). The nurse should also inspect for jugular vein distension, the patient's daily weight, blood pressure and record them accurately (Linton, 2012:701). Daily intake and output are recorded daily to evaluate fluid loss or retention. Medication is given as prescribed and patient is monitored for therapeutic and side effects (Linton, 2012:701). The use of combination drugs such as diuretics, ACE-inhibitors, beta adrenergic blockers, inotropes and nitrates is recommended to optimise cardiac function and to control fluid loss (Linton, 2012:700).

Cardiac arrest. The nurse must be familiar with resuscitation procedures and possess knowledge on how to perform basic cardiopulmonary resuscitation (CPR) (Stellenberg & Bruce, 2007: 31). The nurse is also responsible for monitoring the patient's comfort, dignity and for ongoing support of the family. According to Stellenberg and Bruce (2007:31), restoration of oxygenated blood supply to the brain and vital organs involves artificial ventilation and cardiac massage.

2.14 Factors associated with DNT

2.14.1 Transport

The ambulance service has a critical role in management of AMI and should be considered not only a mode of transport but also a place for initial diagnosis, triage and treatment (Steg et al., 2012:2578). According to Steg et al (2012:2578), initial treatment in the ambulance has been shown to reduce delays and improve clinical outcomes.

2.14.2 Pre- hospital ECG

ECG is an important diagnostic tool in the management of AMI. Thus ambulance personnel should be able to record an ECG for diagnostic purposes and either interpret it or transmit it for review by experienced CCU staff (Steg *et al.*, 2012:2578). According to Steg *et al.* (2012:2578), the recording and interpretation can accelerate in-hospital management and enhance the probability of reperfusion therapy.

2.14.3 Patient assessment

The important feature of assessment of the patient with chest pain and the use of guidelines to promote rapid assessment so that revascularisation such as thrombolysis can be implemented as soon as possible (Elliott, Aitken & Chaboyer, 2012:217). Assessment method should occur within 10 minutes of patient arrival and the initial history should focus on the nature of symptoms such as chest pain (Elliott et al., 2012:217). Accurate and detailed assessment should be carried out by experienced personnel (nurse) to enhance diagnosis and patient management process. According to Elliott *et al.* (2012:190), a thorough cardiac assessment requires the critical care nurse to be competent in a wide range of observational and technical skills. Nursing assessment aims to both define patient health status as well as to inform implementation of an appropriate clinical management plan (Elliott *et al.*, 2012:190).

2.14.4 Haemodynamic monitoring

Haemodynamic monitoring is defined as the measurement of pressure, flow and oxygenation within the cardiovascular system (Elliott *et al.*, 2012:786). Elliott et al. (2012:196), states that haemodynamic accuracy directly affects the patient's condition. In patients with hypotension or cardiac dysrhythmia, thrombolytic therapy is not administered until patient the patient becomes stable. This is to avoid further complications and adverse clinical outcomes (Elliott, *et al.*, 2012:196).

2.15 Theoretical framework

A theoretical framework is based on professional statements resulting from an existing theory (Brink *et al.*, 2012:26). The Betty Neuman's system model was used in the study. The model was developed to guide nursing care of individuals, groups or communities. The core components of the model are the client, the client systems and the three prevention-as-intervention levels (George, 2011:341). According to George (2011:341), Client systems may be physiological, psychological, developmental and spiritual variables that interact with the internal and external environment. The model focused on three prevention-as-intervention levels: primary, secondary and tertiary and are used to retain, attain and maintain system balance (George, 2011:345). Neumann emphasized a holistic, interdisciplinary and wellness-orientated approach to nursing.

2.15.1 The Neuman system model nursing process format

Neuman presents a three-step nursing process format known as the Neuman system model nursing process format (George, 2011:348). The three steps identified are: nursing

diagnosis, nursing goals and nursing outcomes. In these steps, data is identified, nursing interventions are carried out and short and long term goals are validated (George, 2011:348).

2.15.1.1 Nursing Diagnosis

In the process of nursing diagnosis, the nurse identifies potential and actual stressors that can pose a threat to the patient's stability (George, 2011:349). Stressor can be defined as a stimulus that produces tension and have a potential for causing system instability (George, 2011:344). Stressors can strain the patient's normal line of defence which protect the patient in the normal state of wellbeing. Identification of potential stressors is done by collecting subjective and objective data from the patient. The nurse focuses on obtaining a comprehensive database to determine the existing state of wellness and the actual stressor (George, 2011:351). In a patient with AMI in particular, lines of defence served as a barrier to protect the client but these lines of defence may be disturbed by a thrombus leading to an occlusion of the coronary arteries (figure 2.1). The nurse's clinical knowledge can be used in asking important question in order to obtain relevant baseline data. In the study, this process was done by the nurse and it included asking pain questions, history, identifying signs and symptoms and through the performance of a 12 lead ECG during patient presentation. The nurse makes a diagnosis by interpreting the collected data.

2.15.1.2 Nursing Goals

The ultimate goal of nursing management is to keep the patient system stable. Newman 's model (1989) indicates that the three levels of prevention are used to attain, maintain and retain wellness by facilitating system stability. The goal in patients with AMI is to relieve pain and to prevent adverse effects from occurring. In this step, secondary prevention occurs after the patient has experienced a stressor and it focuses on preventing further damage (George, 2011:354). Secondary prevention consisted of interventions required to maintain the client's system stability. In the study in particular, the nurse facilitates appropriate treatment and intervention measures by prompt administration of thrombolytic therapy once AMI diagnosis is confirmed. The nurse also ensures that a proper plan is in place to facilitate the management process and reduce adverse effects. Continuous patient monitoring is important and it should be incorporated in the planning process.

2.15.1.3 Nursing outcomes

This phase begins with the nursing interventions (George, 2011:353). The secondary prevention in this process includes the facilitation of appropriate treatment and intervention measures, aimed to mobilise and optimise internal resources to attain system stability. The CCU nurse should promote integration and ensure that the desired change has occurred and

use the outcomes to develop long term goals. An ideal CCU and its related systems should have appropriate measures in place and the capacity to promote desired nursing care outcomes. Such a CCU may result in reduced DNT and subsequent health outcomes

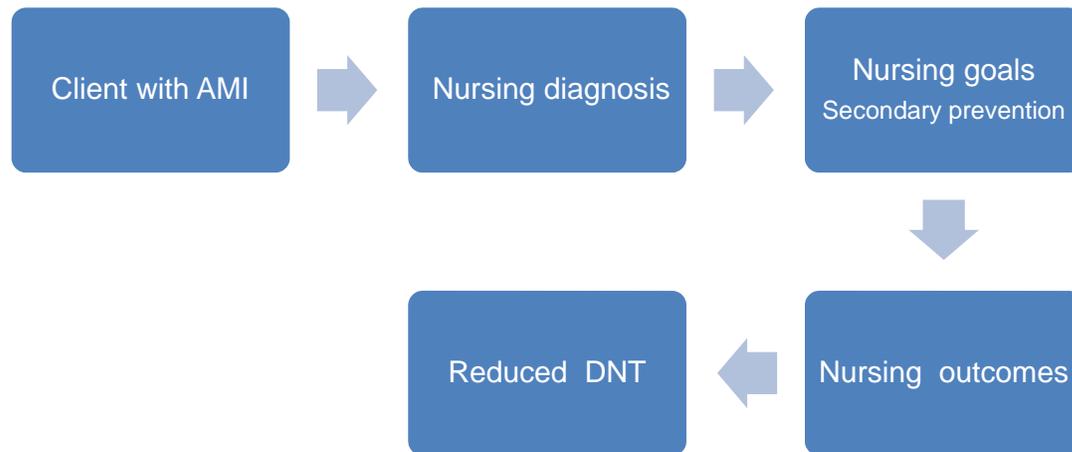


Figure 2.5: Betty Neuman System Model (George, 2011:341)

2.16 SUMMARY

The literature review shows the importance of early intervention during patient presentation. Important management factors include patient assessment, nursing and pharmacological management of patients with AMI. The study examined the effects of secondary prevention on AMI management. Using the framework to approach management, the nurses may recognise their roles and responsibilities in assisting with the management of AMI.

2.17 CONCLUSION

Chapter 2 presented a summary of the literature on assessment and management of patients with myocardial infarction. Early and prompt management of patients is vital in the prevention of extensive myocardial damage, complications and mortality due to AMI. Chapter 3 will explain the methodology used to determine the factors associated with door-to-needle time and to explore the perceptions of nurses on door-to-needle time in a CCU of a tertiary hospital in the Western Cape.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

Chapter three outlines the research method applied during the study. This includes the research design, study population and sample, data collection methods and the data analysis.

3.2 RESEARCH DESIGN

A research design is defined as a blueprint for the conduct of the study that maximises factors that could interfere with the study's desired outcomes (Burns & Grove, 2011:49). A research design also ensures that the study is conducted in a logical and organised manner (Burns & Grove, 2011:49)

A mixed method convergent parallel design was applied in the study to obtain the important and relevant information on the door-to-needle time for patients who received thrombolytic therapy, factors affecting door-to-needle time and the effects of door-to-needle time on patient outcomes. Mixed methods design provides a better understanding of the research problems than a single approach (Creswell, 2006:6). The researcher used the methods to adequately address the research problem. It also enhances the validity or credibility of findings by comparing information obtained from different methods of data collection (Bamberger, 2012:4).

A mixed method convergent design is a design characterised by the concurrent timing for the implementation of the quantitative and qualitative components during the same phase of the research process (Stentz, Plano Clark & Matkin, 2012:3). In this design, the quantitative and qualitative methods are prioritised equally and the different components are kept independent and then mixed during the results stage where overall interpretation is made (Stentz *et al.*, 2012:3). This type of design is useful for confirming results from one type of data with those of another (Stentz *et al.*, 2012:4)

The qualitative data and their analysis refine and explain the statistical results by exploring the participants' views in more depth (Ivankora *et al.*, 2009:5).

In the study, the goal of the quantitative phase was to determine the current DNT and the factors associated with DNT in patients diagnosed with AMI. In the qualitative phase,

interviews were conducted to help explore the perceptions of nurses on DNT. The researcher dealt with the issues of timing, priority, implementation and integration.

Timing

Timing in mixed methods research involves collecting the quantitative and qualitative data in phases or gathering it at the same time (Creswell, 2009:235). Timing is dependent on the initial intent of the researcher. In the study, the researcher intended to collect both quantitative and qualitative data at the same time thus to allow data analysis to run parallel with one another.

Priority

Priority refers to which approach, quantitative or qualitative (or both) a researcher gives more weight throughout the data collection and analysis of the study (Ivankora *et al.*, 2009:9). According to Ivankora *et al.* (2009:9). In this study, priority was given to both approaches. The researcher applied concurrent timing during data collection and analysis process. Concurrent timing is defined as the timing where the researcher executes both the quantitative and qualitative components during a single stage of study (Stentz *et al.*, 2012:3)

Implementation

Implementation refers to whether the quantitative and qualitative data collection and analysis comes in sequence or concurrently (Ivankora *et al.*, 2009:10). Convergent parallel design collects and analyse the data concurrently, thus the researcher applied this principle in the study. Data for both quantitative and qualitative approach were collected and analysed parallel to one another.

Integration

Integration refers to the stage in the research process where mixing or integration of the quantitative and qualitative methods occur (Ivankora *et al.*, 2009:11). Mixing means either that the quantitative and qualitative data are actually merged, one end of the continuum, or kept separate or combine in some way on the continuum (Creswell, 2009:230). In the study, integration of the findings was applied in the data interpretation phase. This was done to help explain the results generated from both approaches. Study outcomes were also discussed in

this phase. According to Creswell, Klassen, Plano Clark and Smith (2011:5), integration of quantitative and qualitative data maximises the strengths and minimises the weaknesses of each type of data.

A quantitative retrospective descriptive record review of case files, both electronic and hard copy, from January 2009 to January 2014 of all patients who had received thrombolytic therapy in the emergency departments, was conducted. This was achieved by the use of a data extraction form to collect relevant data. Descriptive designs are intended to describe a phenomenon (Brink *et al.*, 2012:114) and therefore, the researcher does not manipulate any variables.

Descriptive designs are also used to identify problems in current to practice, make judgements and to determine what other professionals in similar situations are doing (Brink *et al.*, 2012:112). In a period of the qualitative approach, semi-structured interviews were selected to explore the perceptions of nurses on the factors that affect door-to-needle time. The aim of the study was to investigate the in-hospital delay in door-to-needle time in patients with AMI requiring thrombolytic therapy.

3.3 STUDY SETTING

The setting is the location in which the study is conducted (Burns & Grove, 2011:40). The study was conducted at a tertiary hospital in the Western Cape. The hospital provides comprehensive care at a tertiary level to a wide population in the Western Cape including cardiac patients. A private consultation room was provided for data collection and for conducting semi-structured interviews. Data collection was performed at the hospital premises.

3.4 POPULATION AND SAMPLING

3.4.1 Population

Brink, Van der Walt and Van Rensburg (2012:13) defined a population as the entire group or people or objects of interest to the researcher that meets the criteria that the researcher is interested in studying. The population identified for the study consisted of case notes of patients who had received thrombolytic therapy in the CCU and the RPNs currently working in the CCU at a tertiary hospital in the Western Cape.

3.4.2 Sampling

3.4.2.1 Quantitative approach

Sampling is described by Burns and Grove (2011:40) as a process of selecting objects which are representative of the population being studied. All case notes from January 2009 to January 2014 were considered for this study (N=63). The patients were identified from the register kept in the CCU of the tertiary hospital. The researcher identified the folder numbers of patients eligible for study participation and sent them to the Medical Records Department of the tertiary hospital for retrieval. Hard copies of patient folders were accessed at the Medical Records Department of the tertiary hospital and electronic copies from the computer stationed at the department. Folders were kept at the department and the researcher was not allowed to remove or access them from outside the department. Data entry of 15 selected files was checked for accuracy by an independent person.

3.4.2.2 Qualitative approach

Eight RPNs who worked in the CCU were purposively selected for face-to-face interviews. Purposive sampling is based on the judgement of the researcher regarding participants or objects that are typical or representative of the study phenomenon, or who are especially knowledgeable about the question at hand (Brink *et al.*, 2012:141). The RPNs were selected according to gender and experience. Seven female RPNs and one male RPN (only male in the CCU) were used for the interviews. The RPNs were selected if they had more than one year work experience in the CCU.

3.4.3 Inclusion criteria

Files were included if:

- The patient was diagnosed with AMI
- The patient had received thrombolytic therapy in the CCU

RPNs were included if:

- RPNs had more than one year work experience in the CCU

3.4.4 Exclusion criteria

Case notes were excluded if data was missing

RPNs were excluded if they had less than one year of experience in the CCU

3.5 INSTRUMENTATION

3.5.1 Data extraction form

A standardised data extraction form was designed based on available evidence on DNT (Maharaj *et al.*, 2012:242; McNamara *et al.*, 2007:1229). In addition, advice of an expert cardiologist, two nursing academics and the clinical experience of the researcher was used. This was used to collect data relevant to the objectives of the study. Continuous and dichotomous variables were included.

Information included was demographic data, ECG characteristics, factors associated with DNT and relevant patient outcomes. These outcomes were length of hospital stay, morbidity and mortality.

3.5.2 Interview guide

An interview guide with an open question and additional probing questions based on literature and focused on the outcomes, was designed for data collection. The interview guide was designed by the researcher with the goal of reaching the study objectives and outcomes. The main question asked was what are the perceptions of nurses on DNT?

According to Burns and Grove (2011:351) interviews allows the researcher to explore the meaning in greater depth than is possible with other techniques and elicits more information.

The interview guide consisted of the following information:

Section A consisted of the participants profile such as age and gender. Section B consisted of the main question which aimed to explore the perceptions of nurses on door-to-needle time. Section C consisted of probing questions which included the participant's roles, responsibilities and experiences on factors affecting door-to-needle time. All the responses were recorded for data analysis purposes (see appendix E).

3.6 PILOT STUDY

Brink, Van Der Walt and Van Rensburg (2012:56) define a pilot study as a small scale version or a 'dummy run' of the major study. During the pilot study, the researcher can recognise and address any problems by obtaining information for improving the project, making adjustment of the instrument or reassessing the feasibility of the study (Brink *et al.*, 2012:57). A pilot study is also conducted by the researcher to refine the methodology (Burns *et al.*, 2012:49).

A pilot study conducted for this study included (n=6) of the chosen population case notes. One RPN was interviewed in the piloting study. The data obtained from the pilot study was included in the final analysis of the study. No adjustments were necessary following this process.

3.7 RELIABILITY AND VALIDITY

3.7.1 Reliability

Data quality was determined by the availability and the accuracy of data in the case notes. The researcher is an expert in the field. This assisted with the reproducibility of the data obtained. An independent person checked the correctness of entered data. Double-checking was done using 15 case notes selected from the hard copies.

3.7.2 Validity

According to Burns and Grove (2011:334), validity of an instrument is a determination of how well the instrument reflects the abstract concept being examined. Content-related validity examines the extent to which the measurement includes all the major elements relevant to the construct being measured (Burns & Grove, 2011:335). Content validity was ensured through the use of literature (Maharaj *et al.*, 2012:241), clinical experience of the researcher and the use of advice from a cardiology consultant with extensive clinical and research experience. Construct validity is the validity that is considered to be a single broad method of measurement (Burns & Grove, 2011:335).

The data extraction form and the interview guide were designed after an extensive search of literature on factors associated with door-to-needle time. The researcher developed the instrument with support of the cardiology consultant with research experience in DNT. Content validity was validated by study supervisors and two other researchers with nursing and critical care backgrounds. Finally, the data extraction form was reviewed by a statistician from the Centre for Statistical Consultation at Stellenbosch suitability for data analysis.

3.8 RIGOUR

3.8.1 Credibility

Credibility concerns the objectivity of the data presented (Shenton, 2004:66). All the interviews were audio taped and transcribed. The transcriptions were checked for accuracy in line with the audiotapes. Credibility was further ensured by the participant's reading their

transcripts to ensure their words were transcribed exactly as they intended. Accurate description, interpretation and validation of the data were ensured.

After the transcriptions were done, the transcription of each interview was presented to the participant for verification and where necessary, participants could fill in the missing data or remove some information. The identified themes were presented to and verified by all participants.

3.8.2 Transferability

Transferability in this study was assured by providing the reader with sufficient information about the factors affecting door-to-needle time to assist them in understanding of the phenomenon. A detailed description of the study setting, data collection procedure was also provided by the researcher to enable other researchers to determine whether the study findings are transferable to another setting or context (Brink *et al.*, 2012:173).

3.8.3 Dependability

Dependability simply implies that if the work is repeated in the same context, with the same methods and participants, similar results will be obtained (Shenton, 2004:71). The methodology for data collection and analyses was verified by the researcher and the supervisor. Themes and subthemes that emerged during data analysis were also verified with the supervisor. An audit trail was followed by the researcher to allow detailed reporting.

3.8.4 Confirmability

Confirmability guarantees that the findings, conclusions and recommendations of the study are supported by the data and that the agreement between the investigator's interpretation and the actual evidence exist (Brink *et al.*, 2012:127). The themes were checked by the research supervisor to ensure that they agreed with the identified themes. In addition, to ensure confirmation of this study by another future researcher, all the documents and audio recordings provided an audit trail of the research process and results.

3.9 DATA COLLECTION

Data collection is the precise, systematic gathering of information relevant to the research purpose of the objectives, questions or hypotheses of the study (Burns & Grove, 2011:52). For this study, data was collected over six weeks (18/8 - 26/9/2014) using the data extraction form and semi-structured interviews conducted by two fieldworkers in a private room.

3.9.1 Quantitative data

Quantitative data was collected by the researcher using a data extraction form. Data extraction forms were printed and one form was allocated to each case note. Data was collected as recorded in the case notes and it included pain onset time, mode of arrival and the personnel who conducted the initial assessment, namely a junior or a senior RPN or medical registrar. The door-to-needle time was calculated from the patient arrival time, the exact time the ECG was performed and the time thrombolytic therapy was initiated.

3.9.2 Qualitative data

Qualitative data was collected by two field workers using semi-structured interviews. Both field workers underwent interviewing training. Eight semi-structured interview guides were printed for the interviews. The aim and objectives of the study were clearly explained to each participant and informed consent was obtained before the interviews were conducted. The participants also gave consent for the use of audiotape. Consent forms were printed in English.

The interviews of the nurses were conducted by two fieldworkers. First the fieldworkers asked the participants the main question (what are your perceptions on DNT), followed by the probing questions. All the interviews were recorded and they each lasted for 30 minutes or less. Participants were purposively selected according to gender, age and experience in the CCU and all participants participated voluntarily. A sample of eight nurses from a total population of 16 formed the sample size. The sample size was determined by data reached saturation.

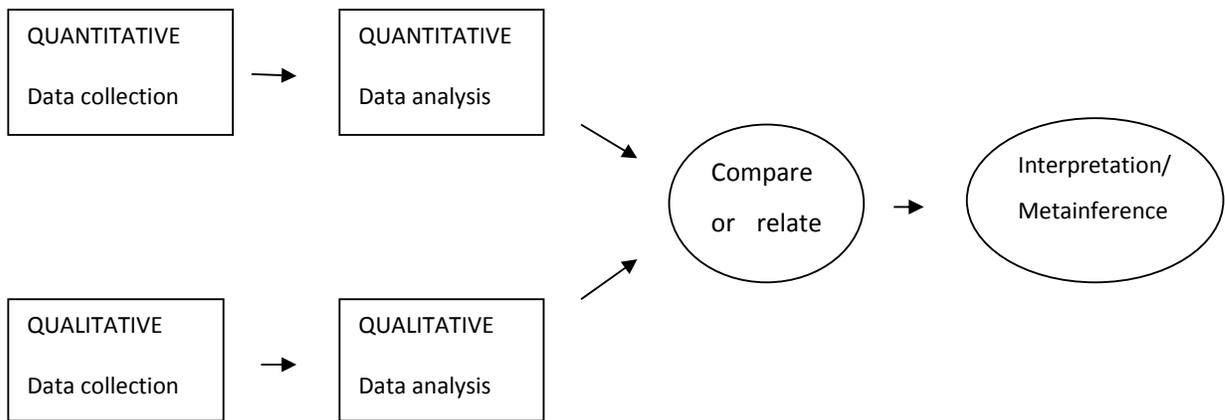


Figure 3.1 Study flowchart: convergence parallel design

Source: Creswell, 2013:38

3.10 DATA ANALYSIS AND INTERPRETATION

Data analysis is the process of categorising, ordering, manipulating and summarising data and describing it in meaningful terms (Brink *et al.*, 2012:177). Data analysis reduces, organises and gives meaning to the data (Burns & Grove, 2011:52).

Data analysis in qualitative research is non-numerical, and can be in written words, videotapes, audiotapes or photographs (Brink *et al.*, 2012:193). Analysis of data in qualitative research therefore involves an examination of text rather than the numbers that are considered in quantitative studies (Brink *et al.*, 2012: 193).

The transcriptions of the interviews were done within 24 to 72 hours of recording. The researcher listened repeatedly to the recordings to ensure accurate capturing of all data. During the process of analysis and reading of the transcripts, the principle of bracketing was applied. Bracketing is defined by Brink *et al.*, (2012:122) as the process where the researcher identifies and sets aside any preconceived beliefs and opinions that she/ he might have about the phenomenon being investigated. The researcher made notes of her opinions about DNT and set them aside during analysis.

The principle of intuition was also applied. In this process, the researcher becomes immersed in the data and develops awareness of the lived experiences by the participants. Thus the researcher was open-minded when describing the participant's experiences of the phenomenon and became involved and immersed in the data. Transcripts and field notes

were read and reread in order to become familiar with the data. The recorded audios were transformed verbatim after the researcher has read the narrative script. Data was broken down and examined for similarities and differences. Themes and subthemes were then generated from the data and were labelled to describe the data.

For the quantitative data analysis, descriptive and inferential analysis was performed. Descriptive statistics are used to describe and summarise data (Brink *et al.*, 2012:179). Statistical methods enable the researcher to reduce, summarise, organise, manipulate, evaluate, interpret and communicate the quantitative data (Brink *et al.*, 2012:179). A qualified statistician from the Centre for Statistical Consultation at Stellenbosch University, Prof M. Kidd was consulted.

Data from each data extraction form was captured by the researcher on an excel spreadsheet designed by the researcher and the statistician. After data capturing, the spreadsheet was sent to the statistician who assisted with the interpretation and analysis of the data using STATISTICA 12© program. Descriptive statistics will be presented as frequency tables and histograms. Median and ranges were used for calculating the door-to-ECG and DNTs.

For comparing categorical variables, cross tabulation with the Chi-square test were done. Results were reported as frequencies with percentages. Comparisons of ordinal data (e.g. length of stay in hospital) were done using the Spearman correlations. A 5% ($p < 0.05$) significance level was used as guideline for significant results.

Chi-square test (test of independence) was used determine whether the variables are statistically independent of if they are associated. The Chi-square test of independence is applied in order to compare frequencies of nominal or ordinal data for a single population and it compares two variables at the same time (Bolboacă, Jantschi, Sestras, Sestras, Pamfil, 2011:532). This was used to determine relationship between DNT and factors associated with DNT. Spearman's correlation coefficient was also used to determine the relationship between DNT and the outcome length of hospital stay.

The study used one of the popular mixed methods design in educational research, the sequential design. Data collection strategies in this method involve collecting data in an interactive process whereby data collected in one phase contribute to the data collected in the next (Driscoll, Appiah-Yeboah & Salib, 2007:21). The purpose of the design is to theoretically

and empirically inform later studies (Venkatesh, Brown & Bala, 2013:38). Data collection and analysis was implemented in different phases and each integrated in a separate phase. Qualitative and quantitative findings were validated independently.

Statistical terms are described as follows:

Mean

Is defined as, the arithmetical average of all scores in a distribution (Brink *et al.*, 2012:185).

Median

Is the midpoint score or value in a group of data ranked from the lowest to the highest (Brink *et al.*, 2012:185).

Range

Is the simplest method for examining variation among scores and refers to the difference between the smallest and largest value in a distribution (Brink *et al.*, 2012:186).

Analysis of variance (ANOVA)

ANOVA is an extension of the t-test, which permits the researcher to compare more than two means simultaneously. It uses variance to calculate the value that reflects the difference between two or more means (Brink *et al.*, 2012:191).

3.10.1 Chi-Square Test

Chi-Square test is a nonparametric test used to evaluate a relationship between two nominal or ordinal variables. This test is used when assumptions about normal distribution in the population cannot be met or when the level of measurement is ordinal or less (Bolboacă, Jantschi, Sestras, Sestras & Pamfil, 2011: 529).

The Chi-square test of independence is applied in order to compare frequencies of nominal or ordinal data for a single population and it compares two variables at the same time (Bolboacă, *et al.*, 2011:532).

3.10.2 Spearman's Correlation Coefficient

Spearman's correlation Coefficient is a nonparametric rank statistic proposed as a measure of the strength of association between two variables (Kossowski, 2011:87). It measures monotone association that is used when the distribution of data makes Pearson's correlation coefficient undesirable or misleading (Kossowski, 2011:87). According to Kossowski

(2011:87), it assesses how well monotonic function can describe a relationship between two variables.

3.11 ETHICAL CONSIDERATIONS

Ethics is defined as the study of ideal human behaviour and ideal ways of being (Pera & Van Tonder, 2011:5).

According to Pera and van Tonder (2011:53) ethical principles provide guidance for thinking and acting in order to determine what should or should not be done in particular situations. Ethical principles are also viewed as generalisations that provide a basis for reasoning (Pera & Van Tonder, 2011:53). Ethical principles include the following:

3.11.1 Autonomy

Autonomy expresses the respect for the unconditional worth of an individual and for individual thought or action (Pera & Van Tonder, 2011:53). It states that people should be treated as ends in themselves and never as a means to an end or to the ends of others. Adequate information about the study was given to the participants and the opportunity to give or withhold consent was allowed.

3.11.2 Non-maleficence

One ought not to inflict evil or harm on others, thus refraining from actions that can cause harm (Newell & Burnard, 2011:52). Participation was voluntary and no psychological distress was caused during the study.

3.11.3 Beneficence

Beneficence is defined as the prevention of evil or harm and the promotion of good (Pera & Van Tonder, 2011:55). Three forms of beneficence can be maintained by taking action in preventing harm, removing harm and promoting good. No intervention or treatment was involved in the study.

3.11.4 Confidentiality

Confidentiality refers to the researcher's responsibility to prevent all data gathered during the study from being linked to individual participants, divulged or made available to any other person (Brink *et al.*, 2012:38). Confidentiality in the study was ensured by keeping all the data in a secure place.

Principles of confidentiality, anonymity and justice were adhered to at all times. Participants were treated fairly and with respect. Information obtained from the case notes was only available to the researcher, supervisor and the statistician. Information obtained from the participants during the interviews was available only to the fieldworker, the researcher and the supervisor. Results were reported in a manner that information obtained could not be linked to the identity of the participants.

Permission was obtained in writing from the Health Research Ethics Committee of the University of Stellenbosch on the 16th of April 2014. Written permission was also obtained from the hospital managers (management) of the tertiary hospital in the Western Cape on the 7th of August 2014. Waiver of consent was obtained from the manager of the medical records. This meant that the researcher has obtained consent from the subjects' legally authorised representative (Vanderpool, 1996:464). Furthermore, the consent presents no more than minimal risk of harm to subjects and it involves no procedures for which written consent is normally required outside of the research context (Burns & Grove, 2011:125). Participants were informed about the essential details of the study before signing the consent forms. Written informed consent was obtained from each of the participants and the form was available in English. Consent was voluntary and participants were informed that they were free to withdraw from the study at any time.

3.12 LIMITATIONS

The first limitation of the study was the inability to obtain all identified case notes from the medical records. Only 39 were included in the study. Some valuable information needed for data analysis purposes could not be obtained from the electronic copies; therefore, they were excluded from the study. The second limitation was the availability of the RPNs due to personal commitments on the set date for the interviews. This resulted in a delay in the data collection process.

3.13 SUMMARY

The research design is a mixed method with both a quantitative and a qualitative approach. This consisted of case notes of patients diagnosed with AMI who received thrombolytic therapy and RPNs working in the CCU at the tertiary hospital. A data extraction form and semi-structured interviews were used for data collection purposes. Ethical considerations were ensured at all times.

3.14 CONCLUSION

Chapter three has discussed in detail, the research methodology used in the study. Included are the data collection, the analysis process and the ethical considerations. A detailed description of the data analysis and interpretation process follows in chapter 4.

CHAPTER 4: DATA ANALYSIS, INTERPRETATION AND PRESENTATION OF RESULTS

4.1 INTRODUCTION

Data analysis entails categorising, ordering, manipulating, summarising data and describing them in meaningful terms (Brink *et al.*, 2012:177). The data analysis and interpretation of the collected data is presented in this chapter. The researcher used the convergence design to analyse both quantitative and qualitative data.

4.2 DATA ANALYSIS

4.2.1 Data preparation

Quantitative data was collected from case notes. Each case note was assigned a number to aid the process of the raw data handling on the excel spreadsheet. The columns of the spreadsheet included the variables and the rows represented each case number.

4.2.1.1 Quantitative data

The information obtained from each case note was entered by the researcher and was double-checked to guarantee data accuracy. In the case of missing data, the cell on the spreadsheet was left blank. In the case where the data from the case note was incomplete for analysis, the case notes were excluded from the study.

The completed spreadsheet was submitted to a statistician, Professor M. Kidd (Stellenbosch University), for analysis. The data was analysed using STATISTICA 12© programme and ANOVA. ANOVA is an extension of the t-test that permits the researcher to compare more than two means simultaneously. It uses variance to calculate the value that reflects the difference between two or more means (Brink *et al.*, 2012:191). The software was used to compare the averages of times, namely, the patient arrival time, the exact time of the diagnostic ECG and the time thrombolytic therapy was commenced. Descriptive statistics are presented in histograms and tables.

4.2.1.2 Qualitative data

The interviews were conducted in the CCU of a tertiary hospital in the Western Cape. The participants were RPNs employed permanently and working daily with patients complaining of chest pain. The RPNs are the first medical contact during patient presentation and had

different views and experiences in the assessment and management of these patients. The years of experience of the participants ranged from three to twenty-one years.

In the study, the researcher collected and analysed the quantitative and qualitative data concurrently. The researcher used the following phases during data analysis

Data display

In this stage of analysis, quantitative data were described visually. The first stage of analysis involved the use of descriptive statistics to analyse the data. Data was displayed in a form of tables and histograms. Data displayed included the comparison of median DNTs using different variables such as mode of arrival, and pre hospital ECG. The current DNTs were also displayed in a table using numbers and percentages. Factors associated with DNT were displayed in a form of histograms and tables. These factors included pre-hospital ECG, patient assessment, whether patient was hypertensive on arrival or haemodynamically unstable. Demographic data included the patient's age, gender, and mode of arrival, pre-hospital ECG and clinical history. The t test was performed using the Spearman's correlation coefficient to determine whether any relationship existed between DNT and the outcome length of hospital stay. No significant relationship between DNT and length of hospital stay existed. This was confirmed by a p value ($p=0.40$).

Data transformation

In case of the qualitative data, data analysis included the collection of open-ended questions and the analysis of the information obtained from the questions asked during the interviews. The interviews consisted of eight RPNs working in the CCU of a tertiary hospital in the Western Cape.

Data transformation involves creating codes and themes qualitatively and counting the number of times they occur in the text (Creswell, 2009:218). According to Creswell (2009:218), this approach enables the researcher to compare the qualitative results with the quantitative results. The researcher started the interpretation of the collected data when the participants described their perceptions on door-to-needle time as well as describing their roles and responsibilities during patient presentation to the CCU. Each participant was coded from one to eight. The analysis process was initiated by critically reading through all the transcriptions to achieve an overview of the interviews. Themes were identified from each interview and noted. According to Robert and Philip (2011:122), the aim in general is to become immersed in the data.

In step two, the researcher managed the data by selecting the transcript that had the most valuable recorded information. Themes and categories from the transcript were noted in order to describe all the aspects of the content. The process continued until the researcher had worked through all the transcripts. During step three, codes were noted. New themes and sub-themes were identified throughout the process. Similar themes were grouped together and the responses that had similar themes were grouped under one main theme.

In the study, quantitative data was not transformed as the aim of the study was not to use the results of qualitative data to explore data in depth or to validate results.

Data correlation and comparison

Data was correlated after analysis of both quantitative and qualitative data. Correlation is defined by Brink et al (2012:210) as the extent to which values of the variables are related to each other. In the study, data correlation included the correlation between the current DNTs revealed by the results and the responses of the participants about their perceptions on DNT. Statistical analysis revealed that of 39 patients thrombolysed, 23 (59%) were thrombolysed within 30 minutes, 9 (23.1%) between 31-60 minutes and 7 (17.9%) between 61-90 minutes. Comparison was done based on the responses of the participants who strongly believed that they had never experienced a delay in DNT. Analysis on factors associated with DNT revealed that ECG and patients factors were associated with DNT. The qualitative results have supported the results as the subtheme patient and ECG emerged from the results after analysis. Nurses believed that the patient's haemodynamic status can lead to a delay in DNT.

Data integration

Integration refers to the stage in the research process where mixing or integration of the quantitative and qualitative methods occur (Ivankora *et al.*, 2009:11). Mixing means either that the quantitative and qualitative data are actually merged, one end of the continuum, or kept separate or combine in some way on the continuum (Creswell, 2009:230). The study findings revealed that personnel shortage is still a major contributor to the delay in treatment as patients cannot be attended to immediately when they present. For the purpose of the study, mixing occurred at the point of data interpretation. Conclusions were drawn based on what was learned from the combination of results from the two strands of the study.

4.3 DEMOGRAPHIC FACTORS OF THE POPULATION

4.3.1 Clinical history

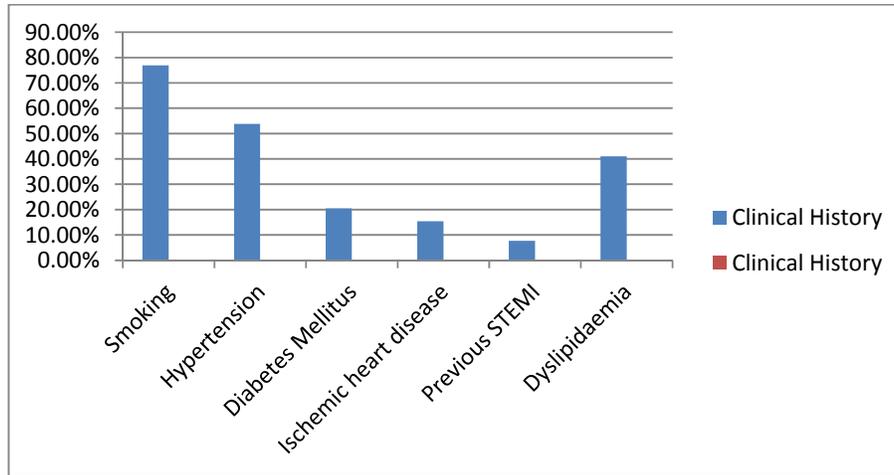


Figure 4.1: Clinical history

Findings of the study show that the majority (76.9%) of the patients were smokers, followed by 53.8% with a risk factor for hypertension. Of the (n=39) patients seen, 41% had dyslipidaemia. A small number of patients (n=3, 7.7%) had a previous STEMI. Diabetes Mellitus was a risk factor amongst 20.5% of the patients.

Table 4.1: Demographic variables

Demographic variables	n	%
Gender		
Male	30	76.9%
Female	9	23.1%
Mode of arrival		
Ambulance	22	56.4%
Walk in	17	43.6%
Type of MI: Inferior		
Type of MI: Anterior	15	38.5%
Pre-hospital ECG		
	9	23.1%

The largest categories of patients (76.9%) were male. Median age was 57 years with 41 years being the youngest and 82 years being the oldest patient. The majority of the patients (56.4%) used an ambulance as a mode of arrival to the CCU. A small number (23.1%) of

patients had a pre-hospital ECG prior to presentation. The predominant area of infarction was the inferior STEMI infarct (61.5%).

4.3.2 Determining current DNT

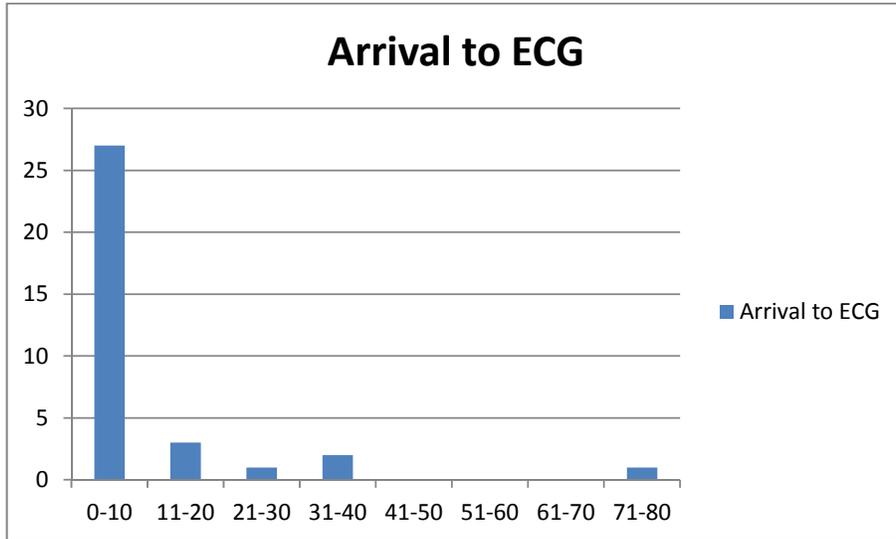


Figure 4.2: Arrival to ECG time

Results shown in figure 4.4 revealed that 27 of the patients had a door-to-ECG time of between zero and 10 minutes, followed by (n=3) patients with a door-to-ECG time of between 11 and 20 minutes. Only one (n=1) patient's ECG was performed within 71-80 minutes of presentation. Five (n=5) ECGs of the 39 (n=39) thrombolysed patients were excluded. One (n=1) was missing in the folder and (n=4) had incorrect times.

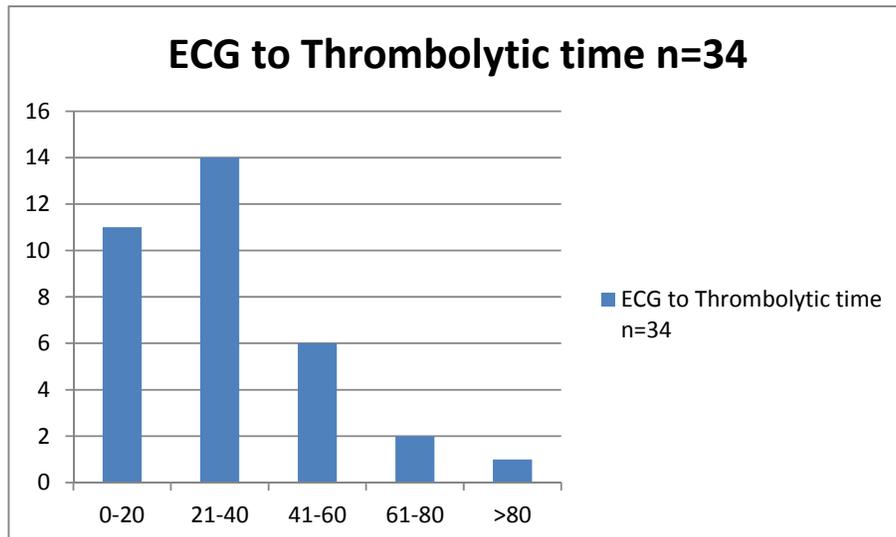


Figure 4.3: ECG to thrombolytic time (time in minutes)

Figure 4.5 shows that a significant number of patients (n=14) had ECG-to-thrombolytic-time of between 21 and 40 minutes. Eleven patients had ECG-to-thrombolytic-time of between zero and 20 minutes and only a small number (n=2) of the patients had thrombolytic therapy after 60 minutes following an ECG.

4.3.3 Time of arrival to thrombolysis (time in minutes)

A door-to-needle time of 30 minutes or less was achieved in 59% of the patients. Furthermore, a door-to-needle time of between 31 and 60 minutes was achieved in 23.1% of the patients and 17.9% of the patients had a door-to-needle time of between 61 and 90 minutes (see Table 4.2).

Table 4.2: Door-to needle time

Door-to-needle time in minutes N=39	n	%
Within 30 minutes	23	59.0%
31-60 minutes	9	23.1%
61-90 minutes	7	17.9%

Table 4.3: Median door-to-needle times

Comparison of median door-to-needle times	
Variable	Median door-to-needle time (mins) (range)
Mode of arrival	
Ambulance	32.5 (5-85)
Walk in	29 (10-65)
Total population	30 (5-85)
Pre-hospital ECG	
Yes	29 (5-65)
No	30 (7-85)

Findings revealed a median door-to-needle time of 32.5 minutes for patients who arrived by ambulance and 29 minutes for those who were walk ins. Patients who had a pre-hospital

ECG showed a median time of 29 minutes with a range of 5 to 65 and of those who did not have a pre-hospital ECG, a median time of 30 minutes was achieved.

4.3.4 Factors associated with DNT

Factors associated with DNT were presented based on the literature. Factors included a pre-hospital ECG and the patient's hemodynamic status. Patient assessment either by a junior/senior doctor or an RPN on presentation is also considered as a factor. Results are presented as follows:

4.3.4.1 Hemodynamic stability

Results showed that the majority (n=32, 82.1%) of the patients were stable on arrival and only a small percentage (n=7, 17.9%) of patients were unstable.

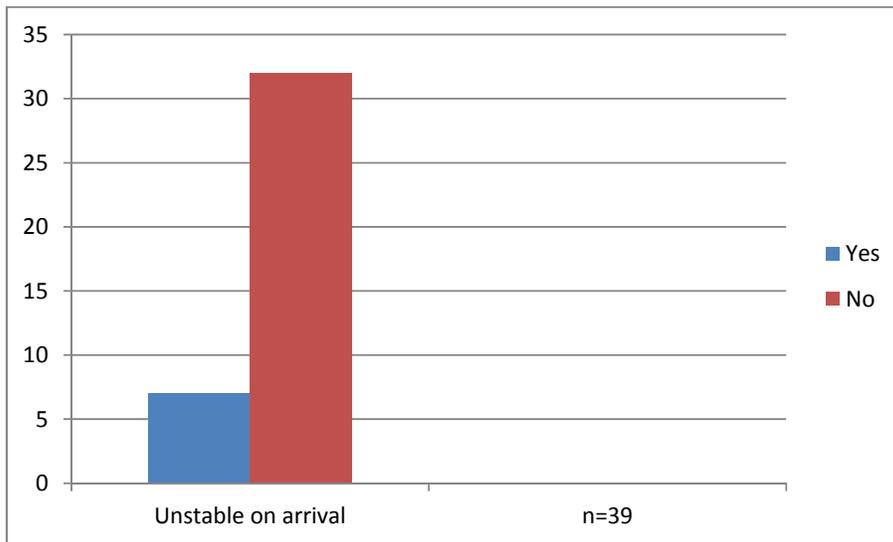


Figure 4.4: Unstable on arrival

4.3.4.2 Hypertensive on arrival

Results shows that a small number (n=2, 5.1%) of the patients were hypertensive during presentation to the CCU while a significant number (n=37, 94.9%) had a normal blood pressure (see Figure 4.4)

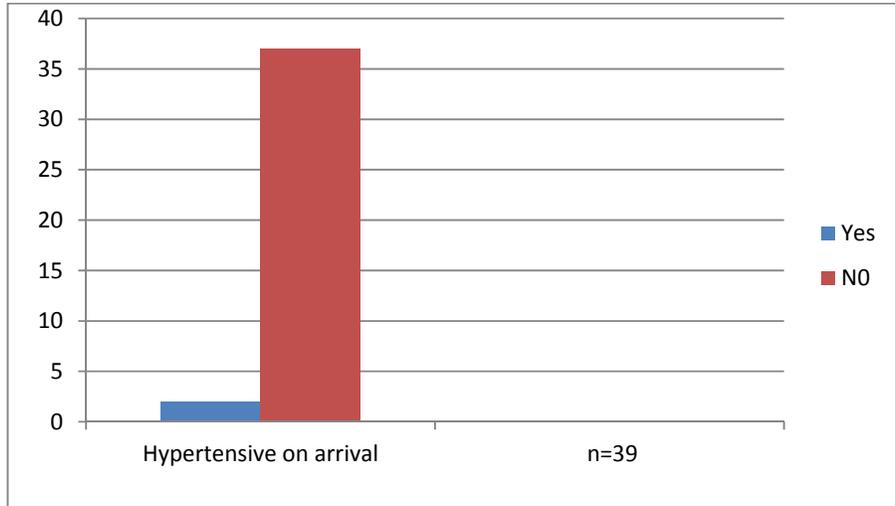


Figure 4.5: Hypertensive on arrival

4.3.4.3 Patient assessment on arrival

A significant number of patients (n=29, 74.4%) were assessed by a senior RPN and few (n=10, 25.6%) of patients were assessed by a junior RPN. Results are presented in Figure 4.6.

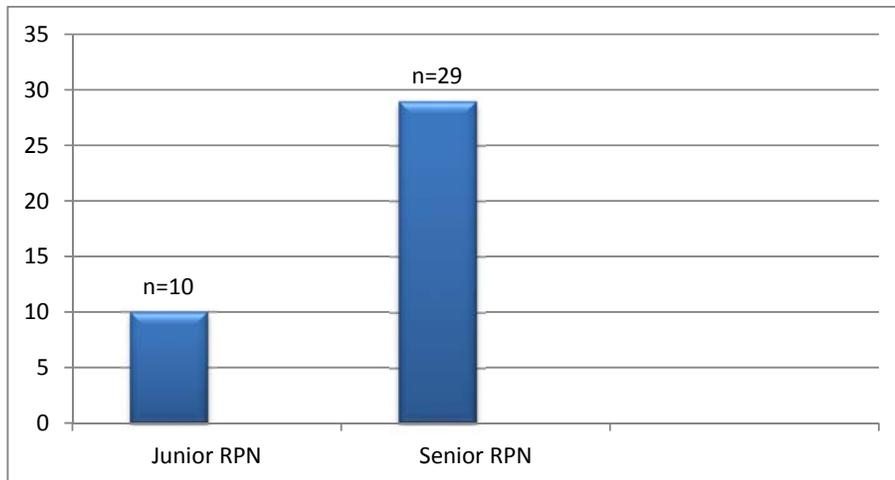


Figure 4.6: Patient Assessments by RPN

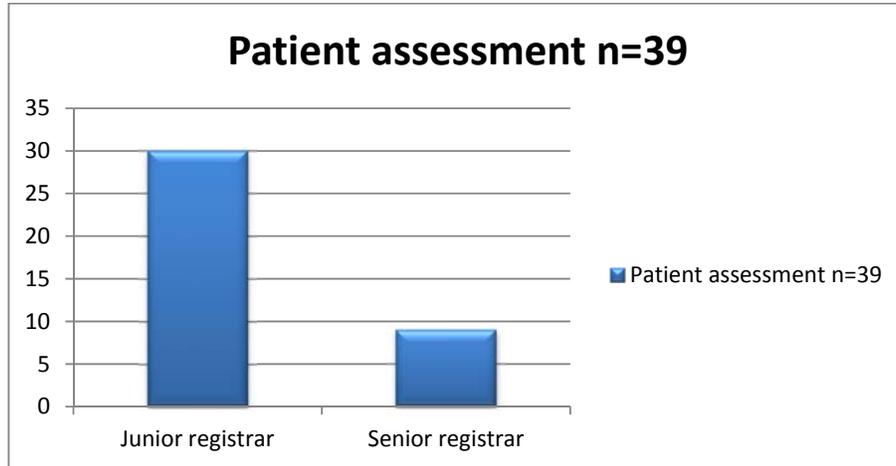


Figure 4.7: Patient Assessment by registrar

The majority of patients (n=30, 76.9%) were assessed by a junior registrar and a small number (n=9, 23.1%) of patients were assessed by a senior registrar.

Table 4.4: Proportions of patients with delay in door-to-needle time

Variables	Median DNT (range)	Delayed DNT	
		n	%
Mode of arrival			
Ambulance	32.5 (5-85)	11	50%
Walk in	29 (10-65)	5	29.4%
Pre-hospital ECG			
Yes		2	22.2%
No		14	46.7%
Hemodynamic unstable			
Yes		4	57.1%
No		12	37.5%
Hypertensive on arrival			
Yes		1	50%
No		15	40.5%
Patient assessment			
Junior RPN		3	30%
Senior RPN		13	44.8%
Junior registrar		13	33.3%
Senior registrar		3	43.3%

Findings revealed that half of patients (n=11, 50%) who arrived by ambulance and (n=5, 29.4%) of those who used private transport had a DNT of more than 30 minutes. Only (n=2, 22.2%) of patients that had a pre-hospital ECG and (n=14, 46.7%) of those who did not have a pre-hospital ECG, had a delayed DNT. Furthermore, results show that a significant number (n=4, 57.1%) who were unstable had a delayed DNT. Of the patients assessed by a senior RPN, a significant number (n=13, 44.8%) and those assessed by a senior registrar a small number (n=3, 43.3%) had a DNT of more than 30 minutes. Patients that were not hypertensive on arrival (n=15, 40.5%) had a delayed DNT (see Table 4.4).

Table 4.5: Factors associated with DNT

Variables	DNTnot delayed		DNT: delayed		Total	P value
	n	%	n	%		
Mode of arrival						
Ambulance	9	(36%)	16	(64%)	25	.425
Walk in	10	(47.6%)	11	(52.4%)	21	
Pre-hospital ECG						
Yes	6	(54.5%)	5	(45.5%)	11	.398
No	14	(40%)	21	(60%)	35	
Haemodynamically unstable						
Yes	3	(42.8%)	4	(57.2%)	7	.986
No	17	(42.5%)	23	(57.5%)	40	
Patient assessment (registrar)						
Junior	15	(39.5%)	23	(60.5%)	38	.383
Senior	5	(55.6)	4	(44.4%)	9	

The findings show (see Table 4.5) no significant relationship was found between DNT and factors associated with DNT. Mode of arrival ($p=.425$), pre-hospital ECG ($p=.398$), being haemodynamically unstable ($p=.986$), and being assessed by a senior registrar ($p=.383$) or nurse did not show any statistically significant relationships with door-to-needle time. For the purpose of this analysis, the researcher used all the available data to report the results.

4.3.5 Patient outcomes

4.3.5.1 Length of hospital stay (in days)

The length of hospital stay of patients was computed from the arrival date to the discharge date. Figure 4.8 shows that the majority of the patients ($n=28$, 71.8 %) had a shorter stay, the length of hospital stay was between one and five days. Six patients stayed between six and ten days and a small number of patients ($n=2$) stayed between 11 and 15 days. The median length of hospital stay was four days with a range of (1-18) days.

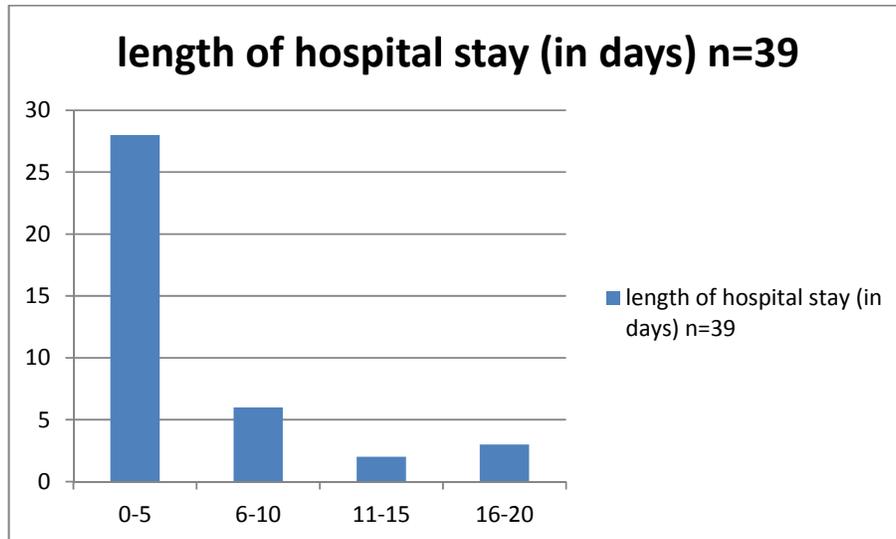


Figure 4.8: Length of hospital stay (in days)

The findings below (see Table 4.5) show that no significant relationship was found between DNT and length of hospital stay. This is indicated by $p=0.40$.

Table 4.6: Length of hospital stay

Spreadsheet1 in results.stw					
	1 variable 1	2 variable 2	3 Spearman	4 Spearman p-val	5 # cases
1	time of arrival to thrombolysis	days in hospital	0.13	0.40	44

4.3.5.2 Mortality

Figure 4.9 shows that only a small number ($n=3$, 7.7%) of patients died before discharge. Deaths were caused by the complications of myocardial infarction. Two of the patients that died used an ambulance as their mode of arrival and thrombolysis was delayed.

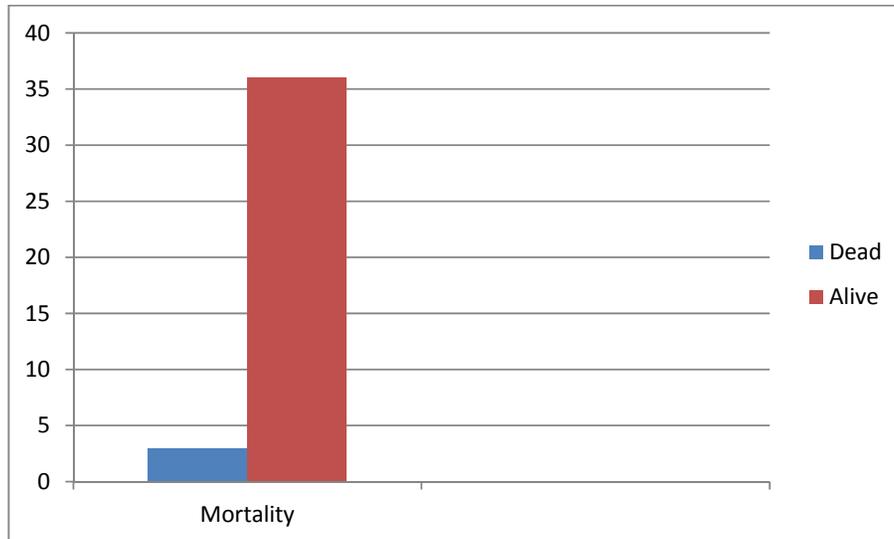


Figure 4.9: Mortality

4.4 FINDINGS OF QUALITATIVE DATA ANALYSIS

The findings of the analysis are presented based on the two subdivisions identified. The subdivisions include participants profile, themes and subthemes identified.

4.4.1 Participants profile

Participants were RPNs working in the CCU of a tertiary hospital in the Western Cape. The participants included seven females ($n=7$, 87.5%) and one male ($n=1$, 12.5%). Their ages ranged from 36 to 49 years. Their years of experience in the CCU ranged from three to twenty-one years.

4.4.2 Themes and subthemes

Five themes emerged from the interview. Subthemes also emerged from two of the main themes. The following table indicates the themes and subthemes identified:

Table 4.7: Themes and subthemes

Themes	Subthemes
1. Cardiovascular nursing care	<ul style="list-style-type: none"> • Assessment • Diagnosis • Planning • Implementation
2. Roles and responsibilities	
3. Scope of practice	
4. Perceptions of nurses on DNT	
5. Factors influencing DNT	<ul style="list-style-type: none"> • Patient • Doctor • Staff • ECG • Hospital (availability of beds, inter hospital communication).

4.4.2.1 Cardiovascular nursing care

4.4.2.1.1 Assessment

This subtheme relates to the patient assessment by RPNs during patient presentation. Only one out of eight participants identified the importance of the patient general assessment, which includes the physical, neurological and psychological assessment. The focus was not only on the affected system which in this case is the cardiovascular system. The assessment was obtained from general limb movements, the patient's level of consciousness and patient's awareness of the main complaint. In addition, patient assessments were carried out independently by each RPN.

“The patient ... you will look at the patient physically, you will ... there’s a lot of things that should go through you when you see a patient, and you start from the head to toes. You can look at the patient’s colour, is the patient sweating, is the patient, does the patient answer your questions, is the patient ... is there any level of conscious ... what do you call it, what is the level of consciousness of the patient. And very important is the pain, this is why the patient is here, does the patient have pain, how long is the pain, is the pain continuing, did the patient take anything for the pain, did it help, is it still there, is it ongoing. While you’re busy with the patient you will assess the patient for movements, the arms, the legs, does it move normally (participant 7).”

“When we admit a patient we usually just look at the physical picture of the patient, we ask the patient if they have pain (participant 2).”

Few participants focused on the diagnosis before performing a detailed assessment of the patient. Based on the quotations below, the main focus was routine observations. The importance of general assessment was not considered by the participants.

“I will do an ECG to check signs of MI or injury (participant 2).”

“The patient comes in complaining of chest pain; it is my job to get the patient on the bed and comfortable and then listen to his main complaints (participant 1).”

“The pulse would indicate to me if the patient has like inferior MI- complications that could start there (participant 5).”

The findings demonstrate that nurses often miss out on important information such as subjective data (not measurable) which could be vital in deciding appropriate management. Assessment includes not only physical data but also spiritual, socioeconomic and lifestyle factors as well. Thus, the nurse should be able to identify the patient’s response, such as fear and the ability to answer questions. A detailed assessment is vital to establish a database about the patient’s response and the ability to manage health care needs.

4.4.2.1.2 Diagnosis

This subtheme overlaps the RPNs patient assessment and was identified from the theme of cardiovascular nursing care. It was mirrored in the category of anxiety and comfort and other disorders identified during the patient assessment. Few nurses have identified the importance of patient comfort and the need to reassure patients that appear to be anxious. The need to assess patient oxygen status was also identified.

“The patient comes in complaining of chest pain; it is my job to get the patient on the bed and comfortable and then listen to his main complaints and try to sort that out first. Make the patient as comfortable as possible and then do your ECG to determine what’s really going on (participant 1).”

“I would calm my patient, reassure my patient, tell the patient of everything that’s going to happen or that’s been happening; calm the family while I’m busy with that also, to get the family to get out – sometimes the family wants to also stand there and watch you doing whatever you’re doing (participant 5).”

“We monitor him to see that he’s comfortable, give some emotional support because some of them are very stressed and anxious (participant 6).”

The results confirmed that the nursing practitioners are aware of their independent roles in managing patients. Nursing diagnosis is the nurse's clinical judgement about the patient's response or potential health problems or needs. In this case, the diagnosis reflects not only that the patient is in pain but that the pain may cause problems such as anxiety, unease to the family and potential complications. It is crucial that every nurse must have the skill to make a nursing diagnosis so as to identify the patient's health problems that can be prevented or resolved by independent and collaborative nursing interventions. The patient's comfort and level of anxiety, obtaining of a 12-lead ECG, the need to reassure the patient and the family are carried out to support the patient's diagnosis.

4.4.2.1.3 Planning

This subtheme emerged after the plan to provide nursing interventions was identified from the participant's responses. Few participants demonstrated the importance of planning for care after a diagnosis had been made. Pain relief was seen as a priority and patients were treated based on the diagnosis of chest pain. Results also showed that another intervention by the nurses after diagnosis was made, was administration of oxygen therapy. This is an important intervention to reduce cardiac workload, anxiety and to improve the patient's oxygenation status. The results are validated by the quotations below.

"I can just give him like a vasodilator to ease the pain (participant 1)."

"En dan gee ons ... dan kom gee ons die gewone middels wat ons dan gee om te voorkom vir ... ons gee bloedverduunning. Ons gee soos onse Disprin en onse Plavix is mos ons sterk medikasies wat ons gee, ons het Clexane (participant 2)."

English translation:

"And then we give ... then we give the usual drugs that we give to prevent ... we give anticoagulants. We give our Disprin and our Plavix is our strong medication that we give, we have Clexane (participant 2)."

"Patient gets oxygen to relieve the pain and the doctor examination and we follow the instructions the doctor gives us (participant 4)."

"Give him an Isordil if he has chest pain - only after the ECG is done - give him some oxygen (participant 6)."

Based on the assessment and diagnosis, the nurse must set measurable and achievable goals for the patient. That might include pain relief through administration of adequate

medication and oxygen. It is important that all the nursing interventions are documented in the nursing care plan so that other nurses and health professionals caring for the patient have access to the information. This can be useful in evaluating the patient's response to treatment and possible complications can be identified.

4.4.2.1.4 Implementation

Implementation is illustrated and is divided into several categories such as monitoring, observations and oxygenation. Few participants indicated the importance of implementation of nursing care after the diagnosis has been made. The focus was on observations, oxygenation and cardiac monitoring.

"I get his vital signs first to determine if we can administer anything and if we can administer anything, find out if he's allergic to anything. And the, yes, give oxygen, make the patient as comfortable as possible and then do your ECG to determine what's really going on (participant 1)."

"You will do the vital signs, connect to the cardiac monitor and when they become unstable they need a bed in the unit. So it's not always the case that there is a bed available in the unit but in the case where a patient is unstable a doctor must ensure that there is space for the patient in the unit (participant 3)."

"They take his observations, do his haemoglobin (HB), do his blood pressure, his temp, his sugar, (participant 6)."

4.4.2.2 Roles and Responsibilities

The current theme overlaps with the subthemes patient assessment and diagnosis. Every nurse practitioner needs to recognise their role in facilitating the process of improving patient care and safety.

Based on the responses below, few participants recognised the importance of performing a 12-lead ECG as an important part of their role in the diagnosis of AMI. The nurses showed commitment to their roles and the need for prompt and early AMI diagnosis. In addition, two participants also identified the importance of the ability to analyse and identify any abnormalities noted on the ECG. Informing the doctor about abnormalities on the ECG was seen as part of their collaborative role and responsibility.

“My role, I will start.....the first thing is, we will do the ECG to establish what kind of MI it is (participant 5)”

“The responsibilities of us, we should know the ECGs, so you will analyse it on your own, and if you see there’s any abnormalities with other symptoms with ... then you will call the doctor immediately (participant 7).”

“Die EKG, as ‘n geregistreerde verpleegkundige word daar natuurlik van ons verwag om die tekens van jou kardiaale infarksie en jou kardiaale besering, ons moet die simptome kan sien. Ons moet op die simptome van die pasiënt gaan, waarmee die pasiënt presenteer, en dan doen ons ook natuurlik op die EKG die veranderinge kan behandel en so. Want somtyds is dokter mos nie op hand nie sodat jy vir hom kan bel om te sê die pasiënt het wel EKG veranderinge wat onmiddellike aandag vereis (participant 2).”

English translation:

“The ECG, as a registered nurse, it is expected of you to identify the signs and symptoms of cardiac infarction and your cardiac injury. We must go according to the patient symptoms, what the patient presents with, and then based on ECG changes we treat the patient. Sometimes the doctor is not available, so you must be able to call him and notify him about the ECG changes that needs immediate attention (participant 2).”

“Call the doctor and inform him about any ECG changes (participant 2).”

RPNs working in the CCU should demonstrate a high level of knowledge, skills, expertise and clinical competencies based on their qualifications and years of experience in the CCU. Attainment of theoretical and clinical skills is important. This enhances confidence in the identification of abnormalities on the diagnostic ECG and improves patient management. In addition, the nurse practitioner has an obligation to remain professionally competent.

4.4.2.3 Scope of practice

This theme emerged spontaneously from the participants during the interviewing process. Despite the fact that the nurse is able to make a nursing diagnosis, one participant strongly believed that the nurse is able to make the same diagnosis as the doctor. The nurse stated that they are bound by acts and regulations regarding nursing practice. The statement shows that in some instances, the nurse practitioner is bound to function interdependently despite the level of their clinical competency.

“The doctor will pretty much make the same diagnosis as the sister has; just the difference is he would be able to prescribe drugs to treat the condition diagnosed on the ECG (participant 1).”

Several participants agreed that the doctor makes the final medical diagnosis. In addition, the importance of administering drugs only after obtaining a written prescription from the doctor was emphasised. The statements demonstrate that the nurses are conscious of practicing within their scope of practice at all times. In addition, they confirmed that only an authorised person is allowed to prescribe treatment.

“At the end of the day, the doctor must make the diagnosis. We are not entitled to order anything (participant 3).”

“Final word is from the doctor, we are unable to give more than what we can give. You give treatment according to your scope of practice (participant 3).”

“We never start anything on our own; we must wait for the instructions (participant 4).”

“You can’t give anything without prescription (participant 6).”

“Omdat ons mos deur ons wette en goed gebind word is daar dinge wat ons nie sommer net kan doen, soos medikasie en goed voorskry en daardie nie (participant 2).”

English translation:

“Because we are bound by the acts, there are things that we just cannot do like prescribing medication (participant 2).”

In contrast, one participant showed some dissatisfaction that the nurse practitioner is bound by acts and regulations, and the need to wait for the prescription before commencement of thrombolytic therapy. Dissatisfaction can be attributed to the delay in commencement of therapy. This proves that the nurse may sometimes be limited by the need to act within the scope of practice and sometimes in emergency situations, a nurse may be bound not use their skills and expertise in providing care to the patient. The succeeding quote confirms the statement.

“We are bound by Acts and regulations, we can’t give antithrombolytic medication (participant 2).”

“Ons hang eintlik (participant 2).”

Afrikaans translation:

“We are actually hanging.”

Nursing practitioners are regulated by the Nursing Act (33 of 2005) and scope of practice R2598. Although the results show that the nurse participants are aware of their independent role in nursing care, they still recognise that they need to act within their scope of practice. A nurse practitioner may act independently in an emergency situation but their roles are limited in a situation where a medical prescription is needed before treatment can be administered to the patient. The need to review the regulations by the regulatory body where nurses can be granted more authority to carry out their independent role might improve management strategies and patient outcomes.

4.4.2.4 Perceptions on DNT

DNT is an important indicator of hospital performance in the management of patients with a diagnosis of AMI. The nurse's response to the question on their perceptions on DNT is described as follows:

“Yes, as I was just saying because I am not saying that now it's not happening before time, you understand, but what I'm saying is that such things do happen, do you understand? What is now, let's say now, because we are a busy unit and the doctor is like always alone (participant 3).”

Based on the quote above, it is clear that the participant could not give a clear explanation on what is understood by the words DNT. The response could be caused by the lack of knowledge and understanding of the meaning of DNT by the participant. CCU is a speciality field, thus nurses working in the CCU have an obligation to demonstrate both theoretical and clinical knowledge which is paramount in their daily practice.

Another participant also reflected a lack of understanding of DNT. According to the response, the participant demonstrated a lack of insight on DNT prior to the study and only heard of the definition during the process before the interviews were conducted. In contrast, the participant still believed that thrombolytic therapy is administered within 30 minutes or less.

“If I remember correctly, they said the time the patient is admitted until we start giving the medication for the myocardial infarction. I would say it ... in my view, it happens quick enough, or good enough. That we start it, I would say 20 minutes to ... 20 to 30 minutes (participant 7).”

Few participants showed insight and understanding of the definition of DNT and believed that the current DNT is within the recommendations of ESC and AHA guidelines for the treatment of AMI. Participants continued to state that thrombolytic therapy is administered promptly after the diagnosis of AMI is made.

“My perception is that DNT is the time from when the patient arrives in the CCU to the time we start with streptokinase-or we start with treatment for the MI (participant 5).”

“I would say that from the time I’ve worked here, I think that our DNT is quite ... or is within the timeframe. That I would say, within 30-45 minutes, or whatever. I would say even quicker than that (participant 5).”

“Well, basically is the time from the ... the point the patient comes into your facility and has his main complaint, to the time the patient actually receives thrombolytic therapy. And I think that should be 30 minutes, not longer than 30 minutes (participant 1).”

“I think it’s ... they’re quite good what I’ve experienced. I mean, if a patient comes in and the sister did the ECG and she sees something that needs to be treated, she will call the doctor, and he will usually, as I have seen, prescribe immediate treatment. And, I guess, what I’ve experienced, the patient usually gets his therapy within 30 minutes (participant 1).”

“I would say there is no delays, there is not actually any delays because strep is available (participant 7).”

“Therapy, ja, dit is vir ons daardie eerste 30 minute vandat die pasiënt by ons gekom het. Binne die eerste 30 minute moet ons begin met die trombolitiese middels. Ons sê time, it’s time to muscle, cardiac time is die ... hoe langer die pyn dan nou hoe meer muscle verloor die pasiënt, hoe groter skade kry ons aan die hartspier, so die eerste 30 minute is ideaal. As ons ‘n pasiënt inkry met akute veranderinge, die eerste 30 minute, as ons hom binne daardie eerste 30 minute kan thrombolise sal dit die ideaal wees (participant 2).”

English translation:

“Therapy, yes, it is in the first 30 minutes from the time the patient present to us. Within the first 30 minutes thrombolytic medication must be commenced. Our time, it’s time to muscle, cardiac time ... the longer the pain, the more muscle is lost by the patient, the more damage is done on the heart muscle, so the first 30 minutes is ideal. If we get a patient with acute changes, the first 30 minutes, it will be ideal if we can thrombolysed him within that 30 minutes (participant 2).”

“The patient comes in by the door ok to the unit. We give with ...What is my perception of ... About when the patient comes to A6 in with myocardial infarction ... Then we give emergency, the treatment immediately after we did the ECG, we know what is the diagnosis, we know that is a MI and we know what ... is the risk factors for not giving the streptokinase, then we start immediately with ... If everything is in order we start immediately with the streptokinase within the first 30 minutes is been given (participant 8).”

The findings demonstrated a positive response as more participants showed insight on what DNT and the ideal time for thrombolysis is as compared to only two with negative responses. Most of the respondents continued to say that they have never experienced a delay in the administration of thrombolytic therapy. Although the results were positive, continuous in-service training about the guidelines and management of AMI should be implemented in the CCU.

4.4.2.5 Factors influencing DNT

The benefit of reperfusion therapy is strongly time dependant. Thus every attempt on AMI management should be to initiate thrombolytic therapy early.

4.4.2.5.1 Patient

Several participants were of opinion that the patient’s hemodynamic status can influence DNT. They stated that this can delay the performance of a 12-lead ECG to make the diagnosis of AMI and subsequently the administration of thrombolytic therapy. Other contributing factors identified were the patient’s blood pressure. Two participants identified the importance of knowing the onset of chest pain. They believed that it would assist with the decision for administering thrombolytic therapy or not.

“When the patient is unstable it is difficult to get the ECG if the patient is restless and uncomfortable, he’s short of breath (participant 1).”

“Many times the patient can't really give you the exact time when the pain started. And the other thing is they might be very hypertensive and a doctor also won't do it, they will first consult (participant 4).”

“When the patient has a very high blood pressure, we will give Tridil to bring the blood pressure. Only when the blood pressure is low, we will give Dobutrax to increase the blood pressure and we will start with streptokinase (participant 8).”

Management strategies of patients with a diagnosis of AMI are based on the initial onset of chest pain and the hemodynamic status of the patient. The results show that the nurses are knowledgeable about the need to stabilise the patient before thrombolytic therapy can be initiated. Patient assessment and implementation of cardiovascular nursing care plays an important role in improving clinical outcomes.

4.4.2.5.2 Doctor

Few participants were of opinion that the doctor's knowledge and the inability to interpret the ECG can be some of the contributing factors for the delay in administration of thrombolytic therapy. Another factor that emerged was the unavailability of the doctor in the CCU during patient presentation.

“The doctor needs to be phoned. I think with the doctors also that we're having here they are also in a learning process. So they normally come here for like six months and then they are out. So they've also got problems of if the patients come in they need to make sure now they have a consultation with maybe the senior registrar or the consultant before they know that now they need to give the strep by that time, you understand (participant 6).”

“As I said sometimes they are not here on that specific time that the patient comes in (participant 6).”

“And the doctor needs to accompany the patients to catheterisation lab. So that patient who is being referred from the other hospital which comes here and needed a strep, he won't be given it at that particular time (participant 3).”

“Ja, dan kan ons ... dit is basies, ja, dan is hulle hierso en dan gaan ons. Of somtyds is die dokter klaar hierso maar dan is dit dokters wat nou nuut by ons is wat dan nou eers weer vir sy konsultant die EKG gaan deurfaks om te kyk, om doodseker te maak

van sy bevindinge, en dan begin ons. Maar gewoonlik, die meeste van die tye, binne die eerste, sê, 45, 30 tot 45 minute kan... (participant 2)."

English translation:

"Yes, then we can ...it is basically, yes, then they are here then we can. Or sometimes the doctor is here but its doctors that are new and he must first fax the ECG to the consultant to have a look at it, to make sure of his findings, then we start. But normally, most of the time, within the first, say 45,30 to 45 minutes (participant 2)."

The results suggest that the need for the doctor to be readily available in the CCU is vital. The doctor's knowledge in the interpretation of the ECG also plays a role in the delay as they need to consult a senior doctor before the decision to administer thrombolytic therapy can be made. Therefore the doctor's level of training was seen as one of the contributors for the delay of the treatment.

4.4.2.5.3 Personnel

Few respondents reported that the shortage of personnel is still a major problem. Due to the problem of personnel shortage, patients cannot be attended to immediately during presentation. This could lead to a delay in the diagnosis of AMI and the subsequent treatment thereof.

"The staff, we cannot foretell, staff not available because of leave and everything that is happening, maybe people going off sick or not available to work (participant 4)."

"But sometimes when we are three - that means the three of us are in the unit - that patient is laying sick outside, so that can also take a little longer because we are busy inside (participant 6)."

"We don't always have staff to accommodate the patient. So it would be nice if the patient is referred beforehand (participant 1)."

In contrast, two of the participants believed that the lack of knowledge and the level of education by the attending nurse or person, especially the urgency of the patient can lead to delay in treatment. The inability of the attending nurse to identify symptoms and abnormalities can lead to the delay in informing the attending doctor of the urgency of patient management.

“Dis ... dit kom net weer daarop as ... hoe goed die ...ons as die geregistreerde verpleegkundiges in die eenheid is, hoe goed ons onse simptome en goed kan uitken as dokter nie daar is nie, en hoe gou ons vir dokter kan inlig wat dit situasie is, so ons moet eintlik maar heeltyd deurlopende opleiding kry oor die veranderinge in behandeling en al daardie tipe goedjies (participant 2).”

English translation:

“It’s ... it comes back to ... how good the ... us as registered nurses in the unit, how good we can identify our symptoms when the doctor is not there, and how quick we can inform the doctor what the situation is, we must actually get continuous training about any changes in patient management and all that type of things (participant 2).”

“All of the staff is not trained on the same level; there are certain staff members that won’t be able to diagnose the ECG, or that are sometimes unsure of how to treat the immediate complaint. So then, sometimes, that sister would have to come and ask you, can I do this or should I do this, the patient is complaining of this and that. And then someone else would then have to tell the other one, no, do this, or leave that first; sometimes you have to structure the other person in order or priority, do this first, that is not that important, or the patient says this, it’s quite important, or he complains of something else it’s not. Then, yes, sometimes you have to structure your colleague in case of what’s important and what’s less important, so it is a bit of a frustration (participant 1).”

Based on the responses, it appears that the attending personnel are not always knowledgeable in identifying abnormalities on the diagnostic ECG and that can lead to delay in treatment. This could be attributed to the level of training of staff members. Therefore, it is important to introduce in-service training such as basic life support (BLS) and advanced life support (ACLS) to all personnel working in the CCU in the attempt to improve their knowledge in management of patients diagnosed with AMI. Mentorship programmes can also be implemented to all new nurses starting in the CCU. This will assist in identifying the individual’s needs, strengths, weaknesses and strategies can be put in place to address the issues identified. Continuous planning, preferably on a daily basis, is needed to deal with the personnel shortages.

4.4.2.5.4 Hospital

Two respondents noted that lack of planning, communication and resources by the hospital to accommodate the patient can lead to the delay in treatment. Patient overload indicates poor hospital planning.

“Well, it’s difficult. I think it would be better if we know about the patient beforehand because we don’t always have beds to accommodate the patient (participant 1).”

“You cannot just accept a patient from another side whereas there is no bed for him inside the unit. But sometimes it does happen that now as I have told you about walk-ins and you will find at the end of the day that you don’t have a bed (participant 3).”

This comment indicates a lack of effective planning and communication between the remote hospitals and the personnel. The attending doctor needs to inform the nursing personnel of any expected patient to ensure the availability of beds on patient arrival. This can reduce the waiting period between patient assessment and commencement of thrombolytic therapy.

4.4.2.5.5 ECG

Only one participant identified the evolving ECG as a contributing factor to the delay in administration of thrombolytic therapy. According to the response below, it is important to repeat the ECG every 5-10 minutes if the patient still complains of chest pain where the diagnosis of AMI could not be made on the initial ECG.

“I think the delay of treatment would be... sometimes it’s that you can’t see immediately on the ECG that it’s ... like I say, it’s like you can’t see it immediately. The ECG is still developing into that (participant 1).”

The results show that the majority of the respondents may not be aware of what evolving ECG is. The nurses are the first medical contact and it is expected of them to be knowledgeable in analysing the ECG and in identification of the abnormalities thereof. This signifies that intervention is needed in terms of training of the personnel about the importance of having the skill in basic ECG interpretation and identification of life threatening abnormalities such as ST elevation. Ongoing chest pain should be seen as an indication for the repeat of ECG despite the absence of ST elevation on the initial ECG.

4.5 SUMMARY

In this chapter, the results of the study were presented and discussed. Patient characteristics, participant profile, current DNT, factors influencing DNT, effects of DNT on patient outcomes and the perceptions of nurses on DNT were presented. Five themes and ten subthemes emerged.

The study revealed a median door-to-needle time of 30 minutes with a range of (5-85) minutes. Furthermore in the study, more than 50% (n=23, 59%) of the patients received thrombolytic therapy within 30 minutes. There was a significant reduction in median door-to-needle time as recorded by the study conducted in Cape Town (Maharaj *et al.*, 2012), that reported a median door-to-needle time of 54 minutes. However in this study, thrombolytic therapy was administered in the CCU. Another study conducted in Qatar by (Mohammed *et al.*, 2013), reported a median door-to-needle time of 33,5 minutes when thrombolysis was initiated in the CCU. Other studies conducted in European countries also recorded a median DNT of more than 30 minutes (Shull *et al.*, 2005; Zed *et al.*, 2004).

In the current study, a large number of the patients (n=23, 59%) were assessed by a senior RPN. This may have resulted in the reduction in door-to-needle time. The study had a small sample size compared to other studies and therefore definite conclusions cannot be drawn based on the results. Although the nurses strongly believed that they have never experienced a delay in administration of thrombolytic therapy, a small number of patients (n=9, 23.1%) were thrombolysed between 31 and 60 minutes . An additional (n=7, 17.9%), were thrombolysed between 61 and 90 minutes. Median door-to-needle time of patients who arrived by ambulance and those who used private transport were compared, patients who used private transport had a shorter median door-to-needle time.

An ECG is an important diagnostic tool for early identification and management of AMI, the AHA recommends a door-to-ECG time of 10 minutes or less. The study revealed that (n=27) of the patients had a diagnostic ECG within zero to 10 minutes of presentation. Five factors influencing delays were identified. These factors included the patient, the doctor, the personnel, the hospital and the ECG (see Table 4.1). Results revealed that nurses believed that the patient's hemodynamic status and the inability to give information about the exact time of pain onset can cause a delay in treatment. They continued that the unavailability of the doctor during patient presentation and the need to consult the senior doctor before the decision to commence thrombolytic therapy is a contributing factor to the delay in therapy. Patient outcomes included length of hospital stay, morbidity and mortality. A median of four

days was achieved with a range of between (1-18) days. No significant relationship was found between DNT and factors associated with DNT. Furthermore, there was no significant relationship between DNT and length of hospital stay $p=0.40$. Three patients died and the deaths were related to the complications of AMI. The complications included, shock and cardiac dysrhythmias.

The study findings revealed that personnel shortage is still a major contributor to the delay in treatment as patients cannot be attended to immediately when they present. Two respondents also confirmed that the lack of knowledge of the attending nurse and their inability to recognise the patients that need urgent attention is a problem as patients may not be attended to promptly. The level of training was also seen as a contributing factor. Lack of planning by the hospital and poor communication is seen to have a negative impact on the patients as beds may not be available when they present and this may prolong the assessment and treatment period.

4.6 CONCLUSION

The results and findings obtained from the data extraction form and semi-structured interviews were analysed, interpreted and presented in this chapter. The following research questions were answered in this chapter:

- What is the door-to-needle time for adult patients presenting with AMI in the coronary care unit (CCU)?
- What are factors associated with door-to-needle time?
- What are the effects of door-to-needle time on the following outcomes: length of hospital stay in coronary care unit (CCU), morbidity and mortality?
- What are the perceptions of nurses on the factors that affect door-to-needle time?

The discussions and conclusions of the findings of the study and recommendations based on the findings are discussed in the succeeding chapter. Recommendations for future research will be made based on the findings.

CHAPTER 5: DISCUSSION, CONCLUSIONS, RECOMMENDATIONS

5.1 INTRODUCTION

The aim of the study was to investigate the in-hospital delays in door-to-needle time in patients with AMI requiring thrombolytic therapy. This chapter will include the discussion, conclusions, recommendations, and suggestions for future research.

5.2 DISCUSSION AND CONCLUSIONS

The discussion and conclusions will be documented according to the objectives of the study.

5.2.1 Objectives of the study

The objectives of the study were to:

- Determine the current door-to-needle time of patients with AMI requiring thrombolytic therapy.
- To identify the factors associated with door-to-needle time (DNT).
- To determine the effects of door-to-needle time on the length of hospital stay, morbidity and mortality and to explore the perceptions of nurses on door-to-needle time.

5.2.1.1 Determining the current DNT of patients with AMI requiring thrombolytic therapy

According to Steg *et al.* (2012: 2574), management of patients including both diagnosis and treatment, begins at the point of first medical contact. A working diagnosis of AMI must first be made before the decision to commence treatment. The diagnosis is made based on the history of chest pain lasting for 20 minutes and not responding to nitrates (Steg *et al.*, 2012: 2574). A 12-lead ECG is an important diagnostic tool and should be obtained as soon as possible, within 10 minutes of the first medical contact. After diagnosis of AMI, reperfusion therapy should be initiated promptly to prevent life threatening complication (Steg *et al.*, 2012:2575).

AHA guidelines (O’Gara *et al.*, 2013: 530), recommend that all patients with a diagnosis of AMI should receive thrombolytic therapy within 30 minutes of arrival. A DNT of 30 minutes is regarded as a delay. According to Maharaj *et al.* (2012: 243), minimising the time between diagnosis of AMI and commencement of thrombolytic therapy is important to improve patient survival and prognosis.

The findings revealed that a significant number of patients (n=27, 79.4 %) had a diagnostic ECG within 10 minutes of presentation. A median door-to-ECG time of 3.5 minutes was also achieved (see Figure 4.4). This shows a significant reduction compared with the 13 minutes reported by Maharaj *et al.* (2012:243). The current door-to-ECG time is in line with the international guideline recommendations. Furthermore, the results revealed a median DNT of 30 minutes as compared with the 54 minutes as reported by Maharaj *et al.* (2012:243). Another study conducted by Muller, Rabelo, Moraes and Azzolin (2008:52), revealed a median DNT of 51.4 minutes. A significant number of patients (n=23, 58.9%) were thrombolysed within 30 minutes (see Table 4.2). The results show a significant reduction in DNT for the majority of patients treated with thrombolytic therapy.

Since nurses are the first medical contact in the CCU, their primary duty is the assessment of a patient's physical and emotional wellbeing (Watson, 2006:34). By accurately assessing and recording the information, the nurse can prioritise nursing care. According to Watson (2006:35), time is a valuable commodity when admitting a patient and in today's climate of clinical effectiveness, a greater level of skill is needed.

Nurses should be proactive in undertaking physical assessment and sound knowledge is needed to facilitate and interpret their findings (Watson, 2006:35). Therefore, all nursing practitioners should demonstrate a high level of clinical assessment and diagnosis of all patients presenting in the CCU. This is important in facilitating management of cardiac patients.

5.2.1.2 Identifying factors influencing DNT

Prevention of delays in the management of AMI is critical in all patients. In the initial phase of AMI, the patient is often in severe pain and complications such as cardiac arrest can occur (Steg *et al.*, 2012:2577). The benefit of reperfusion therapy is strongly time dependant. Therefore early provision of therapy, specifically thrombolytic therapy, is crucial to its benefit (Steg *et al.*, 2012:2577). Minimising delays to commencement of thrombolytic therapy is associated with improved patient outcomes.

Based on the findings of the study, nurses have identified several factors influencing the delay in DNT. The factors include patient, doctor, personnel, hospital and ECG. The participants have revealed that hemodynamic status and the inability of the patient to recall onset of pain were the main factors. According to Steg *et al.*, (2012:2577), patients should be taught to recognise common symptoms suggestive of AMI. The unavailability of the doctor

during patient presentation and need for senior consultation were identified, and the inability to interpret the ECG by the attending nurse or doctor were seen as some of the factors influencing DNT. One participant identified evolving ECG an additional factor. A few nurses confirmed that staff shortage lead to patients not being immediately attended to at presentation.

The analysis is supported by the study conducted in three hospitals in the Western Cape (Maharaj *et al.*, 2012), the study showed that the need to consult the senior doctor, the inability to interpret the initial ECG were the main factors influencing DNT. The Malaysian study also identified the delay in decision making, incorrect initial ECG interpretation and evolving STEMI as the main contributing factors (Loch, Lwin, Zakana, Abidin, Ahmad, Hautmann, 2013:336). Steg *et al.* (2012: 2577), stated that a good indication of quality of care is the time taken to record the first ECG. In addition, the time taken between first medical contact and initiation of thrombolytic therapy indicates quality of care and predicts the patient outcomes.

It is crucial that medical personnel, especially those inexperienced strive towards self-development through the acquisition of skills required to treat cardiac patients. Modifiable organisational measures can also be put in place including effective planning and communication systems in the attempt to reduce delays. The process of patient assessment and admission must be speedy for diagnosis and treatment of AMI to improve patient outcomes and prevent complications. Patient education with the regard to the early recognition of symptoms related to cardiac problems should be a continuous process practised by nurses with every patient encounter.

5.2.1.3 Determining the effects of DNT on patient outcomes

Delays to treatment play a great contribution to coronary death and heart dysfunction since the survival outcomes significantly depend on the time elapsed between the onset of symptoms and the initiation of thrombolytic therapy as the definitive treatment for AMI (Rariyati & Sahar, 2012: 126).

According to Maharaj *et al.* (2012:243), prolonged door-to-ECG time leads to an increased risk of adverse clinical outcomes in patients with a STEMI. ESC recommends a door-to-ECG time of 10 minutes or less within patient presentation and that timely diagnosis of STEMI is a key to successful management (Steg *et al.*, 2012:2574). ECG monitoring should be initiated

as soon as possible in all patients suspected of STEMI to detect life threatening arrhythmias and allow early management where indicated.

For the analysis, all patients treated between the period January 2009 and January 2014 were included. Patient outcomes that were determined were morbidity, mortality and length of hospital stay. The median length of hospital stay of four days was achieved with the range of (1-18) days. Figure 4.8 shows that majority of the patients had a shorter stay. The length of hospital stay in these patients was one to five days. Three patients died due to complications of AMI.

Immediate assessment of the patient during presentation is vital to avoid prolonged periods between patient presentation and rendering of care. Nurses working in the CCU need to provide care in order of priority to avoid long waiting periods between the diagnosis of AMI and the initiation of thrombolytic therapy.

5.2.1.4 Exploring the perceptions of nurses on DNT

The results of the research study indicated that not all nurses working in the CCU had insight into the definition of door-to-needle time. Four of the respondents mentioned that door-to-needle time should be 30 minutes and time longer than 30 minutes is regarded as a delay. The statement is confirmed by (Steg *et al.*, 2012:2586), which stated that for all hospital patients, thrombolytic therapy should be started within 30 minutes. In contrast, a significant number of patients (n=13) assessed by senior RPNs had DNT of more than 30 minutes (see Table 4.4). Two other respondents could not give a clear understanding of the definition and one participant gave an explanation based on what was explained to her. The results show a positive theoretical knowledge based on the response of four respondents as they outnumbered the negative responses. These results may indicate that although the majority of nurses working in the CCU may have knowledge on what the recommended DNT is, patients with a diagnosis of AMI are still delayed treatment.

Attainment of theoretical and practical knowledge is crucial to enhance clinical competence of every nurse practitioner. In addition, a nurse practitioner with good clinical skills and expertise may show a high level of confidence when managing patients, subsequently; this may lead to improvement in clinical outcomes.

5.3 RECOMMENDATIONS

The following recommendations were made based on the results of the study. Recommendations were also based on the interventions to improve door-to-needle time.

5.3.1 General patient assessment

Physical examination embodies skills of healing and patient care. Thus, the ability to gather accurate history and to perform a thorough physical examination sets direction for patient management. The quality of the physical examination includes identifying problem symptoms and abnormal findings and determines the next steps for the patient and guides appropriate management. According to Elliott et al (2012:190), a thorough cardiac assessment requires the critical care nurse to be competent in a wide range of observational and technical skills. Nursing assessment aims to both define patient health status as well as to inform implementation of an appropriate clinical management plan (Elliott *et al.*, 2012:190).

A careful and detailed clinical assessment is important in order to assess the cause and severity of symptoms, to arrange appropriate referral and to assess the patient's individual risk of cardiovascular disease.

Nursing education institutions should also include the importance of a detailed chest pain assessment in the nursing curricula. The importance of pain assessment scales, non-pharmacological and pharmacological management of chest pain should be emphasized. Nurses will be encouraged to recognise the importance of evidence-based practice and the need to incorporate it in their daily practice. According to Willis (2012:6), nursing education should foster strong emphasis on professionalism. This includes embedding a caring professionalism that has patient safety as its top priority, and respects the dignity and values of service users. Nursing Education require a constant commitment to quality, with a willingness to engage with and help extend the evidence base for practice, and to develop reflective practice and critical judgement (Willis, 2012:6).

5.3.2 In-service training

The rapid change in the knowledge base and innovative treatment means that critical care nurses require currency of knowledge and broad clinical skills that can be acquired through continuing education (Elliott *et al.*, 2012:28).

SANC, under the provisions of the Nursing Act 33, 2005 has stated the following on nursing education and training standards: Nurses who acquire knowledge, skills and behaviour that

meet the standards will be equipped to meet the present and future challenges, improve the health and well-being and improve the standards and quality of care. Elliott *et al.* (2012:26), identified the importance of skill mix which is defined as the ratio of caregivers with varying levels of skill, training and experience in a clinical unit or the proportion of RPNs who have a formal specialist critical care qualification.

Therefore, it is crucial to balance the ratio between the qualified and unqualified nurse and to facilitate training in the new skills and clinical competence of the unqualified nurse. Both formal and informal in-service training should be introduced to all the nurses working in the specialised units. As an autonomous practitioner, nurses will provide essential care of a very high standard and provide complex care using the best available evidence and technology where appropriate.

5.3.3 AMI management policies and guidelines

In this study, the findings have revealed a lack of chest pain and AMI management policies and guidelines that are visible to both the nursing and medical professionals. The researcher has also recognised that there are no policies set out by the National department of Health. Therefore the researcher recommends that the National department of Health implements chest pain management policies and guidelines urgently.

The formulation of policies should be guided by the international standards and should be in line with recent innovative management strategies. Formulated policies should be reviewed periodically to ensure that they are up-to-date with the changing trends in patient management. The provision of quality care based on the current evidence may be ensured and subsequently patient care improved. Protocols should also be developed based on the possible presenting symptoms, the need to identify the indications and contraindications (see Table 2.2) for thrombolytic therapy. Evidence based practice strategies should be implemented in all emergency units to enhance quality nursing care and to improve patient clinical outcomes.

5.3.4 Staffing levels

Elliot *et al.* (2012:24), defines a staff establishment as the number of nurses required to provide safe, effective quality care. In the study, one of the factors associated with DNT was personnel shortage. This is seen as an area that needs intervention in order to ensure patient safety. The results confirmed that the nurse-patient ratio, meaning the number of

nursing hours required to care for a patient with a particular set of needs, is compromised and this may lead to adverse patient outcomes.

Furthermore, other identified factors influencing staffing levels include the population served, the services provided by the hospital and the specialities of the personnel working at the hospital. The study was conducted at a tertiary hospital, thus the hospital is expected to provide quality care and to have knowledgeable and skilled personnel providing health care. Improving health care can be facilitated by staff planning from the hospital management and the implementation of effective communication methods.

5.3.5 Planning, more space and communication

A lack of equipment, beds and effective communication was identified by two respondents as a factor that influences door-to-needle time. Effective communication channels should be put in place between the tertiary and remote hospitals in order to enhance quality patient care. This include a good communication network system between the hospital and the Emergency Medical Services (EMS). The hospital may be contacted by the EMS control room and inform them of the patients that need urgent attention so ensure that there is a bed available for the patient. Proper planning in terms of assuring the availability of beds before patient presentation may help reduce the delay in treatment. Continuous planning and evaluation of patient numbers and available beds should be of priority to manage the number of patients presenting in the CCU requiring nursing care.

5.3.6 Patient education

Patient education should be seen as an integral part of care. Patient education should focus on promoting lifestyle choices, risk factor modification and active patient self-management of chronic diseases. Zbierajewskin and Loeb (2010:2) reported that non chest pain symptoms occur frequently in women and may be falsely identified as musculoskeletal, gastrointestinal or emotional in origin and deemed inconsistent with cardiac symptoms. Common MI symptoms such as nausea are less likely to be identified because most patients expect that they will have severe chest pain when having MI. all patients with a diagnosis of AMI should be given a clear and valuable health education to ensure that correct lifestyle modifications are followed. The nurse can also assist with the referral of the patient to other members of the multidisciplinary team (e.g. dietician) to ensure that healthy eating habits are followed.

According to Zbierajewskin and Loeb (2012:2), patients who do not have chest pain delay seeking treatment longer than those who have chest pain. Nurses should stay observant and

have a guide of clinical suspicion for MI in adult patients. Nursing student clinical rotations in cardiac care units must be seen as an opportunity to heighten these future nurses' awareness regarding MI recognition and care. In addition, nurses working in the coronary

5.3.7 Recommendations for future research

The research study has formed a basis of information related to the current DNT and what the perceptions are on DNT.

The following future research opportunities are recommended:

- Investigating the implementation of continuous in-service training of nurses working in the CCU.
- Investigating the implementation of guidelines and policies relating to the management of chest pain and AMI.
- An audit on the implemented staff planning protocol.

5.4 LIMITATIONS OF THE STUDY

The study was limited to one tertiary hospital. The population was limited to patients diagnosed with AMI who received thrombolytic therapy at the tertiary hospital and to RPNs only as they are the only category working in the CCU. The total population was small and it included 39 case notes and eight participants.

5.5 SUMMARY

The current results provide baseline information on the current DNT at the tertiary hospital. In this chapter, the results were discussed based on the objectives of the study. The aim of the study was to investigate the in-hospital delays in door-to-needle time of patients with AMI requiring thrombolytic therapy.

Finally, the institution has a responsibility to formulate policies related to staffing and patient management in the CCU and the need to monitor its effectiveness is vital. Continuous in service training and mentorship programmes should be implemented based on the needs of each nurse and striving for excellence in provision of quality patient care should be their priority.

5.6 CONCLUSION

The study confirmed that although the RPNs working in the CCU strongly believed that thrombolytic therapy is administered within the recommended time of 30 minutes or less on patient presentation, quantitative results showed a significant number of patients were delayed treatment. Numerous factors contributing to the delay were identified. DNT was not seen to affect the patient outcomes.

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APPENDICES

Appendix A: Ethical committee approval letter



UNIVERSITEIT- STELLENBOSCH-UNIVERSITY
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Approved with Stipulations New Application

16-Apr-2014
Makgoale, Kghahlego KR

Ethics Reference #: S14/03/054

Title: **Door-to-needle time in patients with acute myocardial infarction requiring thrombolytic therapy.**

Dear Miss Kghahlego Makgoale,

The New Application received on , was reviewed by members of Health Research Ethics Committee 1 via Minimal Risk Review procedures on 16-Apr-2014.

Please note the following information about your approved research protocol:

Protocol Approval Period: 16-Apr-2014 -16-Apr-2015

The Stipulations of your ethics approval are as follows:

A folder number is part of the patient's identifier. Rather use a study ID with a separate link to the folder number.

Please remember to use your protocol number (S14/03/054) on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:

Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired. The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.

Translation of the consent document to the language applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372

Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western Cape Department of Health (healthrea@pgwc.gov.za Tel: +27 21 483 9907) and Dr Helene Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.

For standard HREC forms and documents please visit: www.sun.ac.za/rds

If you have any questions or need further assistance, please contact the HREC office at 0219389657.

Included Documents:

Supervisor declaration Khondowe
CV Makgoale
Supervisor declaration
CV Hector
Protocol
Synopsis
HREC Checklist
CV Khondowe
Information leaflet
Application form
Investigators declarations

Sincerely,

Franklin Weber 
HREC Coordinator
Health Research Ethics Committee 1

Appendix B: Permission for access to hospital – Tygerberg Hospital



Tygerberg Hospital

REFERENCE: Research Projects
ENQUIRIES: Dr G G Marinus
TELEPHONE: 021 938-6267

ETHICS NO: S14/03/054

Door-to-needle time in patients with acute myocardial infarction requiring thrombolytic therapy.

Dear Ms RK Makgoale

PERMISSION TO CONDUCT YOUR RESEARCH AT TYGERBERG HOSPITAL

In accordance with the Provincial Research Policy and Tygerberg Hospital Notice No 40/2009, permission is hereby granted for you to conduct the above-mentioned research here at Tygerberg Hospital.

A handwritten signature in black ink, appearing to be "D Erasmus", written over a horizontal line.

DR D ERASMUS
CHIEF EXECUTIVE OFFICER

Date: 7 August 2014

Appendix C: Participant information leaflet and consent form

TITLE OF THE RESEARCH PROJECT: DOOR-TO-NEEDLE TIME IN PATIENTS WITH ACUTE MYOCARDIAL INFARCTION REQUIRING THROMBOLYTIC THERAPY.

REFERENCE NUMBER: S14/03/054

PRINCIPAL INVESTIGATOR: MISS MAKGOALE KR.

ADDRESS: 57 TWIN PEAKS, SALFORD ROAD, BELLVILLE 7530.

CONTACT NUMBER: 0824839272

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study staff or doctor any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

- *The aim of the study is to investigate the factors associated with in-hospital delay in door-to-needle time in patients with acute myocardial infarction requiring thrombolytic therapy. The research project will be conducted at Tygerberg hospital and it will include a total of eight participants' altogether.*

- *The study aims to investigate whether thrombolytic therapy is initiated within 30 minutes to all patients with acute myocardial infarction that present to the coronary care unit (to determine the current door-to-needle time). The findings of the study may assist in improving patient care and also clarifying the responsibilities of registered nurses in the management of myocardial infarctions.*
- *Face to face interviews will be conducted with eight registered nurses who are voluntarily willing to participate. All the registered nurses would have met the criteria to be included in the study. Each interview will be 30-45 minutes each and will be conducted at the hospital premises in a private room. Information obtained will be kept confidential at all times and no names will be used. Only pseudonyms will be used and qualifications will not be disclosed.*
- *Explain any randomization process that may occur.*
- *There will be no use of medication.*

Why have you been invited to participate?

As a registered professional nurse with experience and expertise, the researcher will find your input valuable in answering the research question. Your input may also assist in improving patient care and informing certain procedures/protocol in the improvement of door-to-needle time.

What will your responsibilities be?

- *Completely read the consent form and ask the principal investigator any questions you may have. You should understand what will happen to you during the study before you agree to participate.*
- *Talk to the principal investigator if you want to stop being part of the research study.*
- *Know the dates when your study participation starts and ends.*
- *Carefully weigh the possible benefits and any risks involved.*
- *Contact the principal investigator and university institutional review board with any complaints or concerns.*
- *Fulfil the responsibilities of participation as described on the consent form unless you are stopping your participation in the study.*
- *Keep a copy of the consent form for your records.*

Will you benefit from taking part in this research?

- *Your input will benefit both the hospital and the patient. Inputs may help evaluate whether the hospital is in line with the international guidelines in the*

management of myocardial infarction. The findings may therefore help in the drawing of the hospital protocol and overall improvement of patient care. This may also benefit future patients and future nurses who will be working in the coronary care unit. Unit protocol may be formed from the findings yielded by the study.

Are there in risks involved in your taking part in this research?

- *There are no physical risks involved. Emotional risks may occur during the interviews but reassurance and prompt referral to appropriate professional will be ensured should it need be.*

If you do not agree to take part, what alternatives do you have?

- *This is not an intervention study, no treatment or medication is going to be administered to the participants.*

Who will have access to your medical records?

All the information collected will be kept confidential and will be protected at all times. If the information obtained is used in any publications, your identity as the participant will be kept anonymous. Pseudonyms will be used for participants. Your personal characteristics and qualifications will not be disclosed. Only the principal investigator, the supervisor, the statistician and the research ethics committee will have access to the information.

Will you be paid to take part in this study and are there any costs involved?

No, you will not be paid to take part in the study but your transport and meal costs will be covered for each study visit. There will be no costs involved for you, if you do take part.

Is there anything else that you should know or do?

- You can contact the Health Research Ethics Committee at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by your study doctor.
- You will receive a copy of this information and consent form for your own records.

Declaration by participant

By signing below, I agree to take part in a research study entitled (*insert title of study*).

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the study doctor or researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) on (*date*)
2014.

.....
Signature of participant

.....
Signature of witness

Declaration by investigator

I (*name*) declare that:

- I explained the information in this document to
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use an interpreter. (*If an interpreter is used then the interpreter must sign the declaration below.*)

Signed at (*place*) on (*date*)
2014.

.....
Signature of investigator

.....
Signature of witness

Appendix D: Data extraction form

Title: Door-to-needle time in patients with acute myocardial infarction requiring thrombolytic therapy.

Case number:

Today's date:

1.1 Characteristics of patients (demographics, DNT and outcomes).

1.1 Gender	
Male	
Female	
Date of birth	
1.2 Clinical history	
Not documented / not available	
Smoking	
Hypertension	
Diabetes mellitus	
Ischemic heart disease (IHD)	
Previous STEMI	
Other (Specify)	
1.3 Mode of arrival	

Patient date of arrival	
Patient time of arrival	
Ambulance	
Walk in	
1.4 ECG as recorded in folder	
ST elevation inferior	
ST elevation anterior	
ST elevation septal	
ST elevation other area of the heart	
1.5 Diagnostic tests	
Echocardiogram	
Cardiac enzymes	
1.6 Factors associated with DNT (total DNT)	
Pain onset	
CCU arrival to admission	
Patient arrival time and date	
Admission to diagnostic ECG	
Exact time of diagnostic ECG	

Exact date of diagnostic ECG	
Pre hospital ECG	
Hypertensive on arrival	
Haemodynamically unstable	
Diagnostic ECG to thrombolytic therapy	
Junior registrar (initial assessment of patient)	
Senior registrar (initial assessment of patient)	
Consultant (initial assessment of patient)	
Junior RPN (attending to patient on presentation)	
Senior RPN (attending to patient on presentation)	
1.7 Physician rotation period	
February (Yes / No)	
August (Yes / No)	
Total door to needle time	
1.8 Outcomes	
Length of hospital stay	
Days in CCU (date and time)	

Days in high care (date and time)	
Morbidity	
Shock-defined as an altered physiological state that affects the functioning of every cell organ in the body (Elloit et al., 2012:539).	
Pulmonary oedema-defined as abnormal accumulation of extravascular fluid in the lung (Elliot et al., 2012:334).	
Dysrhythmias -defined as abnormal oscillations within the late repolarisation stages of the cardiac cycle (Elliot et al., 2012:252).	
Mortality	
Before discharge (yes/no)	
Date and time	

(Mc Namara et al., 2007, Maharaj et al., 2012).

Appendix E: Interview guide

Section A: Participants profile:

Male

female

Date of birth:

Section B: Main question:

What are your perceptions on door-to-needle time?

Section C: Probing questions:

- Tell me more about your role when a patient present with chest pain?
- What are the responsibilities of the RPN after obtaining a diagnostic ECG?
- Tell me more about the patient assessment after obtaining the ECG?
- Is the doctor always available to make an assessment and diagnosis of the ECG immediately?
- In your experience, tell me what can influence delays in administration of thrombolytic therapy?

Appendix G: Declaration of technical formatting



To whom it may concern

This letter serves as confirmation that I, Lize Vorster, performed the technical formatting of Kgahlego Makgoale's thesis. Technical formatting entails complying with the Stellenbosch University technical requirements.

Yours sincerely

A handwritten signature in dark ink, appearing to read 'Lize Vorster', is written over a simple, light-colored triangular scribble.

Lize Vorster

Language Practitioner

Lize
Vorster
Communication

To whom it may concern

This letter serves as confirmation that I, Lize Vorster, performed the technical formatting of Kgahlego Makgoale's thesis. Technical formatting entails complying with the Stellenbosch University technical requirements.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Lize Vorster', written over a light blue triangular stamp.

Lize Vorster

Language Practitioner