AN ANALYSIS OF THE INTERNAL MEDICINE INPATIENT MORTALITY PROFILE IN MANKWENG HOSPITAL

by

REBECCA MAHLAKO MAHLATJI

[redacted]

MINI-DISSERTATION

Submitted in partial fulfilment of the requirement for the degree of

MASTERS OF MEDICINE

in

INTERNAL MEDICINE

in the

FACULTY OF HEALTH SCIENCES

(School of Medicine)

at the

UNIVERSITY OF LIMPOPO

Supervisor: Prof AR Ratsela

Co-supervisor: Dr R Cordoves and Dr PMN Mangena

October 2022

PLAGIARISM DECLARATION

I declare that **AN ANALYSIS OF THE INTERNAL MEDICINE INPATIENT MORTALITY PROFILE IN MANKWENG HOSPITAL,** submitted in partial fulfilment of the requirements for the degree of Masters of Medicine in Internal Medicine, is my own work and all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree.

Rebecca Mahlako Mahlatji	**28 October 2022**
Full names	**Date**

ACKNOWLEDGEMENTS

I wish to thank the following for their contributions to my research project:

- God Almighty, for wisdom and guidance throughout my studies.
- Department of Health, Limpopo, for approving the study.
- My mother, Selina Mahlatji, for prayers and encouragement when the going was difficult. Much appreciated, Hunadi!
- My husband, Mampuru Mphahlele, for looking after our boys while I concentrated on my project and for his love and support. You are the best, my love!
- All my supervisors (Prof. Ratsela, Prof. Rolando, and Dr. Mangena): your support is gratefully appreciated. You are the backbone of my dissertation.
- Prof. Sutton, for understanding my research topic better. I am grateful for your guidance.
- Information Department in Mankweng Hospital for simplifying data collection for Thank you, the late Ms. Shale Makwela, Mrs. Mashatole, and staff.
- My colleagues in the department of Internal Medicine for their useful comments. You guys rock!
- The technical editor is Prof. TW Molotja.
- To Nareadi, my grandmother, you waited a lifetime for me to complete my studies and stay with you, but that never materialized. In my heart, that's where you are.
- And to you, my late brothers, Mpho Johannes Mahlatji and Tebogo Anthony Mahlatji! May your souls rest in peace!
- To a long list of peopleð family, friends, and colleaguesð without you, it could not be possible.

DEDICATION

This dissertation is wholeheartedly dedicated to my beloved late aunt, Mrs. Matlale Rebecca Maesela, who has been my mother and inspiration when I did not believe in myself as a specialist. Your dreams are coming true, Mahlako!

To Motheo, my eldest son, and our triplet sons, Mokgobi, Masetloe, and Nkoane, your love and understanding are beyond measure. I love you, my lucky charms!

ABSTRACT

Background: Departmental analysis of causes of death assists in defining hospital health policy priorities. They are important in rural tertiary hospitals like Mankweng.

Aim: The aim of the study was to analyse the causes of death in inpatients over 12 years in the Internal Medicine Department in Mankweng Hospital, Limpopo Province, South Africa, from the 1st of June 2019 to the 1st of November 2019.

Methods: This was a five-month (1st June 2019 to 1st November 2019) retrospective descriptive study with an analysis of the inpatientsô mortality profile in Mankweng Hospital with emphasis on all deaths that occurred in the Internal Medicine wards (census sampling). A questionnaire was designed and used to collect data from 228 deceased files. The main causes of death by age group were determined. The effects of factors such as the óweekend effectô, deaths within 48 hours of admission, and the proportion of HIV/AIDS on deaths, which have been identified globally as affecting inpatient mortality rates, were also determined in this study. The collected data was analysed using Excel spreadsheets.

Results: A total of 228 medical records of deceased inpatients constituted the study population. The median age was 56 (14-103) years and 51.3% of females died. Communicable diseases accounted for 56.1% and non-communicable-related deaths constituted 43.9%. Leading causes of death were pneumonia (30.5%) and cancer (33%) with more (58) males dying from pneumonia and TB. Age was observed as significant determinant of death. More than 90% of patients knew their HIV status, close to half (46.9%) were HIV positive, 72% had a CD4 count < 200 cells/mm^3 with only 25.2 percent on ARVs. At least 120 (52.6%) of participants had comorbidities.

Conclusion: The mortality of Internal Medicine inpatients at Mankweng Hospital demonstrates a dual burden of communicable and non-communicable diseases, as well as an increase in the number of participants above 60 years dying within 48 hours of admission and no óweekend effectô. This challenges national and provincial health system

Keywords: Inpatients, Mortality profile, Cause of death, óWeekend effectô, Death within 48hours

TABLE OF CONTENTS **PAGE**

LIST OF TABLES

LIST OF FIGURES

DEFINITION OF CONCEPTS

Communicable diseases: Infectious diseases that can be transmitted from person-to-person by direct contact with an infected individual or through the discharge of that individual, or by indirect ways (such as by a vector). Pathogenic microorganisms such as bacteria and viruses, such as the Human Immunodeficiency Virus (HIV) may cause these disorders (Stats SA, 2018).

Cause of death: It is the disease or injury that launched the train (sequence) of pathological (disease-related) events that resulted directly in death, or the accident or violence that caused the fatal injury (Stats SA, 2018). This study will use the listed cause of death as provided by the certifying doctor

Inpatient: Someone admitted to a hospital for treatment (Collins English Dictionary). Patients older than 12 years admitted to the Internal Medicine wards from Mankweng Hospital's casualty are referred to as inpatients in this study.

Mortality profile: A set of characteristics or qualities that identify the relative frequency of deaths in a specific population. It is a tool that brings together a selection of mortality indicators (Huicho et al., 2009).

Natural death: A death that has been certified as being caused by natural causes and has been registered as such under Act 51 of 1992, the Births and Deaths Registration Act (Maphanga, 2009; Stats SA, 2018).

Unnatural death: Unnatural death is defined as death that does not occur because of senescence or sickness. Unnatural causes of death include the following:

(a) Any death due to the application of force, direct or indirect and its complications;

(b) Any death due to the effects of any chemical or toxic substance, or drug, or any death due to an electrical effect

(c) Any death where another person, by a negligent act or omission, can be held responsible for the death;

(d) Any death occurring while the deceased was under the influence of a local or general anaesthetic; and

(e) Where the death is sudden and unexpected (National Health Act 61 of 2003, South African Government)

Non-communicable diseases: Medical disorders or diseases that are not contagious and cannot be passed from one person to another. They are frequently long-lasting and are caused by a combination of genetic, physiologic, environmental, and psychosocial factors (WHO, 2011). Cancer, asthma, and heart disease are just a few of them (Stats SA, 2018).

Tertiary hospital: A level three hospital and sometimes called a provincial tertiary hospital (KZN Health, 2014). It comprises specialized consultation care by specialists working in a centre with staff and facilities for particular investigation and treatment, as well as research, usually on referral from primary or secondary hospitals (Gauteng Health, 2008). Limpopo Department of Health, 2018, further subdivides level three hospitals into T1 tertiary services (tertiary hospitals) and T2 tertiary services (central hospitals). T1 tertiary services are all Medical and Surgical disciplines, multidisciplinary trauma, the Intensive Care Unit, Paediatric Intensive Care Unit, Neonatal Intensive Care Unit, and Burns. T2 tertiary services are Cardiology/ Cardiothoracic (Medical, Paediatrics, Surgical); comprehensive Oncology services (Medical, Paediatric, Surgical, Gynaecological, Radiation); Nephrology and Urological (Medical, Paediatric, Renal Dialysis, Transplant). For this proposal, Mankweng shall be referred to as a tertiary hospital as it offers T1 tertiary services**.**

‘Weekend effect’: A difference in death rate for inpatients treated for treatment over the weekend against those admitted on weekdays (Bell, 2013). The óweekend effectô in this study will be a difference in inpatient death rate from Friday 16h00 to Monday 08h00 compared to patients admitted between Monday 08h00 and Friday 16h00.

LIST OF ABBREVIATIONS

AIDS: Acquired Immunodeficiency Syndrome

ARVs: Anti-retrovirals

COPD: Chronic obstructive pulmonary disease

CVA: Cerebrovascular accident

DM: Diabetes Mellitus

ICD: International Classification of Diseases

ICU: Intensive Care Unit

HIV: Human Immunodeficiency Virus

MDG: Millennium Development Goals

M and M: Mortality and Morbidity

MRC: Medical Research Council

NCDs: Non-Communicable Diseases

PMHC: Polokwane/Mankweng Hospital Complex

SA: South Africa

SADC: Southern African Development Community

Stats SA: Statistics South Africa

TB: Tuberculosis

WHO: World Health Organization

CHAPTER 1

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 INTRODUCTION

The analysis of inpatient mortality data provides insight into the healthcare system's outcomes and their relationship to the local disease burden. According to Stewart, Choudry, and Buckingham (2016), hospital mortality should be researched for the following reasons: to detect quality failures, to learn from good practice, to fulfil the professional commitment to continual learning, and to satisfy public expectations. Stewart et al. (2016) continue to argue that using a single metric, or even a single technique, to understand hospital mortality is a mistake since it presupposes inpatient fatalities are all the same; they certainly are not. Each group is diverse and necessitates a different strategy. By utilizing both qualitative and quantitative approaches in each group, the study will be able to begin facilitating learning and progress in our understanding of hospital mortality.

1.2 BACKGROUND TO THE STUDY

In South Africa, a substantial study on general hospital and community mortality has been conducted. Myer, Smith, and Mayosi (2012) used regularly gathered data on medical inpatient admissions to analyse temporal trends and transient patterns in in-hospital mortality at Groote Schuur Academic Hospital in Cape Town, South Africa. The study demonstrated the difficulties facing South Africa's general public health system in developing and expanding its services in the face of a complex disease burden. The findings revealed a significant death rate among young people due to the burden of infectious diseases such as HIV/AIDS, with antiretroviral medication as a possible cure. Simultaneously, the burden of non-communicable diseases (NCDs) is increasing. This distinct disease burden has put a strain on a public healthcare system that is trying to expand access to services, and it has hampered the country's capacity to meet its Millennium Development Goals (MDG).

It has been discovered that several factors, such as the impact of HIV/AIDS, death within 48 hours of admission, and the óweekend effectô, might alter the mortality rates of adults in hospitals around the world. The óweekend effectô has been thoroughly studied in the

United Kingdom, although research in underdeveloped nations has been scarce. HIV/AIDS has been identified as the main contributor to mortality in poor nations, according to Gona et al. (2020) and Kochanek et al. (2019).

Thus far, no research on the Internal Medicine adult mortality profile has been conducted at Mankweng Hospital, Limpopo. This study intends to analyse the Internal Medicine inpatient mortality profile from the 1st of June 2019 to the 1st of November 2019 by cause of death and time of death, that is, whether death occurred within 48 hours of admission or not. The association of HIV/AIDS with mortality will also be analysed. The effects of factors such as the óweekend effectô, death within 48 hours of admission, and the impact of HIV/AIDS on deaths, which have been identified globally as affecting inpatient mortality rates, will also be determined for Mankweng Hospital in this study.

1.2.1 Why mortality analysis?

Mortality analysis provides clinicians and health managers with a regular avenue for discussing adverse events, complications, and errors that have resulted in patient morbidity or mortality. Some authors believe in implementing a two-way approach:

- First, analysis of incidents to determine the causes of adverse events and develop improvement plans through quality assurance programmes and related strategies
- Second, discussion of significant cases with staff, particularly residents and registrars, is an educational tool (Whitfield & Blitz, 2000).

In South Africa, mortality review is one of the Ministerial priorities as well as one of the tertiary hospital service delivery indicators. Departments in the hospitals are expected to hold monthly Mortality and Morbidity (M and M) meetings. These meetings form part of the quality assurance cycle where improvement plans are drawn (Whitfield & Blitz, 2000).

While the aim of individual M and M meetings varies, clinical management, continuous professional development, patient safety, and quality improvement were the most commonly mentioned overall goals. According to Orlander et al. (2002), a successful M and M meeting should:

- Recognize conditions that result in negative patient outcomes;
- Encourage consideration of such occurrences;
- Recognize and disseminate information derived from personal experiences;
- Bolster accountability for delivering high-quality care; and
- Create forums where healthcare workers can discuss and comprehend the causes of errors.

The importance of monthly M and M meetings as part of the quality improvement cycle is reinforced by research conducted by Whitfield and Blitz (2000) at the then-Medical University of Southern Africa (Medunsa). This procedure reveals difficulties with individual physicians' behaviour or performance as well as clinical competence.

Incorporating reviews into current M and M meetings, according to Stewart et al. (2016), would ensure alignment with quality improvement and other sources of quality and safety data, as well as policies and processes focused on managing training loopholes, health issues, and contraventions of known safety protocols or behavioral issues. Unless there are clear links between the mortality review process and particular quality improvement initiatives, as well as integration within a larger clinical setting, this is unlikely.

A qualitative (whole hospital measure) retrospective case record examination of all or a sample of deaths, according to Stewart et al. (2016), is the gold standard for examining deaths. The drawback is that it is laborious and potentially subjective. It is prone to hindsight bias, and inter-rater reliability is low in several areas (for example, determining the 'preventability' of mortality).

The variety of factors impacting hospital death rates is:

- Characteristics of the hospital, such as the availability of specialized cardiac services.
- Patients' characteristics: for example, patients are more likely to die if they are older and sicker.

- Local services that are provided, such as hospice care and nursing homes (Stewart et al. 2016), Safety issues are frequently condition-specific, and therefore high mortality is common.

1.3 PROBLEM STATEMENT

According to media reports, over 500 patients died in Mankweng Hospital between October 2012 and February 2013 (Sowetan, February 8th, 2013). Furthermore, in 2013, there were complaints raised in service delivery and management meetings (where the researcher was present) that the mortality rate in Internal Medicine was high as compared to other hospitals of similar size and demographic data..

Mankweng Hospital delivers regional and district services due to the lack of regional and district hospitals around it. The patients are both referred and self-referred. As a T1 tertiary hospital in Limpopo, Mankweng Hospital tends to receive more patients with

- infections like HIV/AIDS, complicated by opportunistic infections;
- NCDs with target organ failure; and
- injuries requiring intensive care.

Due to the mixture of services delivered, the inpatients' mortality profile must be studied. M and M meetings are held, and mortality data is routinely collected by the hospital Health Information System. However, the absence of summary data on a six-monthly or annual basis is a problem. Collected data would give a better overview of the situation and allow for specific patterns to be identified (Stewart et al. 2016). This will also provide timely information for planning and implementing an efficient and successful health service delivery strategy to improve the health care of patients served by this institution (Malangu et al., 2014). Of particular concern are the burden of infections and NCDs, late diagnosis and presentation, with death within 48 hours of admission as a marker, and the óweekend effectô This study will address that gap.

1.4 AIM OF THE STUDY

The study aims to analyse the causes of death in inpatients above 12 years in the internal medicine department of Mankweng Hospital from the 1st of June 2019 to the 1st of November 2019.

1.5 OBJECTIVES

The objectives of the proposal are:

1.5.1 To determine the number of inpatient deaths in Internal Medicine wards over the study period.

1.5.2 To establish the causes of death by age and sex.

1.5.3 To demonstrate the association of HIV/AIDS with deaths by assessing the proportion of HIV-positive patients with CD4 less than 200 cells/mm^3.

1.5.4 To determine the proportion of patients dying within 48 hours of admission.

1.5.5 To establish the admission day and time of death, that is, weekend or weekday.

1.5.6 To determine the association between causes of death and death within 48hours of admission

1.6. RESEARCH QUESTIONS

1.6.1 What are the causes of death for patients admitted to Internal Medicine Mankweng?

1.6.2 What is the association between HIV/AIDS and the inpatients' deaths?

1.6.3 What proportion of patients dies within 48 hours?

1.6.4 What are the effects of weekend admissions on mortality?

1.7 OVERVIEW OF THE RESEARCH METHODS

This study analysed the Internal Medicine inpatient mortality profile at Mankweng Hospital, a tertiary hospital in Limpopo Province, South Africa. The analysis focused on the causes of death, death within 48 hours of admission, the óweekend effectô, as well as the impact of HIV/AIDS on mortality. Data was collected from Internal Medicine wardsô admission records, Mortality and Morbidity (M and M) records. All patients (census

sampling) who met the inclusion criteria were included in the study. This was a five-month (1st June 2019 to 1st November 2019) retrospective descriptive study involving a total of 228 deceased files. A questionnaire was designed and used to collect data from 228 deceased files. The data was entered using Excel and analysed using descriptive data analysis.

1.8 SIGNIFICANCE OF THE STUDY

This study is meant to analyse the mortality profile of the inpatients in Internal Medicine to assist the following communities:

a. Patients: Reduction of the number of deaths, improved quality of life, and thereby improved life expectancy through initiating quality improvement programmes based on the insights derived from this study.

b. Staffing: Identify gaps in their continuous professional development and come up with strategies to improve training at all levels.

c. Limpopo Provincial Department of Health:

- Improve and achieve Millennium Development Goalsô target number 3
- Proper planning for resources and services

1.9 BRIEF CHAPTER OVERVIEWS

In line with the objectives of the research study, the chapter layout is as follows:

- **Chapter 2** provides the literature review that underlines published data on the causes of death, death within 48 hours of admission, the óweekend effect', as well as the impact of HIV/AIDS on mortality.
- **Chapter 3** gives the research methodology used for the study.
- **Chapter 4** reports the research findings.
- **Chapter 5** consists of an analysis of the research results, a discussion of the studyôs strengths and weaknesses, and a conclusion with suggestions for further studies.

CHAPTER 2

LITERATURE REVIEW

Chapter 2 provides the literature reviewed for the research study. A concentrated literature search was carried out in electronic databases such as PubMed, Science Direct, and Google Scholar. ôInpatient mortalityô, óweekend effectô, ómortality within 48 hours of admissionô, óearly mortalityô, ómortality profileô, ôHIV/AIDS and mortalityô, and ôHIV/AIDS and CD4 countô were some of the key phrases utilized. Studies on the óweekend effectô, death within 48 hours after admission, HIV/AIDS' impact on mortality, and adult inpatient mortality were requested, as these factors all contribute considerably to mortality in South Africa (Bradshaw & Laubscher, 2003). Outpatient studies were excluded from consideration for this study.

The phrases ôHIV/AIDS and mortalityô, ómortality within 48 hours of admissionô, and óweekend effectô were used as they form part of the study objectives. Understanding these factors leading to changing mortality rates is crucial for budgeting and policy making in health.

2.1 INTRODUCTION

According to Malangu et al., 2014, death affects all age groups worldwide. However, deaths occurring in adults are of significant importance because of the societal role that adults play in the well-being of both children and the elderly.

The purpose of conducting a mortality profile in internal medicine is to analyse and understand the factors associated with the deaths in order to improve patient care and outcomes. This analysis entails studying the prevalence of mortality, identifying the clinical factors associated with death, and evaluating the impact of various variables on patient mortality. Authors such as Lenti, Croce, Brera, Ballesio, Padovini, Bertolino, Di Sabatino, Klersy, & Corazza (2023) and Niv, Berkov, Kanter, Abrahmson, & Gabbay (2017) suggest that by examining the age, sex, comorbidities, causes of early mortality, and other characteristics of patients who died, health professionals can gain insights into the specific needs and challenges faced by these patients. This information can help inform clinical decision-making, resource allocation, and the development of targeted

interventions to reduce mortality rates. Additionally, studying mortality profiles can provide valuable information on the effectiveness of current treatment strategies, allow various stakeholders to identify societal and systemic challenges to direct resources, and identify areas for quality improvement in the delivery of care.

In South Africa, an increase in adult mortality rates from 6.8 per 1,000 adults in the 1990s to 9.9 per 1,000 adults by 2007 was reported following a community-based study in the rural areas (Kanjala, 2010). The explanation for such an increase is multi-factorial and includes the growing burden of chronic and lifestyle-related diseases and HIV/AIDS in adults (Malangu *et al.*, 2014).

Mortality analyses have been conducted in various settings and contexts, ranging from single facility levels to multinational and global settings, and over time periods that can range from a few months to several decades. Gona et al. (2020) researched mortality trends in 16 Southern African countries that are members of the Southern African Development Community (SADC) and analysed mortality trends over a 17-year period (1990ï 2007) with a key focus on the impact of the HIV/AIDS global pandemic on the mortality trends in this region. Their main findings were that mortality in some Sub-Saharan countries had massive increases (as high as 114 times) over the 17 years of study, mainly due to HIV/AIDS and challenges in providing anti-retrovirals in those resource-constrained countries. Kochanek et al. (2019) looked at national mortality data for the entire United States of America (USA) for the year 2017 by analysing death certificate data.

Mortality has also been analysed at a more localised level: for instance Myer and colleagues looked at mortality trends in adult patients admitted to medical wards in a single hospital (Groote Schuur Hospital in Cape Town, South Africa) between 2002 and 2009. They found that inpatient mortality among this group of patients increased substantially over the decade under study, with the median age of dying patients reducing. Their findings were attributed to the HIV/AIDS pandemic, but they also suggested deterioration in the standard of healthcare.

Malangu *et al.* (2014) reviewed the Polokwane Mankweng Provincial Hospital Complex in Limpopo South Africa, for a period 1 January 2008 to 31 December 2010 and there were

5232 deaths. This was a whole hospital analysis with a focus on the top ten causes of death.

All studies focused on the top ten causes of death, both natural and unnatural, in all departments. Despite all these, no analysis of mortality profiles was ever done in Internal medicine department of Mankweng Hospital; however, a study like this was conducted in Groote Schuur in the Western Cape Province, South Africa (Myer *et al.*, 2012).

Taken together, these studies indicate that mortality analysis can be conducted at the level of a single department within one hospital, or can be conducted in multiple countries over time periods greater than a decade. These studies can reflect single-centre factors (such as poor emergency care in one facility) or national trends (such as high trauma rates in one country) or multinational patterns (such as the global HIV/AIDS pandemic) These factors will be discussed in the next section, starting with the mortality profile trends and causes of death**.**

2.1.1. Mortality profile trends

According to World Health Organization (WHO) forecasts, infectious diseases would be the largest cause of mortality in less resourced nations by 2020, whereas non-communicable diseases (NCDs), such as heart and cerebrovascular illnesses, would be the main cause of death in middle- and high-income nations (WHO, 2011).

Kanjala et al. (2010) conducted a community-based study that found an increase in adult mortality rates in rural areas of South Africa. The strengths of this community-based mortality study were that meaningful and effective community interventions were designed. The small size (792 deaths) and limited geographic scope of the Dikgale site limit the generalizability of the Kanjala study.

The reasons for this rise in mortality rates are complex and include the rising burden of NCDs as well as HIV/AIDS in adults (Malangu et al. 2014). The study shows HIV was a factor in increased mortality even five years after the rollout of antiretroviral (ARV) in the public sector.

However, Statistics South Africa (2019) reported a reversal of this trend with a decline in the HIV/AIDS adult mortality rate from 2009 to 2019. The reason given for the decline was that South Africa rolled out what later became the largest ARV programme in the world, which had the benefit of reducing HIV/AIDS associated mortality beginning in 2004.

Research outside of South Africa has also found a link between HIV/AIDS and increasing mortality. Gona et al. (2020) examined HIV/AIDS-related mortality, productivity losses, years spent with disability, and disability-adjusted life years in South Africa, Lesotho, eSwatini, and Mozambique in the Southern African Development Community (SADC) region. They found that Botswana still had a significant burden of HIV/AIDS despite the availability of ARVs in those countries. These studies highlight the important contribution of HIV to mortality in Southern Africa and the delayed improvement in mortality in the first years following the rollout of anti-retroviral.

Mortality trends have also been analysed in hospitals in South Africa. Hospital deaths in Cape Town were studied by Myer et al. (2012). The study looked at first-time admissions to Groote Schuur Hospital for adult medical inpatients. Annual increases in mortality rates were largest during the first 48 hours of admission, according to the findings, and were linked to rising age, subsidised patients, the black population group, and males. The emergency room had the most fatalities, according to reports. This is consistent with the idea that pre-hospital morbidity is a major contributor to the rise in in-hospital mortality.

Adebusoye and Kalula (2019) focused on the Internal Medicine department, analysing mortality in elderly patients admitted to Groote Schuur Hospitalôs medical wards between 2010 and 2013. This population group's death rate was found to be high, with a male preponderance. Abnormal laboratory results and a brief hospital stay were also linked to an elevated mortality rate in older patients, indicating a high death rate in the first 24 hours.

Myer et al. (2012) reported similar findings among the elderly. The high mortality rate is most likely due to late diagnosis and presentation, as well as insufficient service at district and regional hospitals. The primary causes of death were sepsis, renal failure, and malignancies with metastases. The rearrangement of medical teams (known as firms) was found to reduce mortality by enhancing the effectiveness of medical care.

The top ten causes of mortality, both natural and unnatural, were the focus of all studies, and patient and hospital variables varied across all departments. Collectively, these research findings suggest that adult inpatient mortality is influenced by a number of variables, including the óweekend effectô, death within 48 hours of admission, and the impact of HIV/AIDS, both globally and in the Western Cape, South Africa (Gona et al. 2020; Kochanek et al. 2019).

2.2. CAUSES OF DEATH

The South African Medical Research Council (SAMRC), previously called the Medical Research Council of South Africa, is a government institution that undertakes health research in SA. The SAMRC has spent 53 years compiling mortality statistics and conducting research in SA, which gives an indication of the trends over many years.

According to the Medical Research Council of South Africa (SAMRC), there are three basic categories of causes of death:

- *Communicable diseases (CD)* such as tuberculosis, maternal (obstetric) diseases, perinatal disorders, and dietary deficits are all examples of Type 1 causes. These type 1 causes are also known as pre-transitional causes. HIV/AIDS is typically classified as a Group 1 cause.
- *Non-communicable diseases (NCDs)* such as malignant neoplasms, diseases of the heart, respiratory illnesses, digestive and urological problems, as well as mental and neurological conditions, are all examples of Type 2 causes.
- Intentional and unintentional injuries are classified as Type 3 causes.

According to a study conducted by the South African Medical Research Council (SAMRC 2014) in 2011, the top 10 leading causes of death in the Western Cape were HIV/AIDS, tuberculosis, ischemic heart disease, interpersonal violence, cerebrovascular accidents, lower respiratory infections, chronic obstructive pulmonary disease (COPD), diabetes mellitus (DM), and cancer of the lung. The top 5 causes were: TB, influenza and pneumonia, HIV, cerebrovascular diseases, and diabetes mellitus. This further lends credence to the concept of a complex disease burden in SA, showing a combination of NCDs, CDs, and trauma as leading causes of death.

This complex disease burden has been further elaborated by Myer et al. (2012), who determined SA suffers from a "quadruple burden of diseaseò i.e., NCDs, infectious disease, trauma, and high maternal deaths. These two findings suggest that SAôs complex disease burden may be unique compared to either developed or developing countries.

In comparison, Kochanek (2018) showed that in a high-income country such as the USA, four of the top 5 leading causes of death were non-communicable diseases (such as heart disease and cancer). Studies in low-income countries show communicable diseases predominating although there has been a consistent increase in NCD-attributable deaths in these countries (Kershaw et al 2019).

2.3 COMMUNICABLE DISEASES (CDS)

The communicable diseases commonly seen in internal medicine include respiratory infections such as pneumonia and influenza, gastrointestinal infections such as gastroenteritis and sexually transmitted infections such as HIV/AIDS. These diseases are caused by pathogens such as bacteria, viruses, and parasites and can be transmitted from person to person (WHO 2014).

Kershaw et al. (2019) further indicated that the mortality rates associated with communicable diseases can vary depending on various factors such as specific disease, the population affected and the availability of healthcare resources. Mortality rates can also be influenced by factors such as age and underlying conditions.

Different authors such as Bradshaw & Laubscher, 2003 and Kochanek et al. 2019 observed that the main communicable causes of death (infectious and parasitic) vary depending on the country (developing or developed) but lower respiratory infections have been consistently responsible for the most deaths in this category. Infectious diseases such as HIV/AIDS and tuberculosis were purported to be the leading causes of death in this group. These infectious diseases can have significant mortality rates if left untreated or if complications arise. Mortality rates associated with sexually transmitted diseases can vary depending on factors such as access to healthcare and treatment options.

A provincial mortality analysis by Maphanga (2009) found that more females (52%) than males died in Limpopo province, one of the more rural provinces in South Africa with the

highest mortality being among patients in the 30- to 44-year-old age group. Deaths in both genders were primarily caused by infectious and parasitic disorders such as pulmonary TB and infectious gastroenteritis. Combinations of infectious and parasitic diseases, non-communicable diseases (NCDs), and ill-defined reasons were among the top ten causes of mortality. This finding points to a disease burden that includes both CD and infectious illnesses.

The HIV/AIDS pandemic has been and continues to be a major driver of mortality, especially in Sub-Saharan Africa (Kanjala, Michael, Todd, Slaymaker, Calvert, Isingo, Wringe, Zaba, and Urassa 2014). According to Boulle et al. (2014), AIDS has killed millions of people globally since 1981, with a high number of individuals currently living with HIV in Sub-Saharan Africa. South Africa has one of the world's highest rates of HIV/AIDS infection, with 19% of the adult population affected. It follows then that a high contribution of deaths from HIV/AIDS can be expected when analysing mortality in South Africa.

Gona et al. (2020) reported that Botswana, South Africa, Lesotho, eSwatini, and Mozambique were the five leading countries in the percentage of deaths attributed to HIV/AIDS in 2017. While the South African Development Community (SADC) has made significant improvements in access to ARVs, it still has high HIV/AIDS fatality rates.

2.3.1 Health System Factors and mortality due to communicable diseases

The outcome of infectious disease is dependent on multiple factors, such as patient/ host factors (e.g. age, other comorbidities) and the influence of the health system. The health system is able to alter the course of an infectious disease, for example through preventative strategies (e.g. vaccination), early diagnosis and availability of therapies.

Some researchers have looked at the contribution of health system factors to mortality. Wajanga (2014) investigated the causes of inpatient mortality in Senegal, Malawi, and Tanzania and found the following health system failures which contribute to higher mortality:

- Late presentation to the hospital.
- Fewer patients are being tested for HIV in hospitals.

- Low laboratory capacity, which restricts CD4 T-cell testing and leads to delays in the diagnosis and treatment of opportunistic infections.
- Deferred in-hospital ARV initiation, and
- Loss of follow-up after hospitalization.

This led to the devising of advanced strategies to reduce inpatient mortality.

Abuto et al. (2021) found similar challenges in Ethiopia in their investigation, even with the implementation of a "test-and-treat" strategy. The importance of the link between late diagnosis and the existence of opportunistic infections in terms of increased mortality risk was emphasized.

While developing countries in Africa had high death rates secondary to infectious complications of HIV/AIDS, studies in developed countries (Europe, the USA, and Australia) indicated an increase in deaths due to non-infectious causes in HIV-positive patients (Smith et al. 2014).

From the research quoted above, it is clear that mortality trends are dependent on patient factors (such as HIV infection), as well as health system factors (such as access to facilities, availability of diagnostic resources, and policies regarding access to treatments such as antiretroviral).

2.3.2 HIV/AIDS and mortality

Aside from affecting public health, the HIV/AIDS epidemic is one of the most damaging global pandemics ever. The economically productive population (that is, young and middle-aged adults) is the group most affected, and it primarily weakens the social and economic institutions in the developing nations. Significant healthcare and economic issues are brought on by HIV/AIDS, particularly in sub-Saharan Africa (Lamprecht, Martinson, & Variava 2023).

HIV weakens the immune system by infecting white blood cells, which are important for the body's ability to fight off diseases. HIV-positive individuals run the risk of contracting opportunistic infections or malignancies that could be fatal if untreated (WHO, 2021).

Acquired immunodeficiency syndrome (AIDS) is the most severe and final stage of HIV, with a list of more than twenty one opportunistic infections (UNAIDS 2019). HIV-positive patients die within less than two years of acquiring the virus if not treated with antiretroviral drugs.

The number of deaths attributable to HIV and AIDS-related illnesses significantly decreased after the introduction of ARVs and their subsequent widespread availability, according to several authors, including Kanjala, Michael, Todd, Slaymaker, Calvert, Isingo, Wringe, Zaba, and Urassa (2014); Ford, Boulle, & Egger (2016); Harris, Rabkin, & El-Sadr (2018); and Statistics South Africa (2022). Additionally, communicable disease mortality decreased, and the overall crude death rate decreased. In spite of this, 8.45 million South Africans, or 13.9% of the population, were HIV-positive in 2022 (Stats SA 2022). However, HIV-positive patients continue to have higher mortality rates than HIV-negative patients despite the availability of ARVs.

It is important to clarify the persistent elevation in mortality even after the introduction of public-sector ART programs. The studies quoted above may also have been conducted in the first 20 years of introducing ART to Southern African countries, and it is possible that these trends may change as the programs mature and become more established and health care workers improve the outcomes by addressing the short-comings.

Therefore, understanding changing mortality rates is crucial for budgeting and policymaking. There are not enough local data to compare the outcomes and disease load between HIV-positive and HIV-seronegative inpatients, though. Important mortality information is added by this study, including causes of death by HIV status. While antiretroviral therapy reduces mortality, communicable disease management still has to be improved by maintaining high CD4 counts.

2.3.2.1 CD4 count and mortality

Mortality in HIV positive patients is closely linked to the CD4 count. Lawn et al. (2008) have noted that mortality is substantially correlated with a baseline CD4 count less than 50cells/mm^3 and WHO stage 4 disease (AIDS) in their observational studies from a variety

of countries in sub-Saharan Africa. The most common causes of mortality were sepsis, cryptococcal meningitis, malignancy, and tuberculosis.

Even with the availability of and free access to antiretroviral medications in Senegal, late diagnosis was connected to high mortality in HIV-positive individuals (Gona et al. 2020). As a result, population education is advocated to promote early detection and treatment.

Boulle et al. (2014) analysed mortality in HIV patients initiating ARVs in South Africa, Europe, and North America. At the time of this study, South African patients started therapy with more advanced illnesses, as seen by lower average CD4 counts as compared to patients on ARVs in other countries.

A key reason for South African patients starting antiretroviral therapy late (i.e., with lower CD4 counts) was the guidelines that initially limited ARVs to HIV patients with CD4 counts below 200 cells/mm^3 by the South African government. There has been a progressive increase in the CD4 threshold for initiation of ART, consequently allowing patients to start ARVs at less advanced stages of disease.

As of 2010, eligibility was extended to CD4 values below 350cells/mm^3. The government further implemented universal screening and care in 2016 (UNAIDS, 2019), thus allowing ART to be started at any CD4 count. In 2022, 4.7 million people living with HIV were on ARVs (Stats SA, 2022). The results of this expansion of eligibility for ART are that South African mortality in HIV patients now approaches that of similarly infected patients in high-income nations after four years on ARVs.

In contrast, Kim et al. (2020) showed that being diagnosed with HIV with a lower CD4 count was not associated with high mortality in South Korean patients. Kim et al.ôs study is based in a well-developed country with excellent health resources and a low HIV prevalence. This may account for the positive outcomes compared to the situation in countries with high HIV prevalence and weaker health systems. In contrast, May et al. (2016) discovered that baseline CD4 count was predictive of mortality in the first year of ARV treatment but that the effects fade after 5 years of ARV treatment, when people living with HIV develop non-communicable diseases.

2.4 NON-COMMUNICABLE DISEASES (NCDS)

At a global level, seven of 10 leading causes of death were non-communicable diseases (NCDs) (WHO 2018B; 2018C). The main types of NCDs are cardiovascular diseases (such as heart attacks and strokes), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asthma), and diabetes. NCDs disproportionately affect people in poor countries, where more global NCD deaths (31.4 million) occur.

Mortality among young and middle-aged persons between the ages of 15 and 59 is becoming increasingly preventable by changes in risk activities such as tobacco use, alcohol use, substance abuse, lack of exercise or physical activity, bad nutrition, or medical interventions (for example, early detection and treatment of cervical cancer, cardiovascular disease, and diabetes). An estimated 80% of NCDs are preventable.

A review by Kochanek et al. (2019) in the United States found that cardiac illnesses, malignant neoplasms, accidents, chronic respiratory disorders, and cerebrovascular diseases were the major causes of mortality, with younger patients suffering from NCDs. According to the study, death rates for the age groups 25 to 34 and 35 to 44 climbed dramatically from 2016 to 2017. This was due to the fact that age-adjusted death rates were used, which are not actual measures of mortality risk. These were used to compare Hispanics versus non-Hispanics.

Studies such as Li, Zeng, and Liu, et al., (2017); Nojilana, Bradshaw, and Pillay-van-Wyk, (2016) are in agreement that the main four NCDs leading to premature death are cardiovascular diseases, cancers, DM, and chronic respiratory diseases and account for more than 70% of deaths. Most low- and middle-income countries (China and the South) are attempting to meet the United Nations (UN) Sustainable Development Goals (SDGs) by 2030 by allocating more resources to the ever-growing NCD epidemic.

2.5 COMMUNICABLE AND NON-COMMUNICABLE DISEASES - THE QUADRUPLE BURDEN

Communicable illnesses have been the leading cause of death worldwide for ages. Non-communicable diseases (NCDs) became a prominent problem in industrialized countries after World War II. NCDs now appear to be increasing throughout the world, with a growing prevalence in poorer nations (Naidoo, 2019).

The simultaneous appearance of various disease spectrums typically causes a 'double burden' in developing countries (CD and infectious diseases). The health shift in South Africa in the early 1990s was marked by a significant injury load on top of the double burden, leading to a 'triple burden' of CD, infectious illnesses, and trauma (Bradshaw *et al.,* 2002).

South Africans' poor health is recognized to be linked to a 'quadruple illness burden.' Bradshaw et al. (2002) and Kabudula, Tollman, Mee, Ngobeni, Silaule, Gómez-Olivé, Collinson, Kahn, and Byass (2014) found that the impact of HIV/AIDS has resulted in a quadrupling of the illness burden in South Africa in recent years. This means that NCDs, trauma and injury, HIV/AIDS/infectious diseases, and infant and maternal deaths all play a significant role in mortality rates. Furthermore, it demonstrates that all provinces are affected by the quadruple burden of disease to varying degrees, with HIV/AIDS and tuberculosis (TB) being more relevant in this study.

2.6 EARLY MORTALITY (DEATH WITHIN 48 HOURS OF ADMISSION)

The timing of death in inpatients has been a subject of research. Other authors, Garcia-Vidal, Fernandez-Sabe, Carratala, Diaz, Verdaguer *et al.* (2008), and Kershaw *et al.* (2019), refer to death within 48 hours of admission as "early mortality". Early mortality in medical wards is caused by a variety of factors, including healthcare provider-related factors, system-related factors, and resource-related ones. In their analysis of a hospital in Botswana with low resources, Kershaw et al. (2019) found that although acute illnesses like septic shock and pneumonia are related to early inpatient mortality, system and healthcare worker factors may be the main causes of poor health outcomes.

Different authors explored early mortality in highly resourced and low resourced countries; however, due to methodological discrepancies, patient age, and enrolment restrictions, it was difficult to compare the findings. They ranged from a low death rate to a high death rate. The early mortality findings were summarised as follows:

- The Spanish study done by Garcia-Vidal et al. (2008) concentrated on factors leading to death within 48 hours of admission. The mortality rate was low due to their study population, where severely immunosuppressed patients were excluded and the hospital was well-resourced**.**
- A high mortality rate within 24 hours of admission was excluded in Niv, Berkov, Kanter, Abrahmson, and Gabbay's (2017) study as the deaths were expected due to old age, and therefore they concluded that in-hospital mortality is inadequate as a measure of quality.
- Patients with an estimated prognosis of less than 24 hours were omitted from the Lenti, Croce, Brera, Ballesio, Padovini, Bertolino, Di Sabatino, Klersy, and Corazza (2023) study, lowering the total in-hospital early mortality rate.
- When no prognostic limitation was imposed, nearly one-third of the deaths in the Sanclemente et al. (2004) study happened within 48 hours of admission.

Similarly, the fact that a patient in need of medical care has been admitted to a separate specialist ward may imply that the quality of patient care has been impaired, increasing the risk of death within 48 hours of admission (Sousa, Marques, Burmester, Apolinari, & Brandao, 2017). The findings indicate that early mortality is not a universal trend across the world, and there may be population and health system factors unique to each context which would account for the presence or absence of this pattern.

The death rate in the first 24 hours among senior patients (age more than 75) was estimated to be more than thirty percent in a study by Adebusoye and Kalula (2019) concentrating on trends in elderly ICU inpatients in Cape Town. This was one of the highest death rates in low-income countries' intensive care units. Furthermore, when compared to other sources of admission, the internal medicine department was linked to a high rate of mortality. Increased age is linked to high mortality from NCDs as well as early mortality, according to the findings of this study. To reduce the influence of death risk

factors in our environment, efforts in the overall control of NCDs, as well as adequate ICU equipment, technical skills, and improved care of the above-mentioned diseases, are required.

Barba et al. (2006) found that the risk of death within the first 48 hours is higher for patients admitted on weekends than for those admitted on weekdays in a similar study conducted in Spain. It has been speculated that this is due to fewer staff on duty, especially the more senior and more experienced doctors and nurses. These findings were reiterated by Jen et al. (2009) in an English study where the changeover of junior hospital staff was linked to a higher death rate for medical patients.

The above evidence supports the conclusion that the most significant predictors of death within 48 hours are advanced age, masculine sex, admissionôs diagnosis, and the óweekend effectô.

2.7 'WEEKEND EFFECT'

The concept of the 'weekend effect,' or inferior results for patients admitted to hospitals on weekends, is not new and has been a hot topic in England, as reported by Honeyford *et al.* (2018). They further reported that patients admitted or receiving surgery on the weekend had a higher risk of dying than those admitted during the week, based on a systematic review and meta-analysis of published data on the weekend effect in the United Kingdom (UK).

The explanations for these are multi-factorial, such as staffing levels (medical specialist physicians who are on call and not physically present in the hospital on weekends, nursing and other Health Care Workers). Other organisational factors like the unavailability of diagnostics over weekends; patient factors, such as sicker patients admitted over the weekend (Sun *et al.,* 2019); the longer median length of stay (Bressman *et al*., 2020); as well as societal factors like financial and working patterns of relatives in elderly patients. The same problems with staffing exist in Limpopo.

In corroboration of this, other studies done at Groote Schuur Academic Hospital, South Africa, and in Spain by Myer *et al*. (2012), Barba *et al*. (2006), and Marco *et al.* (2010) concluded that more patients die during weekends and after hours due to skeleton staffing.

In further research, the link between the óweekend effectô and mortality has been reported differently when comparing developed and developing countries.

- In Malawi, there was no difference in mortality between night and day admissions or weekend or holiday versus weekday admissions (Prin *et al.,* 2020).
- No specific circumstances or hospital attributes could be identified to explain the weekend effect phenomenon in the United States (Sharp *et al.,* 2013).
- Han et al. (2018), reviewing mortality data in England, suggested that it is not only the weekend effect that is an elevated risk for death for patients admitted as emergencies, but night-time admissions have an additive effect.

It is unclear how the weekend staffing differs or is similar in these very different contexts as an explanation for the different results seen.

2.8 CONCLUSION

This chapter highlights the literature presented by other authors. The next chapter will delve into the methods applied to fulfil the studyôs objectives and answer the research questions.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

Chapter 3 provides the research methods applied in this research study. The chapter delineates the research design, reasons for using quantitative method, study population, sampling, data collection tool, data analysis, reliability, validity, objectivity and bias. The chapter is then concluded with ethical considerations. This study aimed to analyse the Internal Medicine inpatient mortality profile in Mankweng hospital, a tertiary hospital in Limpopo Province, South Africa. The analysis focused on the causes of death, death with 48 hours of admission, the óweekend effectô, as well as the impact of HIV/AIDS on mortality.

3.2 RESEARCH DESIGN

A five-month (1st June 2019 to the 1st November 2019) retrospective descriptive study with an analysis of the inpatientsô mortality profile in Mankweng Hospital with emphasis on all deaths that occurred in the Internal medicine wards. The advantage of this design is that multiple diseases and outcomes can be studied at the same time and the disadvantage is that large samples are required (Sheppard, 2004). According to Stewart et al. (2016), a quantitative approach to the case-note reviews of all, or a subset of, deaths using standardized Retrospective Case Record Review (RCRR) methodology will give a good insight into problems of emergency and the general wards.

3.2.1 Study population

The study population was drawn from all deaths that occurred to inpatients in the Internal Medicine wards in Mankweng Hospital, Limpopo Province, South Africa from the 1st of June to the 1st of November 2019. These patients either were referred from the feeder Primary Health Care Centres, Community Health Centres, General Practitioners, and Regional Hospitals; or were self-referred.

3.2.1.1 Mankweng Hospital

Mankweng Hospital is one of the two tertiary hospitals in Limpopo Province. It is part of the Polokwane/Mankweng Hospital Complex (PMHC) and it is situated 30km east of Polokwane in the Capricorn District (Figure 1). The mission of the PMHC is to provide tertiary services to level 1 (District) and level 2 (Regional) hospitals in the Limpopo Province (Limpopo Health, 2018).

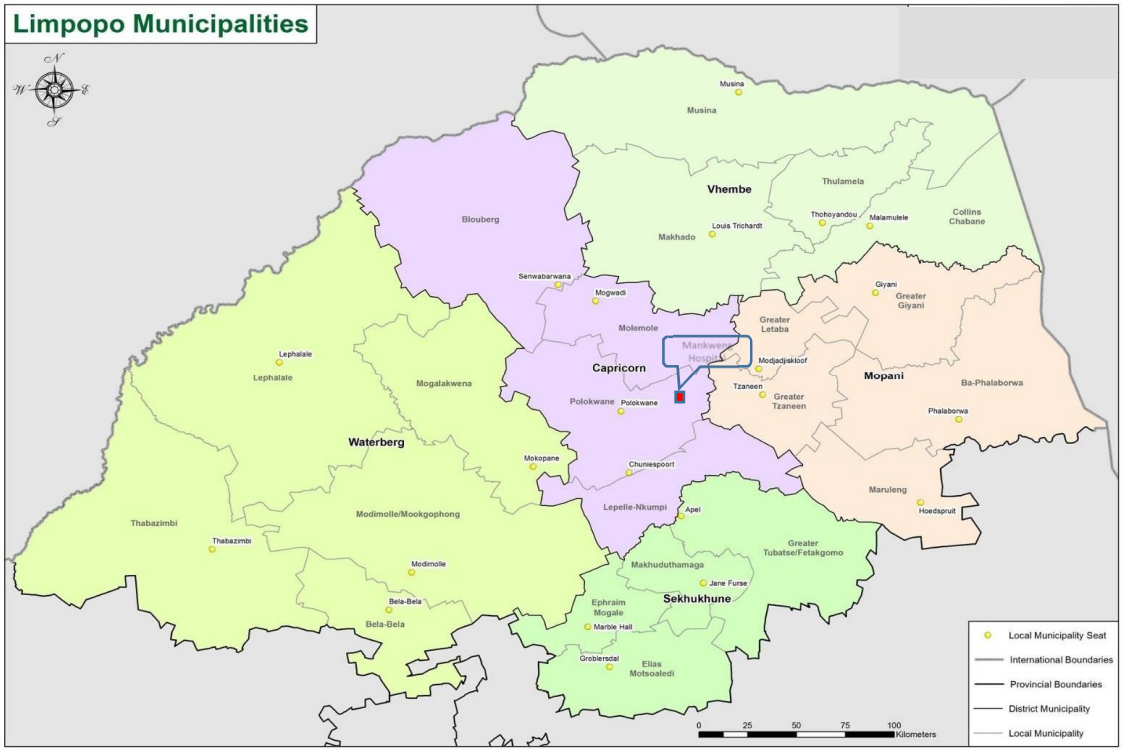


Figure 1: Location of Mankweng Hospital (Adapted from the Department of Agriculture and Forestry).

However, because there are no other hospitals in the area, Mankweng Hospital provides district, secondary, and tertiary care. General Surgery, Orthopaedics, Ophthalmology, Psychiatry, Paediatrics, Paediatric Surgery, Neonatology, Plastic Surgery and Reconstruction, Maxillofacial Surgery, Emergency Services, Obstetrics and Gynaecology, Family Medicine, and Internal Medicine are among the departments at the 509 usable bedded-hospitals (Mankweng Strategic Plan, 2018).

3.2.1.2 Internal Medicine Department

The Internal Medicine Department has two wards; male medical and female medical wards. The total bed capacity is 58. The 1 x two and 1 x three bedded side cubicles are used as isolation cubicles. The bulk of patients are admitted to these wards from casualty department and a few from out-patients department. There is no acute medical admission ward and medical high care/ Intensive Care Unit (ICU). Patients requiring intensive care services are admitted in the main or cardiothoracic ICU depending on bed availability.

The staff complement of the department during the study period was as follows:

- Medical officer Grade 3 x 2
- Registrars x 2
- Medical officers x 6
- Medical interns x 8
- Nursing personnel x 50
- Cleaners x 6

The two medical officers grade 3 are in charge of the two wards. After hours a team of one medical officer grade 3, one medical officer/ registrar and an intern covers the whole hospital. A full complement of laboratory and microbiological resources as well as imaging modalities like plain x-rays, CT scans and MRI is available with the option of outsourcing during mechanical breakdowns.

3.2.2 Sampling

The study was conducted at Mankweng Hospital and the sample was collected from Internal medicine wards patientsô admission records and M and M records. The total number of deaths over the study period was 228. All the deceased files (census sampling) were used and therefore no sampling was done. Since all the deceased files were used in this study it can be safely said that utmost, accuracy is achieved and no part is left to chance.

3.2.2.1 Inclusion criteria

All inpatients that died from the 1st of June 2019 to the 1st of November 2019 who were:

- over 12 years of age as this is a cut-off age for adult patients in Mankweng Hospital
- Admitted into medical wards under the Internal Medicine department
- With a medical diagnosis (both natural and unnatural)
- Entered in the ward admission register or recorded on a mortality record

3.2.2.2 Exclusion criteria

- Patients younger than 12 years,
- Patients with medical diagnoses admitted to other wards and
- Admitted to medical wards by other disciplines for example Psychiatry was excluded.

3.2.3 Data collection

The sources of data collection were the patientsô records and M and M records. The data were collected from the records in a form of a questionnaire which was designed by the researcher. It included the following variables: sex, age, date of admission, date and time of death, HIV status, CD4 count, whether on ARVs or not, and cause of death. The length of admission before death in days was calculated from the date and time of admission and the date and time of death. For the cause of death from the patientsô records, the discharge diagnosis was used.

3.2.3.1 Data collection tool

a. Questionnaire design

The questionnaire was in English only as it was used by the researcher and her assistants who have a good command of the language. Sheppard (2004) states that the main function of a questionnaire is measurement and it aims to give a standard framework (one that is

identical for all respondents) on which facts, opinions, and attitudes are recorded. There were binary questions, multiple choice questions, and categories.

3.2.4 Data analysis

Descriptive statistics were analysed utilising Excel spreadsheets. Descriptive statistics for patientsô demographics were presented as numbers, percentages and charts. The results were expressed as range and mean (± standard deviation). Graphs, tables and figures were used for data presentation. The significant level was set at $p<0.05$ (Hall, 2004). The assistance of a bio-statistician was sought.

Analysis of Variance (ANOVA) was used for independent variables with more than two categories (Healy, 2002), for example, age, sex, HIV status, time of admission, time of death, etc. This assisted in answering the question of the impact of mortality; however, it has a drawback in that it requires interval-ratio measurement of the independent variable and nearly equal numbers of cases in each group.

The analysis focused on the following factors: deaths within 48 hours of admission, the weekend effect, and the impact of HIV/AIDS on the deaths. The causes of death were condensed into two broad categories as per the Global Burden of Disease cause list, namely: Group I: communicable diseases and Group II: non-communicable diseases and unnatural deaths (Stats SA, 2014).

3.3 RELIABILITY, VALIDITY, AND OBJECTIVITY

Data validity was achieved through triangulation, where various data sources from the hospital patientsô files, Internal medicine M and M reports, as well as hospital information department records, were used. Furthermore, the triangulation of the method included questionnaires and interviews. A concerted effort was made to collect the missing data by analysing and comparing the hospital data with the M and M reports done by the Internal medicine department. The data collection tool was reviewed by the biostatistician and experts in the field.

Validity was attained for the causes of death that are age- and sex-specific, and corrections were made. This measured the accuracy of what the researcher was looking for. The

assistance of two nursing researchers was sort in examining the accuracy of the data to improve descriptive data validity (Struwig & Stead, 2001).

Reliability means consistency. It involves the reliability of the instrument and the conditions under which it is used (Sheppard, 2004).

3.4 BIAS

Measurement bias arises when data collected for use as a study variable is erroneous; this was prevented by employing the assistance of experts in the field and the biostatistician in designing the questionnaire as well as training the assistants.

Since the study was a retrospective study, selection bias is most likely to happen because the outcome happened before patients were selected for the study. A review of all the patient deaths in the Internal Medicine department reduced bias as all deaths in the study period were included.

Information bias included how missing data was handled. There was information bias in this research study. There was some missing data due to poor recording, wrong patient file numbers, and missing records. A concerted effort was made to search for missing information using patientsô names, hospital numbers, and dates of admission, retrieving their hospital records where possible.

3.5 ETHICAL CONSIDERATIONS

ǐ The ethical clearance processes

The process of ethical clearance started with a formal application to the School Senior Degrees Committee (SSDC), followed by approval by the Faculty Higher Degree Committee (FHDC). These two committees provided oversight of the protocol's quality and approved it for submission to the following committees:

- Turfloop Research Ethics Committee (TREC) (reference number: REC-0310111-031).

- Limpopo Department of Health (load protocol onto the National NHRD database) (reference number: LP 202209 028)

The study commenced after ethical clearance was obtained from all the committees and approval from the office of the CEO Mankweng Hospital. The use of the work of others was acknowledged through proper referencing.

ǐ **Protecting the rights of individuals and the hospital**

Deceased patientsôand the hospital's rights were protected as follows:

- The names and folder numbers of the deceased patients were extracted from the ward books, and a list of patients with their hospital numbers was created.
- All cases were assigned a unique number.
- The list of patient names and file numbers was linked to the data collection sheet by the unique number and kept securely stored separately from the data collection sheets.
- Files were requested from the records section, and data was collected as per the
- The files were kept by the research team for one month and then returned to the records section.
- A master list of patients and hospital numbers was then safely stored in a locked drawer
- Paper records (questionnaires) were kept under lock and key at all times. Only accessible to researcher and supervisor who will ensure that records do not leave the hospital
- Electronic records are secured with a password and backup on the researcherôs Google Drive account, which is password protected.
- A consent waiver was requested from the Ethics Committee (TREC) because of:
    - Minimal risk of harm
    - Difficulty in tracing patients' families and
    - The risk of emotional trauma if families are contacted about the previous death.

3.6 CONCLUSION

This chapter dealt with the research methods used in this study that assisted in answering the research questions. Data collection methods were clarified. It discussed reliability, bias, validity, and ethical considerations. The following chapter will present and analyse the statistical inpatient mortality data.

CHAPTER 4

PRESENTATION AND INTERPRETATION OF FINDINGS

4.1 INTRODUCTION

Chapter four presents the findings acquired from the methods used in this research. The study aimed to analyse the causes of death among inpatients in the internal medicine department of Mankweng Hospital. The deceased's biographical elements are followed by a summary of the characteristics of the study population. The causes of death (that is, communicable and non-communicable) will be depicted next followed by the association between causes of death and the weekend as well as death within 48 hours of admission. HIV was excluded from the causes of death and presented as a subsection of communicable diseases. This was intended to fulfil one of the objectives of this study, which is to analyse the proportion of HIV-positive patients with a CD4 count of less than 200cells/mm^3.

4.2 BIOGRAPHIC ELEMENTS OF THE DECEASED

A total of 228 records of deceased participants were included in the study. All the patients were black, and most (95.2%) were from the Capricorn district in Limpopo. The age range was from 14 to 103, with a mean age of 56 years. Close to half (44.3%) of deaths were observed in the over-60-year-old age group. This is demonstrated in Figure 4.2.1 below.

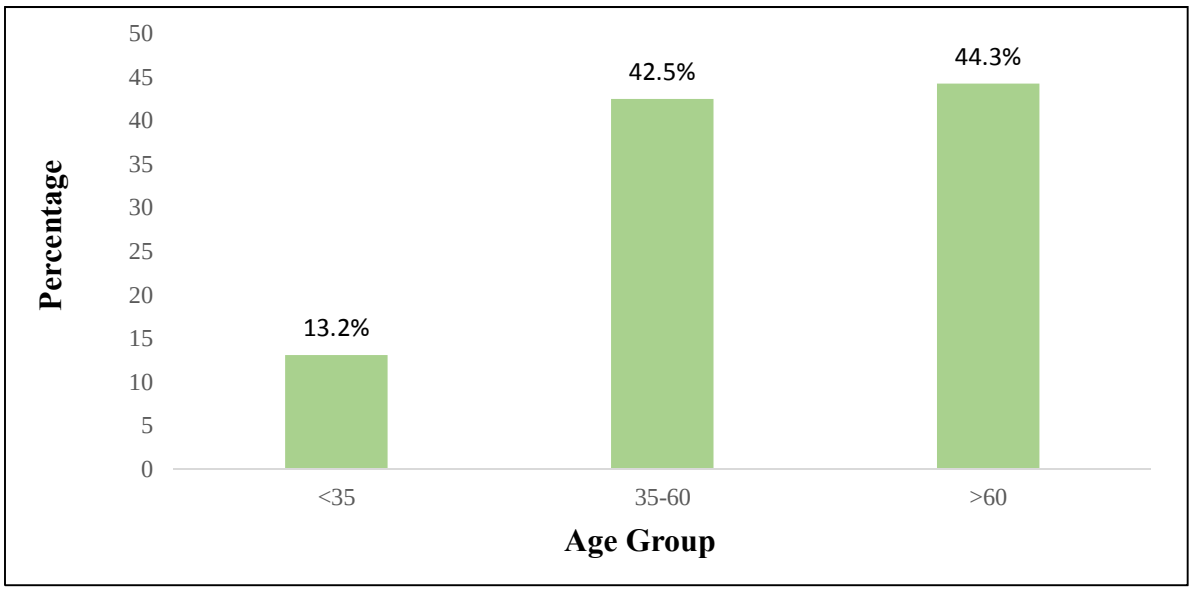


Figure 4.2.1: Age group distribution of the participants in percentages (n=228)

Figure 4.2.2 below demonstrates the gender of the participants, and more females died (51.3%) as compared to males.

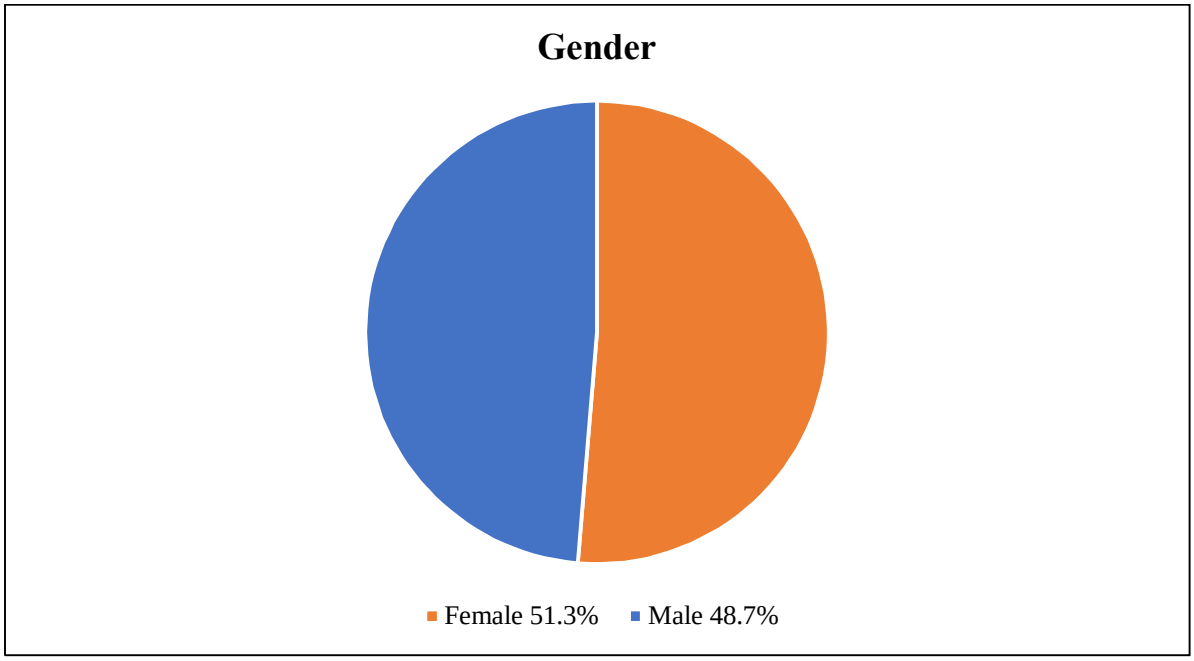


Figure 4.2.2: Gender distribution of the participants (n=228)

4.3 CHARACTERISTICS OF THE STUDY POPULATION

A total of 1021 patients were admitted during the study period, and 228 (22.3%) died over these five months. The study population characteristics, obtained from descriptive statistical analysis, are depicted in frequencies and percentages in Table 4.3.1 overleaf. This table shows that over half (56.1%) of patients died from communicable diseases. Over 90% of the deceased were tested for HIV, of whom close to half (46.9%) were HIV-positive. Most (72% of the HIV-positive patients) had a CD4 count of < 200 cells/mm^3, with 25.2% on ARVs.

The co-morbidities were observed in 120 patients. No patients died of unnatural causes during the study period. The majority (78.5%) of deaths occurred during the weekdays, and a few deaths (39%) occurred within 48 hours of admission. More patients were admitted on Thursday.

Table 4.3.1: Characteristics of the study population

CHARACTERISTICS	Frequency	Percentage (%)
Causes of death		
Communicable Diseases	128	56.1%
Non-communicable Diseases	100	43.9%
Unnatural	0	0.00%
Comorbidities		
Yes	120	52.6%
No	108	47.4%
Weekend		
Yes	88	38.6%
No	140	61.4%
Day of admission		
Monday	42	18.4%
Tuesday	31	13.6%
Wednesday	29	12.7%
Thursday	50	21.9%
Friday	27	11.8%
Saturday	25	11.0%
Sunday	24	10.5%
Death within 48 Hours		
Yes	89	39.0%
No	139	61.0%
HIV Status		
Positive	107	46.9%
Negative	101	44.3%
Unknown	20	8.8%
For HIV positive patients: CD4 in cells/mm^3		
<50	42	39.3%
51-99	21	19.6%
100-199	14	13.1%
> 200	22	20.6%
Unknown	8	7.5%
For HIV positive patients: On ARVs		
Yes	27	25.2%
No	80	74.8%

4.4 CAUSES OF DEATH

Figure 4.4.1 below presents an outline of the causes of deaths in the study sample. Among the communicable diseases, pneumonia, sepsis, and tuberculosis were the main causes of death. The main non-communicable causes of death included hypertension, cerebrovascular accidents, and diabetes. The results also showed that cancer contributed to the causes of death, with prostate, cervical, lung, hepatocellular, and haematological malignancies contributing to almost 15% of the communicable (CD) and non-communicable (NCD) deaths.

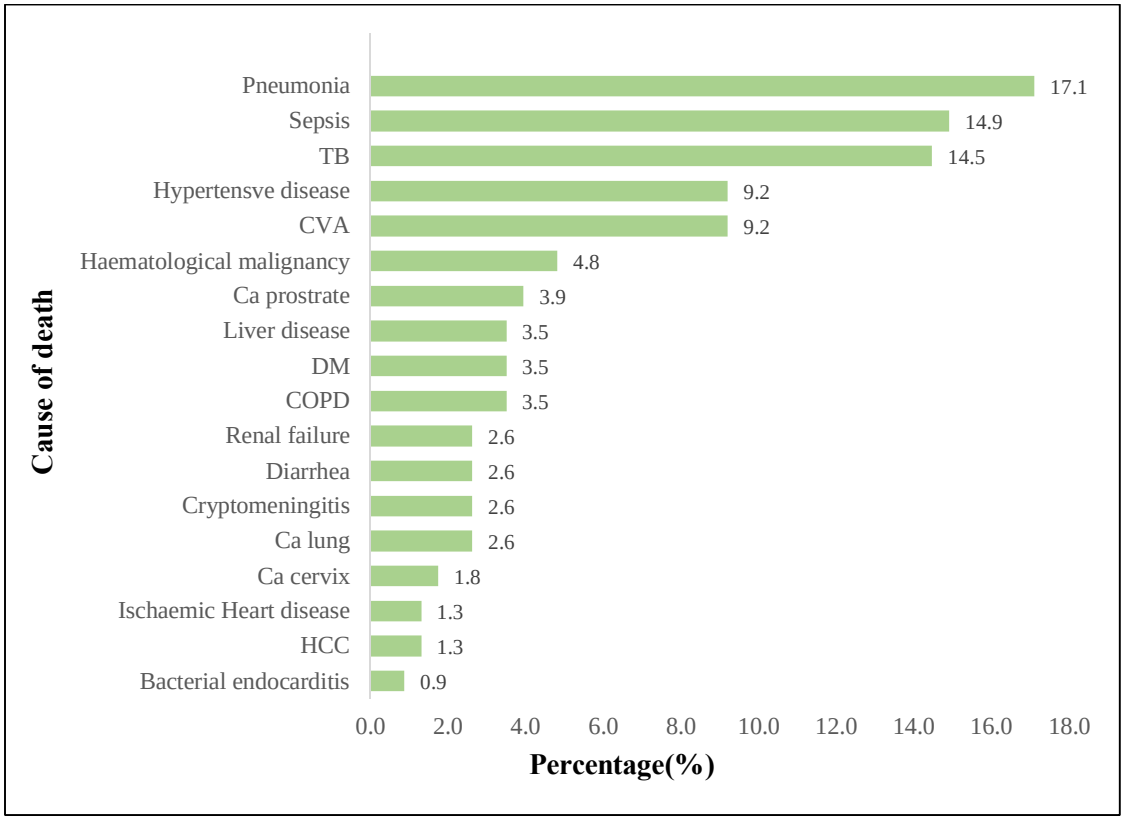


Figure 4.4.1.: Causes of death among the study population (n=228)

4.4.1 Causes of death according to age and gender

The causes of death were further separated into age groups and genders. Table 4.4.1.1 overleaf summarises the findings. The highest number (102 of 228) of deaths was observed in the age group >60 years, with a female preponderance (55 females against 47 males). The leading category of deaths in these older patients was non-communicable diseases, which included CVA and diabetic complications. The major communicable cause of death

in this group was sepsis. The leading cause of death in males over 60 was cancer of the prostate (9 out of 47). In females of the same age group the leading causes of death were stroke (13 out of 55) and sepsis (12 out of 55).

More (67 out of 96) males died in the age group of 35ï 60 years. The leading causes of death in this age group were infectious diseases, with TB (23 of 33) observed more in males and sepsis (10 of 33) in females. Malignancies, both non-haematological (n = 22) and haematological (n = 11) contributed 33 of 228 of the total deaths, with haematological malignancies occurring more (6 of 11) in this age group.

More (23 of 30) female patients in the age group <35 died as compared to males; the leading causes of death were pneumonia in females (9 out of 23) and TB in males (4 out of 7). This was the age group that had the highest number of HIV infections. Overall, this age group <35 years had the highest number of deaths due to communicable diseases.

The Chi-square test showed that there was a significant association between increasing age and DM, CVA, HT, HIV, TB, renal failure, and haematological malignancies, all p-values < .05.

Table 4.4.1.1 Causes of death in sex and age group

Age Group	Sex	Bacterial endocarditis	Hepatocellular carcinoma	Ischaemic Heart disease	Cancer of cervix	Cancer of lung	Diarrhea	Renal failure	Cryptococcal meningitis	Chronic obstructive pulmonary disease	Diabetes mellitus	Liver disease	Cancer of prostate	Haematological malignancy	Cerebrovascular accident	Hypertensve disease	Tuberculosis	Sepsis	Pneumonia	Systemic lupus erythomatosis	Total
<35	Male	1									1						4		1		**7**
<35	Female				1		1		3			1		3			3	2	9		**23**
35-60	Male		2	1		1	4	1	2	1		3		2	5	5	15	6	9		**57**
35-60	Female	1			2			1	1	1		2		4	1	4	4	10	7	1	**39**
>60	Male					4		3		6	4		9	1	2	7	4	3	4		**47**
>60	Female		1	2	1	2	1	1			3	2		1	13	5	3	12	8		**55**
Total		**2**	**3**	**3**	**4**	**7**	**6**	**6**	**6**	**8**	**8**	**8**	**9**	**11**	**21**	**21**	**33**	**33**	**38**	**1**	**228**

4.5 COMMUNICABLE CAUSES OF DEATH

Further analysis of the data showed that of the 128 (56.1%) patients who died of communicable diseases, pneumonia accounted for nearly one-third of the deaths, followed by sepsis (26.6%) and tuberculosis (25.8%). There were no reports of malaria or influenza-related deaths. This is depicted in Figure 4.5.1 below.

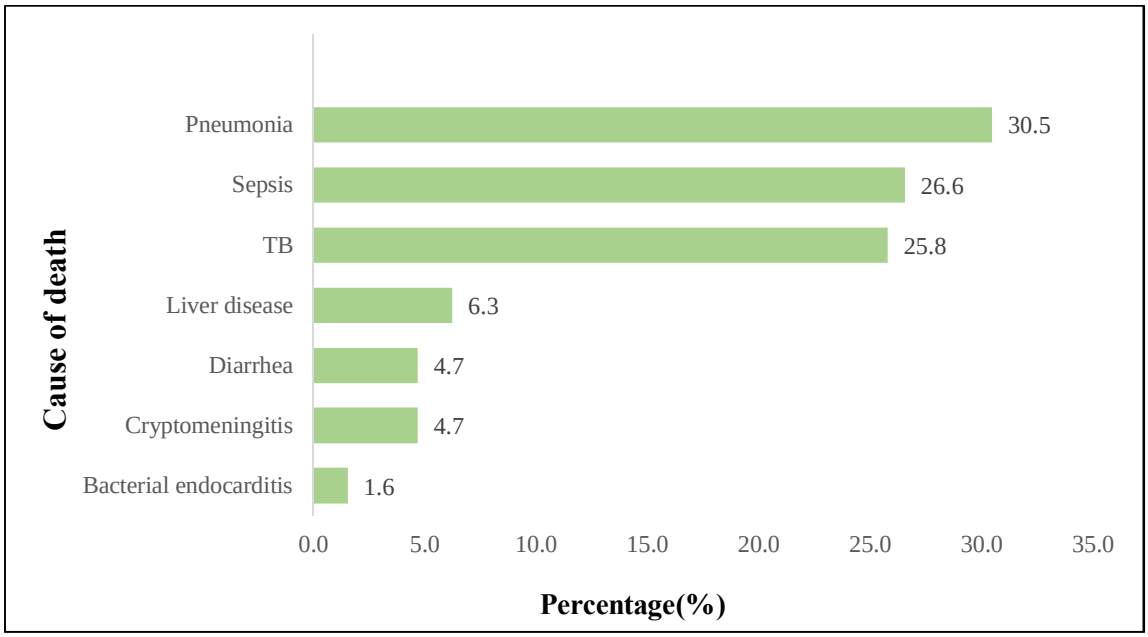


Figure 4.5.1: Communicable causes of death (n=128)

4.6 HIV ELISA and CD4

The results showed that a high proportion (46.9%) of patients was diagnosed with HIV at the time of death, with more females (56 of 107) and a mean age 45 (14-77) years. Over two thirds (66 of 107) of those who were HIV positive were in the age group between 35 and 60 years and males (41 of 66) dominated this age group accounting to 71.9%. The second highest percentage 95.6% (23 of 30) of HIV-positive female patients was in the younger age group of less than 35 years. There was a significant association between younger age (<35 and 35-60 age groups) and HIV sero-positivity with p-value of<0.001. This is depicted in Figure 4.6.1 below.

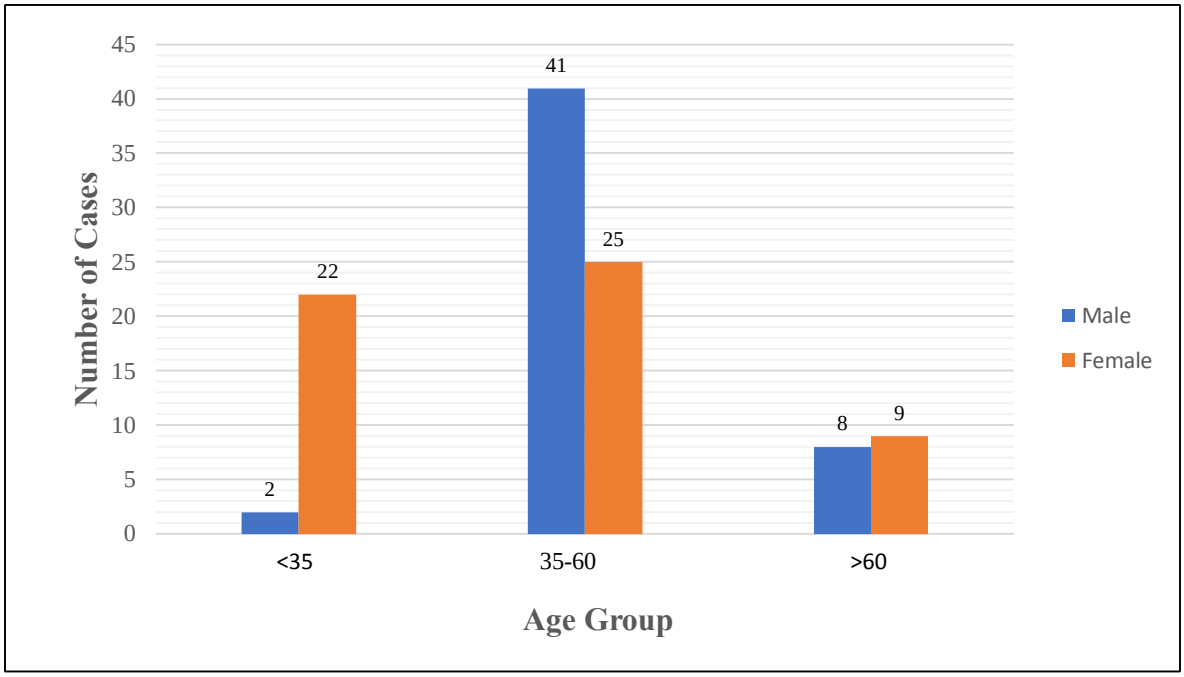


Figure 4.6.1: Distribution of HIV positive participants by age groups and gender (n=107)

Further analysis of the HIV and CD4 data depicted in Table 4.6.1 below indicates that two out of five patients (39.3%) had a CD4 count < 50 cells/mm^3, while one out of five patients had CD4 counts greater than 200 cells/mm^3. The overall mean for CD4 cell count was 129 cells/mm^3 +/- 159.6 (range 1 to 700). Males had a lower mean of 112.1 cells/mm^3 +/- 140 (range 1 to 700) compared to females at 144.3 cells/mm^3 +/- 175.4 (range 1 to 700). A quarter of the deceased were on ARVs.

Table 4.6.1: Distribution of cases per investigations

Investigations	**No**	**%**
HIV ELISA POSITIVE (YES)	107	46.9
CD4 in cells/mm^3		
<50	42	39.2
51-99	21	19.6
100-199	14	13.1
> 200	22	20.6
Unknown	8	7.5
On ARVs	27	25.2

4.7 NON-COMMUNICABLE CAUSES OF DEATH

The study found that of the 100 (43.7%) patients who died of non-communicable diseases, the leading causes of death were hypertension, cerebrovascular accidents, haematological malignancies, diabetes mellitus complications, and COPD. A high number (22%) of non-haematological malignancies were observed, including prostate, lung, cervix, and hepatocellular carcinoma, resulting in cancer contributing to a total of 33% of deaths. See Figure 4.7.1 below.

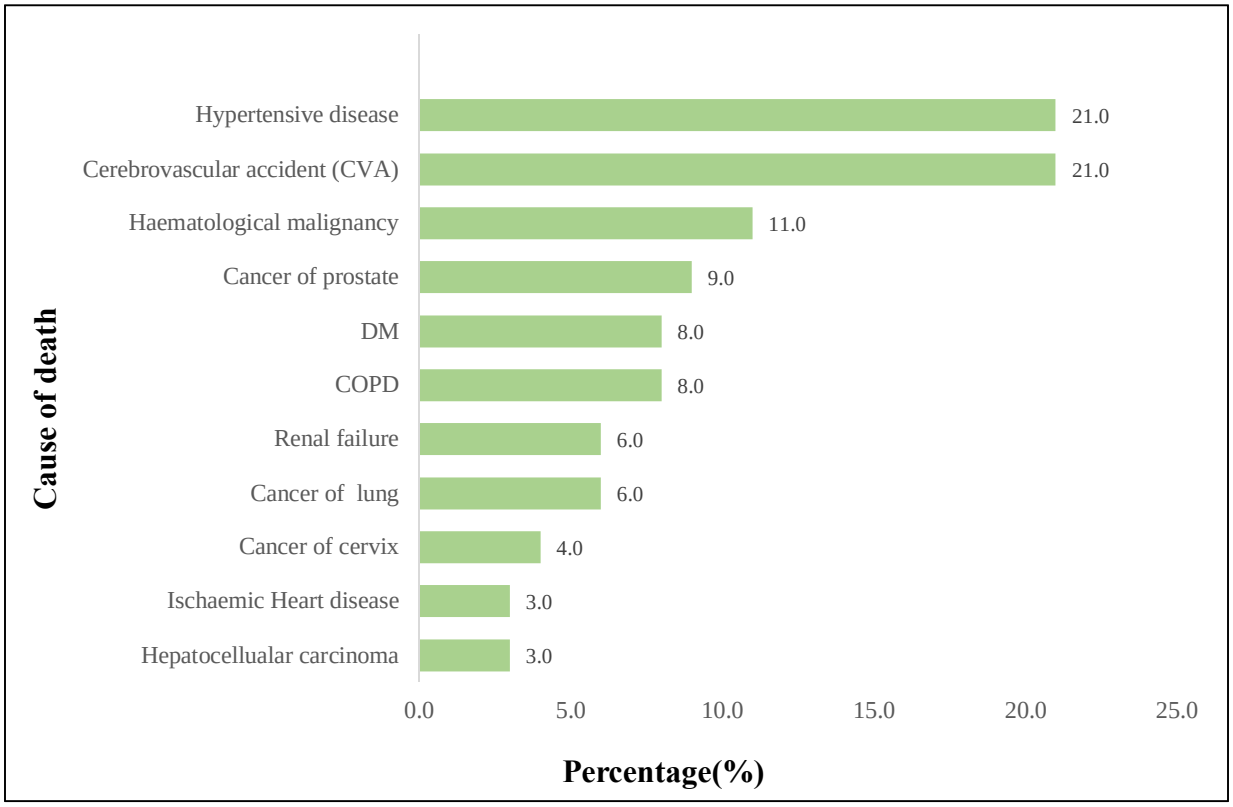


Figure 4.7.1 Non communicable causes of death (n=100)

4.8 EARLY MORTALITY (DEATH WITHIN 48 HOURS OF ADMISSION)

Early mortality (death within 48 hours of admission) was observed in 39.0% of patients while a high percentage (61%) did not die within 48 hours of admission. Two thirds (67%) of deaths occurred within seven days of admission. The mean days from admission to death were 8.4 (1-57) days. This is depicted in Figure 4.8.1 overleaf.

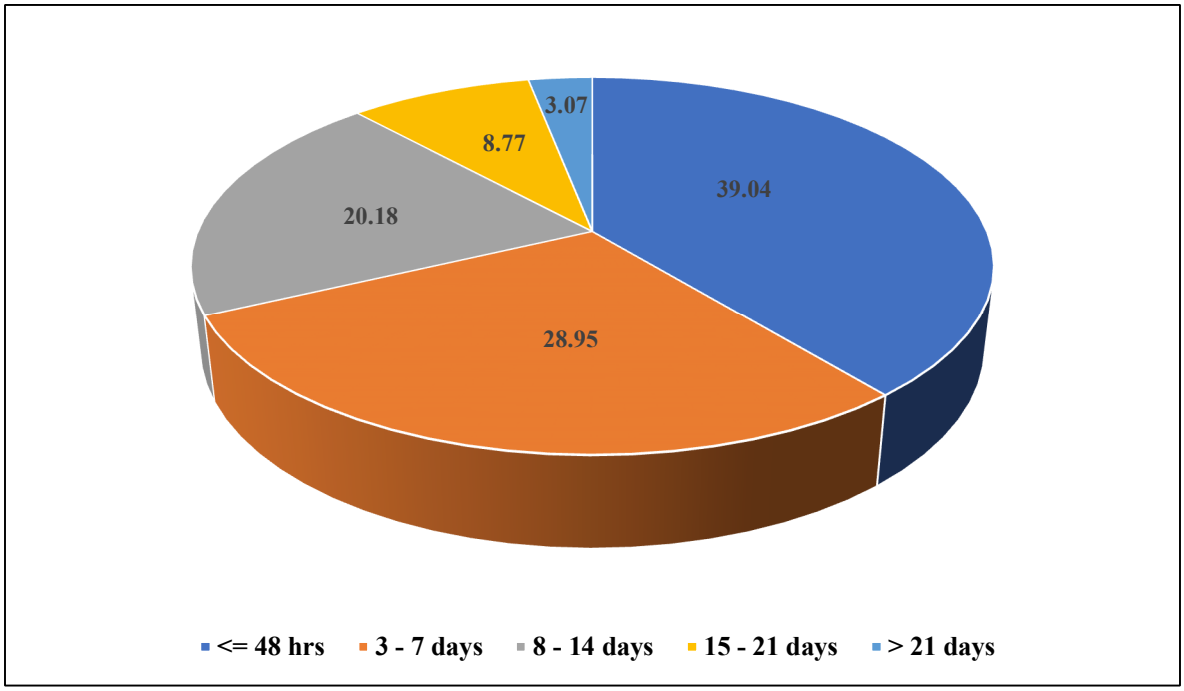


Figure 4.8.1: Number of days from admission to death (n=228)

A further analysis of this data showed that the majority of males died within 48 hours of admission, predominantly with pneumonia, sepsis, and TB. Included were 58.5% males between the ages of 35 and 60.

4.9 DAYS OF THE WEEK AND THE 'WEEKEND EFFECT'

In this study, a "weekend" was defined as any admission between 16 h00 on a Friday afternoon and 08 h00 on the following Monday. Thursday had the highest (50 out of 86) number of admissions. Our study showed that close to 40% of the patients died during the weekend.

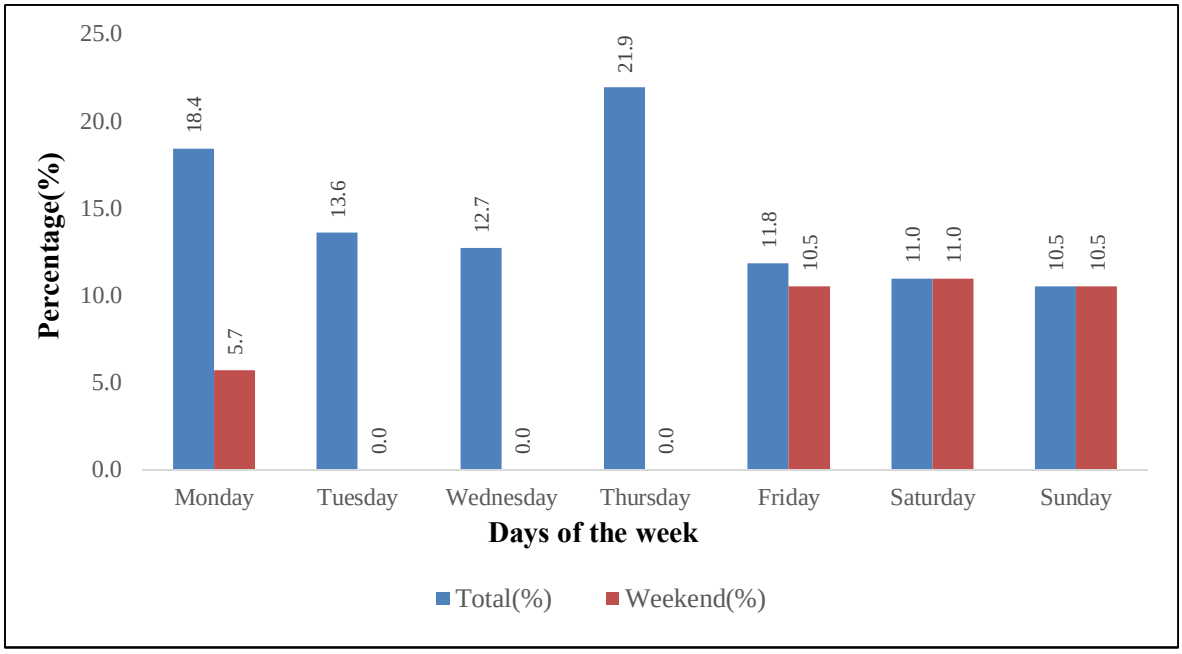


Figure 4.9.1: Days of the week and weekend (n=88)

NOTE: *"Weekend" defined as any admission between 16h00 on a Friday afternoon and 08h00 on the following Monday*

4.10 ASSOCIATION BETWEEN EARLY MORTALITY (DEATH WITHIN 48 HOURS) AND CAUSES OF DEATH

In this section, the association between causes (CD and NCD) death and death within 48 hours of admission will be presented next.

Table 4.10.1 overleaf shows that the patients who died within 48 hours of admission predominantly had the following: haematological malignancies (97.8%), DM (73.0%), renal failure (48.3%), pneumonia (36.0%), and HT (27.0%). There was a significant association between mortality and renal failure, DM, and death within 48 hours of admission; all p-values were less than 0.05.

Table 4.10.1 Association between early mortality (death within 48 hours) and causes of death

	DEATH WITHIN 48 HOURS		P- value
CDs	**NO**	**YES**	
HIV			**0.103**
No	69(49.6%)	54(60.7%)	
Yes	70(50.4%)	34(39.3%)	
Pneumonia			**0.657**
No	93(66.9%)	53(64.0%)	
Yes	46(33.1%)	32(36.0%)	
TB			**0.734**
No	118(84.9%)	77(86.5%)	
Yes	21(15.1%)	12(13.5%)	
Diarrhea			**0.407**
No	129(92.8%)	85(95.5%)	
Yes	10(7.2%)	4(4.5%)	
NCDs			
Renal failure			**0.050**
No	90(64.7%)	46(51.7%)	
Yes	49(35.3%)	43(48.3%)	
HT			**0.351**
No	109(78.4%)	65(73.0%)	
Yes	30(21.6%)	24(27.0%)	
CVA			**0.053**
No	120(86.3%)	84(94.4%)	
Yes	19(13.7%)	5(5.6%)	
DM			**0.041**
No	117(84.2%)	65(73.0%)	
Yes	22(84.2%)	24(73.0%)	
Liver diseases			**0.865**
No	131(94.2%)	84(94.4%)	
Yes	8(5.8%)	5(5.6%)	
COPD/Asthma			**0.667**
No	131(94.2%)	85(95.5%)	
Yes	8(5.8%)	4(4.5%)	
Haematological malignancies			**0.207**
No	131(94.2%)	87(9.8%)	
Yes	8(94.2%)	2(97.8%)	

4.11 CONCLUSION

Chapter 4 called attention to the data that was obtained from the Internal Medicine inpatient mortality study. The findings were that a total of 1021 patients were admitted during the study period and 228 (22.3%) died over these five months. Over half (56.1%) of patients died from communicable diseases, over half (51.3%) were females, over half (52.6%) had co-morbidities, close to half (44.3%) were above 60 years of age and close to half (46.9%) were HIV-positive. Most (72% of the HIV-positive patients) had a CD4 count of < 200 cells/mm^3, with 25.2% on ARVs. Cancer (33%) and pneumonia (30.5%) were the leading cause of death.

No patients died of unnatural causes during the study period. The majority (78.5%) of deaths occurred during the weekdays, and a minority of deaths (39%) occurred within 48 hours of admission.

The following chapter will discuss the findings and then wrap up this research study by summarising the limitations, benefits, and recommendations for future studies.

CHAPTER 5

DISCUSSION, CONCLUSION, RECOMMENDATIONS AND LIMITATIONS

5.1 INTRODUCTION

Chapter 5 discusses the study results introduced in Chapter 4 with a reflection on the literature and previous studies on the inpatient mortality profile in Internal Medicine. Furthermore, the conclusion, recommendations, and limitations of the study will be discussed. This study aimed to analyse the Internal Medicine inpatient mortality profile at Mankweng Hospital, a tertiary hospital in Limpopo Province, South Africa. The analysis focused on the causes of death, death within 48 hours of admission, the óweekend effectô, as well as the impact of HIV/AIDS on mortality. This chapter will have the following sub-sections:

- Biographic elements of the deceased
- Causes of death
- Communicable causes of death
- Non-Communicable causes of death
- Unnatural causes of death
- HIV ELISA and CD4
- Days of the week and the óweekend effectô
- Death within 48 hours of admission
- Association of causes of death and clinical characteristics
- Conclusions
- Recommendations
- Limitations of the study
- Contributions of the study

5.2 DISCUSSION

5.2.1 Biographic elements of the deceased

The findings of this study showed that the highest percentage of inpatient mortality in the Internal Medicine Department of Mankweng Hospital, Limpopo Province, occurred in

females, at 51.3%. This was consistent with the Limpopo provincial population profile, which shows that there are more females (54.6%) than males Bradshaw et al 2002. This Limpopo provincial female dominance was further supported by Maphanga (2009) at 52%, and Myers et al. (2012) in the Western Cape also documented more females than males at 52%. But against this was a study by Bradshaw & Laubscher (2003) in Limpopo and Calık Basaran, Aktas, Sener, Ceylan,Yekeduz, Baspınar, Simsek, Ozısık, Sain Guven, Oz, Serife & Durusu Tanrıover, (2018) in a University Hospital, where males were 51.7% and 54% respectively.

In terms of age, a high mortality was observed with rising age from the 35ï 60 age group to the >60 age group, with the peak in age group above 60. In agreement with this was a study conducted by Myers et al. (2012) in the Western Cape that found that annual increases in mortality rates were linked to rising age.

These differences between provinces may be due to differences in health care services, and the differing prevalence of HIV and NCDs in the provincial populations, as well as differences in health system performance. On the other hand, the intra-provincial differences might be due to changes in disease profile over the years.

Most (95.2%) patients were from the Capricorn district due to the lack of district and secondary hospitals in this area and the referral system. Mankweng Hospital, as a tertiary hospital, services Philadelphia, St. Ritas, and Letaba Hospitals, which are in the Sekhukhune and Mopani districts, respectively.

According to the studies mentioned above, including my own, inpatient mortality is higher in women than in men generally, with a male preponderance with increasing age after 35 years. The differences in mortality between females and males are statistically insignificant, with a p-value greater than 0.05. The causes of these differences need to be investigated. In particular, it may need to be evaluated whether patients receive different standards of care according to their gender.

5.2.2 Causes of death

The top ten causes of death were pneumonia (17.1%), sepsis (14.9%), tuberculosis (14.5%), hypertensive disease (9.2%), cerebrovascular accident (9.2%), haematological

malignancies (4.8%), cancer of the prostate (3.9%), liver disease (3.5%), diabetes mellitus (3.5%), and chronic obstructive pulmonary disease (3.5%).

The leading causes of death were infectious diseases, collectively accounting for 46.5%, and cancer, collectively accounting for 15%. Cardiovascular diseases, especially hypertensive diseases and cerebrovascular accident, were the second leading cause of death. The disease burden of both communicable and non-communicable diseases depicted in our study correlates to the concept of ñdouble burden of diseaseò as outlined by authors such as Myer et al. (2012) and Bradshaw et al. (2002).

The South African Medical Research Council provided support for the findings at Mankweng Hospital, Limpopo (SA MRC, 2014). HIV/AIDS, tuberculosis, ischemic heart disease, cerebrovascular accidents, lower respiratory infections, chronic obstructive pulmonary disease, diabetes mellitus, interpersonal violence, and lung cancer were the top 10 main causes of death in the Western Cape in 2011. The profile for deaths from Mankweng is similar, though the SAMRC data shows a more pronounced prevalence of HIV. We suggest that the contribution of HIV to deaths in Mankweng is being underestimated as HIV is not being recorded on the death notification form or M and M register even though 46.9% of deaths occurred in HIV seropositive patients. This study did not estimate the contribution to deaths by trauma (accidents or interpersonal violence) as it focused on admissions to the medical department.

5.2.2.1 Causes of death according to age and gender

In terms of age, a high mortality was observed with rising age from the 35ï 60 age group to the >60 age group, with the peak in age group above 60 and with a female preponderance. In agreement with this was a study conducted by Myers et al. (2012) in the Western Cape found that annual increases in mortality rates were linked to rising age but with male gender against female gender in my study.

These patients were dying of non-communicable diseases, which included CVA, sepsis and diabetic complications. Bradshaw and Laubscher (2003) affirms our findings that the leading cause of death in to the >60 age group was non-communicable diseases. Males in the same age group were dying more from cancer of the prostate.

Our study observed that males aged 35-60 years died in greater numbers (67 out of 96) and infectious disorders were the primary causes of death in this age group, TB (23 of 33) being more common in males and sepsis (10 of 33) being more common in females. This association between age and causes of death in medical wards has been studied in a Nigerian study by Arodiwe, Nwokediuko, & Ike, (2014). They determined that infections (20.2%) were the most common cause of death followed by renal failure (10.5%), HIV (10.3%). There were more deaths in males than females. Non-haematological (n = 22) and haematological (n = 11) cancers contributed 33 of 228 deaths, with haematological malignancies occurring more frequently (6 of 11) in the age group 35-60 years.

The Chi-square test showed that there was a significant association between increasing age and DM, CVA, HT, HIV, TB, renal failure, and haematological malignancies, all p-values $< .05$.

The age distribution of causes of mortality is comparable with the findings of a nationwide study (Stats SA, 2002) and a burden of disease research (Bradshaw et al, 2003). These studies support the notion that age appears to be a powerful predictor of cause of death, and interventions should be directed toward appropriate age groups

5.2.3 Communicable causes of death

The communicable diseases ranked highest (56.1%) in contributing to mortality over the study period. This was similar to the National Burden of Disease study which estimated higher proportions of communicable disease Bradshaw and Laubscher (2003). The leading communicable causes of death in Mankweng Internal Medicine Department, South Africa, in 2019 were predominately infectious, constituting more than 80% of the deaths. Pneumonia (30.5%), sepsis (26.6%), TB (25.8%), liver disease including Hepatitis B and C (6.2%), and diarrhea presumed to be infectious (7.5%) were among the top five causes of death.

This was in accordance with the WHO's forecast that infectious diseases would be the largest cause of mortality in resource-limited nations by 2020. Other studies Calık Basaran et al. (2018) and Nasir, Jamil, Siddiqui, Talat, Khan and Hussain (2015) observed higher prevalence with regard to sepsis (70%). These differences might be due different

methodologies and disease profiles. The patients in these studies had a high chronic illness burden and are older with mean age of 62 (19-95) years versus 56 (14-103) years in my study.

There were no deaths due to influenza or malaria observed. The time period of the data collection is mostly outside the malaria season experienced in Limpopo, which explains the lack of mortality due to this infection. The researcherôs experience of the research facility is that influenza is rarely tested for, and hence our data likely represents a significant underestimation of influenza deaths, which have been reported to account for 6000 to 11, 000 deaths in South Africa annually. The elderly account for half of this figure, while 30% are HIV positive (National Institute of Communicable Diseases).

5.2.4 HIV ELISA and CD4

In this study, 91.2% (208 of 228) of the participants were tested for HIV. This implies that Mankweng Hospital has achieved only one of the three United Nations (UN) Far-Track "90-90-90" HIV strategy targets, as more than 90% of patients know their HIV status. Marinda et al. (2020) supported the current study findings in their south African 2017 national HIV survey, where 84.8% of patients knew they had HIV, 70.7% were taking ARVs, and 87.8% were virologically suppressed. Different from the current study, Wajanga (2014) investigated the causes of HIV-positive inpatient mortality in Senegal, Malawi, and Tanzania and found the following health system failures: low laboratory capacity and fewer patients being tested for HIV in hospitals, which seemed not to be the case in my study.

Close to half (46.9%) of patients were HIV positive, with the Limpopo provincial HIV prevalence estimated at 15%, this finding shows the outsize impact of HIV on mortality. Furthermore, other researchers (Gona *et al*., 2020; Kanjala, 2010; Kochanek *et al*., 2019; and Malangu *et al*., 2014) affirmed the high mortality secondary to HIV/AIDS in highly resourced, international as well as Sub-Saharan countries. The current study was comparable with the findings by Bradshaw and Laubscher (2003) were HIV accounted for 42% deaths.

HIV mortality disparities highlight the importance of social determinants, raise concerns about care quality, and provide policymakers with pertinent information to address inequities.

In terms of HIV and age**,** 62% were between the ages of 35 and 60. Further analysis of the data showed that there were more females as compared to males, and the majority of HIV-positive female patients are younger than their male counterparts (age range less than 34 versus age group 35ï 60). In support to our findings, Mabaso, Makola, and Naidoo et al. (2019) and Pillay-van Wyk, Msemburi, Laubscher, Dorrington, Groenewald, and Bradshaw (2019) found that Black African males aged 35 to 49 have a higher HIV prevalence. These gender disparities, which may point towards intrinsic structural socio-economic inequalities that make women more exposed at a younger age due to being in relationships with older male partners and resultant difficulties with negotiating safer sex, may be one of the contributing factors.

Patients with a CD4 count less than 200 cells/mm3 were 77 (72%). Those with the most severe HIV (that is, CD4 counts of <50) made up 39.2% of the deaths. This finding shows that most HIV patients in the study had advanced disease and significantly suppressed immune systems. May et al. (2016) further support the notion that baseline CD4 is predictive of mortality in the first year of ARV initiation. Kim et al. (2020) suggest the opposite in a Korean study that showed that being diagnosed with HIV with a lower CD4 was not associated with high mortality.

It is important to note the difference in contexts: Kim et al. reached their findings in a setting of low HIV prevalence and a well-resourced health system, while our findings were obtained in a setting of high HIV prevalence and poor health resources. Other studies (Boulle *et al*., 2014 & Kim *et al*., 2020) found that South African patients are initiated at a lower CD4 count (<50 cells/mm^3) as compared to patients in other countries (Europe and North America).

In support of the above, Lawn et al. (2008) have noted that mortality is substantially correlated with a baseline CD4 count of less than 50 cells/mm^3 and WHO stage 4 disease (AIDS) in their observational studies from a variety of countries in Sub-Saharan Africa.

The most common causes of mortality in HIV positive patients were sepsis, cryptococcal meningitis, malignancy, and tuberculosis.

Additionally, these two conditions (HIV/AIDS and TB) as well as acute respiratory infections were found to be highly related to HIV positivity by Byass, Calvert, Miiro-nakiyingi, Lutalo, Michael, Crampin, et al. (2013), indicating that they are likely causes of death in people with HIV. We suggest that HIV was a significant factor underlying the deaths due to communicable diseases including tuberculosis, pneumonia and diarrhoea.

To reduce mortality in individuals with advanced disease, Mfinanga, Chanda, Kivuyo, and Guinness et al. (2015) proposed adherence assistance and screening, as well as pre-emptive treatment of cryptococcal infection at the beginning of ARV. Our study did not seek to evaluate the ART program in Limpopo, but the data obtained suggest that Limpopoôs ART program has deficiencies such as late initiation of ART and failure to reach the 90% target for patients with a suppressed viral load.

Given the significant correlation between CD4 count and opportunistic infections and mortality, absolute CD4 count is important for patient management. The current study highlights this substantial link by showing a high prevalence of cryptococcal meningitis, TB, pneumonia, and sepsis among HIV-positive individuals with a CD4 count of <200 cells/mm^3. Hoffman, Schomaker, Fox, et al. (2013) further state that although there is a well-established link between the CD4 count at the time of ARV initiation and mortality risk, it is unknown whether the effect size will remain constant over time. Once again, our data strongly suggest that the Limpopo ART program has not reached the 90% target as set by the WHO.

In contrast, deferred in-hospital ARV initiation and late presentation to the hospital led to high mortality in this group. Furthermore, a very bleak picture is observed in this study: of the second 90 UN targets (90% of people who are HIV positive are taking ARVs), only 27 (25.2%) were on ARVs. The reasons behind this low ARV uptake need to be investigated and appropriate interventions should be implemented.

5.2.5 Non-Communicable causes of death

The study found that 43.7% of deaths were attributed to non-communicable diseases; this was in accordance with studies done by Global Burden of Disease (WHO 2019) at 43%, Bradshaw and Laubscher (2003) in Limpopo at 42% and Pillay-van Wyk, Msemburi, Laubscher, Dorrington, Groenewald, Glass et al (2016) at 43.4%.

The leading non-communicable causes of death were hypertensive disease (21.0%), CVA (21.0%), and haematological malignancies (11.0%). Diabetes mellitus complications and COPD were at 8%, respectively.

A high number (22%) of non-haematological malignancies were observed, including prostate, lung, cervix, and hepatocellular carcinoma, resulting in cancer and contributing to a total of 33% of non-communicable causes of death. In agreement with these findings, Calık Basaran et al. (2018) observed malignancy in 71% of the cases and diabetes mellitus (25.7%), hypertension (35%), and congestive heart failure (18.8%) were the most prevalent illnesses. These figures were higher than in the current study due to different research settings.

Of concern was the high number of patients with gynaecological and urogenital malignancies dying in medical wards. This may indicate inadequate investigation of patients in the Casualty Department and inappropriate admission to the Medical Wards. These patients are therefore admitted to Internal Medicine because they have complications of cancer such as anaemia or renal impairment. The lack of urogenital and oncology services in Mankweng Hospital also contributes to late diagnosis.

The high burden of deaths attributable to hypertension is a reflection of the poor outcomes in primary care, while the high number of deaths due to haematological malignancies can be blamed on the intrinsically high mortality rate for these neoplasms and the lack of a specialised haematology unit in the entire province.

According to WHO (2018b and 2018c), in much of the world, non-communicable illnesses are the leading causes of adult mortality. The findings in this study corroborate a review by Kochanek et al. (2019) in the United States (US) that showed that mortality rates for

people aged 25 to 34 and 35 to 44 years climbed drastically from 2016 to 2017 due to NCDs. This pattern indicates an epidemiological change in the causes of death towards NCDs as more young people develop lifestyle diseases.

According to different studies (Naidoo (2019); Bradshaw et al. (2002); and Li, Zeng, and Liu et al. (2017)), the main four NCDs leading to premature death are cardiovascular diseases, cancers, DM, and chronic respiratory diseases. These accounted for more than 70% of deaths, and in this study, they accounted for more than 80% of deaths. This further illustrates the poor outcomes at the primary care level, as failures at this level lead to more patients developing advanced disease, which has a high mortality rate even with appropriate resources.

Patients >60 years old were dying of non-communicable diseases such as diabetic complications, CVA, and hypertensive diseases supported by Bradshaw et al. (2002 confirmed same findings among the 45-59 age groups and >60. Furthermore, Adebusoye and Kalula (2019) and Guerreiro, Henriques, Trevas, et al. (2022) supported the study's findings that advanced age is correlated with an increase in deaths from non-communicable diseases (NCDs) and early mortality caused by communicable diseases (CD), thus resulting in a double burden of diseases.

To minimize the impact of death risk factors in our environment, efforts in the overall control of NCDs, as well as appropriate staffing and improved care of the aforementioned diseases, are crucial. In addition to these general causes, the deceased had the following comorbidities: DM, hypertensive diseases, renal failure, malignancies, and HIV. Diabetes mellitus hypertension and congestive heart failure were the most prevalent concomitant illnesses Calık Basaran et al. (2018).

Other researchers, such as Li, Zeng, and Liu et al. (2017) and Nojilana, Bradshaw, and Pillay-van-Wyk et al. (2016), believe that more funds should be allocated to low- and middle-income countries, such as South Africa, to reduce premature deaths caused by the main four NCDs.

5.2.6 Unnatural causes of death

No unnatural deaths during the study period.

5.2.7 Days of the week and the ‘weekend effect’

Our study showed that close to 40% of the patients died during the weekend. Four out of 10 patients were admitted over the weekend with the following conditions: HIV, TB, HT, CVA, COPD/Asthma, and renal. There was no significant association between mortality and admission day; all p-values were greater than 0.05.

According to various studies (Myer *et al*., 2012; Barba *et al*., 2006; Marco *et al*., 2010), one possible cause is that during the weekend, there is less staffing, which would cause a poorer quality of care. No other studies that analyse the 'weekend effect' in Limpopo were found. There are also some studies (Prin *et al*., 2020; Sharp *et al*., 2013; and Han *et al.,* 2018) that indicate that part of this effect is a statistical artifact, and therefore it is not possible to affirm that these deaths are preventable or attributable to a poorer quality of care at the weekend.

Our finding correlates with Prin et al.'s in finding no significant óweekend effectô on mortality. As our study did not evaluate the changes in staff profiles between weekdays and weekends, it is unclear why no difference was found. It should reassure the public and hospital staff though that there is no significant increase in mortality over the weekend.

Bressman et al. (2020) in the US academic medical centresô study further indicated that patientsô characteristics, like comorbidities and severity of illness, play an important role. This correlated with our study where at least 120 patients had comorbidities and presented with severe diseases.

Nevertheless, the majority of the authors (Myer *et al*., 2012; Barba *et al.,* 2006; Honeyford *et al*., 2018; Sun *et al*., 2019; Han *et al*., 2018; and Marco *et al*., 2010) agree that it is a real challenge during weekends, affecting the mortality rate, and it is suggested to be deeply analysed in order to improve in this regard.

5.2.8 Early mortality (Death within 48 hours of admission)

The participants who died within 48 hours of admission were 39.0%. Our findings were comparable to Adebusoye and Kalula's 2019 Groote Schuur study and Myer et al. (2012), where mortality in the first 24 hours of admission was 32.4 deaths per 1,000 and 30 to 50 deaths per 1000 from 2002 to 2009, respectively. This high proportion in the current study may point to issues with emergency resuscitation in patients with acute medical conditions or the severity of illness at presentation. The absence of an acute medical admission ward might be worsening the situation.

The proportion of deaths between three and seven days after admission was the second highest (29%). This means that more than 67% of deaths happen within seven days of being admitted. Of note, 3.07% were hospitalized for more than 21 days. These patients had malignancies and infective endocarditis. This emphasise the need for haematological services in the province. The mean days from admission to death were 8.4 (1ï 57) days compared to 16 (0ï 142) days in Calik Basaran et al. (2018)**.** These differences are due to varying disease profiles of the study populations where in the Calik Basaran et alôs. (2018) study a high burden of chronic illnesses was observed.

More (60.5%) males died within 48 hours of admission from pneumonia, sepsis, and TB. There were 52 out of 86 males between the ages of 35 and 60. Our findings were comparable to the Bradshaw & Laubscher (2003) study where more males were having TB in the age group of 45-60 years. Our participants were younger with a mean age of 56 years.

This finding suggests either that males present very late to the hospital or that male patients may receive lower quality of care upon admission. A high number of pneumonia cases were observed, implying that patients with respiratory problems died before further investigations were done to exclude diseases like tuberculosis. Alternatively, pneumonia guidelines were not used, as the first 48 hours are crucial in pneumonia management. A further breakdown of the aetiology and factors related to death within 48 hours of the pneumonia cases is required, as that was not part of this study.

Garcia-Vidal et al. (2008) confirmed in their Spanish study that community-acquired pneumonia was the leading cause of death within 48 hours of admission, with respiratory failure and septic shock at admission. Because patients with severe immunosuppression were not included in their research population and because the hospital had adequate resources, the mortality rate was low.

While severe illnesses such as septic shock are associated with early hospital mortality, Kershaw et al. (2019) discovered in their Botswana district hospital study that a variety of factors are involved. The healthcare workers (that is, limitations in training and education of personnel and inadequate communication between health-care providers) and the system as a whole (that is, low resource settings) may be more important to poor outcomes than a lack of diagnostic and treatment resources.

The internal medicine department of Mankweng Hospital operates in the same format, with one chief medical officer, one junior medical officer/registrar, and one intern covering the entire hospital after hours. As a result, the on-call team does not review or handover inpatients after hours, on weekends, or on public holidays. The small sample as well as the type of study was the limitations of Kershawôs study.

Further analysis of the data using the Chi square test revealed that there was a significant association between mortality and renal failure, DM, and death within 48 hours of admission; all p-values were less than 0.05. This highlights a necessity to expand renal services in the province to Mankweng Hospital as well as introduce other treatment modalities like glucagon-like-peptide 1 (GLP-1) analogues in management of patients with diabetic complications.

Overall, the causes of death associated with mortality within 48 hours of admission to the internal medicine department are complex and influenced by various factors such as age, gender, and underlying health conditions. However, identifying the causes of death can help healthcare providers develop better treatment strategies and improve patient outcomes.

5.2.9 Association between early (death within 48 hours) and causes of death

More males died within 48 hours of admission from pneumonia, sepsis, and TB. There were 52 males between the ages of 35 and 60. Our findings were comparable to Adebusoye and Kalula's 2019 Groote Schuur study, where mortality in the first 24 hours of admission was 32.4 deaths per 1,000 and Bradshaw & Laubscher (2012) were more males were having TB in the same age group of 45-60 years. Our participants were younger.

There was a significant association between COPD/asthma ($p = 0.014$) and male gender, which is smoking-related.

There was a significant association between mortality and renal failure, DM, and death within 48 hours of admission; all p-values were less than 0.005. The patients who died within 48 hours of admission predominantly had the following: haematological malignancies (97.8%), DM (73.0%), renal failure (48.3%), pneumonia (36.0%), sepsis, and HT (27.0%). There was a significant association between mortality and renal failure, DM, and death within 48 hours of admission; all p-values were less than 0.05.

5.3 CONCLUSION

From this study, the Internal Medicine inpatient profile at Mankweng Hospital showed that from June 1 to November 1, 2019, a total of 1021 patients were admitted, and 228 (22.3%) died, with more (51.3%) women dying. Patients who died during the weekend were more than one-third (39%). The mortality rate in the first 48 hours of admission was 39.0%, reaching 68.3% during the first week of admission.

Infectious conditions like pneumonia (in general and HIV-related), TB, and sepsis are still playing an important role among the communicable diseases in our setting. Hypertensive disease, cerebrovascular accidents, and haematological malignancies were the top three non-communicable causes of mortality (53% of non-communicable causes of death) in Internal Medicine at Mankweng Hospital.

Close to half (46.9%) of patients who died were HIV positive, and patients with CD4 counts of <200 cells/mm^3 were 77 (72%). Of concern was that 39.2% had CD4 levels less

than 50 cells/mm^3. The findings revealed a high percentage of patients tested in hospitals for HIV and only 27 (25.2%) on ARVs.

The high number of patients with a CD4 count < 200 cells/mm^3 and the fact that only 25.2% of the HIV patients were taking ARVs are evidence that the primary care level needs major improvement, representing a big challenge for our health care system.

In conclusion, the mortality trends reported here help to comprehend the Internal Medicine department of Mankweng Hospital's progress toward meeting some of the Millennium Development Goals for health. Most importantly, the trends highlight the emergence of the "double burden of disease" and the importance of monitoring the evolution of NCD conditions and risk factors, as well as the need for the Limpopo Department of Health to focus on their prevention, control, and treatment while continuing to strengthen HIV/AIDS prevention and treatment programs in order to achieve further mortality rate reductions.

The similarities with the national profile suggest that the provincial initiatives might easily draw strength from the national health priorities in satisfying the province's health requirements.

5.4 RECOMMENDATIONS

The following are the recommendations:

a. Limpopo Province:

- Pietersburg Hospital in Limpopo, as well as other South African tertiary hospitals, should be included in future research to include more patients and examine the inpatient mortality profile on a larger scale.
- To keep the HIV/AIDS death rate from rising further, the Limpopo Department of Health should work harder and devise innovative strategies to increase adherence to ARVs.
- More health professionals are needed to allow the Internal Medicine department to introduce firms to assess all hospitalized patients after hours and on weekends. Advanced Medical Life Support (AMLS) training for healthcare staff, especially new recruits and interns, would be extremely beneficial.

- More funding, as well as earlier detection and treatment of the four major non-communicable diseases will reduce the proportion of individuals who die within 48 hours of being admitted to the hospital due to these diseases that are preventable.
- In terms of cancer, early screening is advocated, and expansion of oncology and urogenital services as well as the establishment of Haematological services in the province will reduce the number of deaths.
- The findings of this study highlight a necessity to expand renal services in the province to Mankweng Hospital.
- Introduction of other treatment modalities like glucagon-like-peptide 1 (GLP-1) analogues in management of patients with diabetic complications.

b. **Mankweng Hospital:**

- Referring institutions, with the assistance of Mankweng Hospital, must ensure that people can obtain and continue to use ARVs in order for the UN's health-related SDGs to be met by 2030. This can be accomplished through spreading information about HIV infection and how to prevent it, as well as by treating and continuous adherence counselling of HIV patients.
- The creation of an acute medical admission unit may reduce the number of people who die within 48 hours.
- Protocols on the management of all conditions, especially emergency conditions, should be designed and disseminated throughout the province. This highlights a necessity to expand renal services in the province to Mankweng Hospital as well as introduce other treatment modalities like analogues in management of patients with diabetic complications.

c. **Staff:**

- When analysing mortality data, the importance of effective record-keeping, as well as data quality issues such as incompleteness and misclassification should be emphasized.

5.5 CONTRIBUTIONS OF THE STUDY

This study is meant to analyse the mortality profile of the inpatients in Internal Medicine to assist the following communities:

a. ***Patients:*** Reduction of the number of deaths, improves quality of life, and thereby improves life expectancy.

b. ***Staffing:*** Identify gaps in their continuous professional development and come up with strategies to improve training at all levels.

c. ***Limpopo Provincial Department of Health:***

Improve and achieve Millennium Development Goalsôtarget number 3

Proper planning for resources and services

5.6 LIMITATIONS OF THE STUDY

The limitations of this study were secondary to its nature, a retrospective study and therefore information bias occurred. There were a high number of files without time of admission due to the admitting doctor not writing it. The researcher had to go to the file and use the time the doctor saw the patient as admission time.

The study was done in Mankweng Hospital alone and therefore its generalisability to Limpopo and South Africa is impossible

6. REFERENCES

Abuto W, Abera A, Gobena T, Dingeta T, & Markos M. (2021). Survival and Predictors of mortality among HIV positive adult patients on Highly Antiretroviral Therapy in public hospitals of Kambata Tambaro Zone, Southern Ethiopia: A retrospective cohort study. *HIV AIDS (Auckland, N.Z)*, 13, 271-281. https://doi.org/10.2147/HIV.S299219.

Adebusoye, L.A & Kalula, S.Z. (2019). *Mortality among older patients admitted to the medical wards of Groote Schuur Hospital,* Cape Town, South Africa, 2010-2013. *SAMJ* Feb; 109(2) DOI: 10.7196/SAMJ.2019.v109i2.13275.

Arodiwe, E, Nwokediuko, S, & Ike, S. (2014). Medical causes of death in a teaching hospital in South-Eastern Nigeria: A 16 year review. *Nigerian journal of clinical practice.* 17. 711-6. 10.4103/1119-3077.144383.

Barba, R, Losa, J.E, Velasco, M, Guijarno C, de Casasola, G & Zapatero, A. (2006). Mortality among adult patients admitted to hospital on weekends. *Eur J Intern Med* Aug; 17(5):322-4. doi:10.1016/j.ejim.2006.01.003.PMID: 16864005.

Bell, D, Lambourne A, Percival F, Laverty A.A & Ward, D.K. (2013). Consultant input in acute medical admissions and patient outcomes in hospitals in England: A multivariate analysis. *PLoS One* 8(4): e61476. doi:10.1371/journal.pone.0061476.

Bradshaw, D, Nannan, N, Groenewald, P, Joubert J, Laubscher, R, Nojilana, B, Norman, R, Pieterse, D & Schneide, M. (2002). Provincial mortality in South Africa - priority setting for now and a benchmark for the future. *S Afr Med J.* 95(7)496-503.PMID: 161156448.

Bradshaw, D & Laubscher, R. (2003). Mortality profile from registered deaths for Limpopo Province, *SA 1997-2001* (http://www.mrc.ac.za).

Bressman, E, Rowland, J.C, Nguyen, V & Raucher, B.G. (2020). Severity of illness and the weekend mortality effect: a retrospective cohort study. *BMC Health Services Research.* 2020 March 4; 20(1):169. (https://doi.org/10.1186/s12913-020-5029-6).

Boulle A, Schomaker M May MT, Hogg RS, Shepherd BE, Monge S, Keiser O, Lampe FC, Giddy J, Garone D, Fox M, Reiss P, Dabis F, Costagliola D, Castagna A, Ehren K,

Burger C, Burger R, & Doorslaer E.(2022). The health impact of free access to antiretroviral therapy in South Africa Social Science & Medicine Volume 299,2022, 114832,ISSN02779536,https://doi.org/10.1016/j.socscimed.2022.114832.(https://www.sciencedirect.com/science/article/pii/S0277953622001381)

Byass P, Calvert C, Miiro-nakiyingi J, Lutalo T, Michael D, Crampin A, et al. InterVA-4 as a public health tool for measuring HIV/AIDS mortality: a validation study from five African countries. Glob Health Action. 2013; 6: 22448. [PubMed Abstract]. [Google Scholar]

Calık Basaran, N., Aktas, B. Y., Sener, Y. Z., Ceylan, S., Yekeduz, E., Baspınar, B., Simsek, C., Ozesık, L., Sain Guven, G., Oz, Serife G., & Durusu Tanrıover, M. (2018). Mortality Facts in Internal Medicine Wards: A Descriptive Study from A University Hospital. *Acta Medica*, *49*(4), 6ï 13. https://doi.org/10.32552/2018.ActaMedica.314

Campbell C, Gill MJ, Saag M, Justice AC, Guest J, Crane HM, Egger M & Sterne JAC. (2014). Mortality in patients with HIV-1infection starting Antiretroviral Therapy in South Africa, Europe, or North America: A collaborative analysis of prospective studies. *PLoS Med* 11(9): e100718.doi:10.1371/ journal. pmed.1001718.

Cornell M, Grimsrud A, Fairall L, et al. Temporal changes in programme outcomes among adult patients initiating antiretroviral therapy across South Africa, 2002ï 2007. *AIDS.* 2010; 24(14):2263ï 2270. 10.1097/QAD.0b013e32833d45c5 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Cornell M, Johnson LF, Wood R, et al. Twelve-year mortality in adults initiating antiretroviral therapy in South Africa. *J Int AIDS Soc*. 2017; 20(1):21902. 10.7448/IAS.20.1.21902 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Department of Health Limpopo. (2018). *Limpopo Department of Health Annual Repor*t. (Online). Available from: https://provincialgovernment. co.za/departmental annual/674/2018 -limpopo- health-annual-report.pdf. Accessed 10032020.

Ford N, Boulle A, & Egger M. Accounting for and responding to HIV-associated mortality. *AIDS*. 2016; 30(3):521ï 523. [PubMed] [Google Scholar]

Garcia-Vidal, C, Fernandez-Sabe, N, Carratala, J, Diaz, V, Verdaguer, R, Dorca, J, Manresa, F, Gudiol, F. (2008).Early mortality in patients with community acquired pneumonia: causes and risk factors. *Eur Resp J* 2008; 32: 733-739 DOI:10.1183/09031936.00128107.

Gona, P.N, Gona, C.M, Ballout, S, Sawmya, R.R, Kimokoti, R, Mapoma, C.C & Mokdad, A.C. (2020). Burden and changes in HIV/AIDS morbidity and mortality in Southern African Development Community Countries, 1990 ï 2017. *BMC Public Health* **20**, 1-14. Article number: 867 (2020). https://doi.org/10.1186/s12889-020-08988-9.

Guerreiro R, Henriques C, Trevas S, et al. (January 30, 2022) Predicting Prognosis in Internal Medicine: A Short and Long-Term Mortality Comparison Analysis. Cureus 14(1): e21734. doi:10.7759/cureus.21734

Hall, G.M. (1994). *How to write a paper*. London: BMJ Publishing Group.

Han I, Sutton, M, Clough, S, Warner, R & Doran, T. (2018). Impact of out-of-hours admission on patient mortality: longitudinal analysis in a tertiary acute hospital. BMJ Qual Saf 2018; 27:445-454. doi :10.1136/bmjqs-2017-006784. Epub 2017 Sep 29. PMID: 28971886:PMCID5965349.

Harris, TG, Rabkin, M, & El-Sadr, WM. Achieving the fourth 90: Healthy aging for people livingwith HIV. *AIDS*. 2018; 32(12):1563ï 1569. 10.1097/QAD.0000000000001870 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Healy, J.F. (2002). *Statistics: A tool for social research*. Sixth Edition. Belmont, CA: Wadworth group. Division of Thompson Learning Inc.

Honeyford, K, Cecil, E, Lo, M, Bottle, A & Aylin, P. (2018). The weekend effect: does hospital mortality differ by day of the week? A systematic review and meta-analysis. *BMC Health services Research* 18: 870 (https://doi.org/10.1186/s12913-018-3688-3).

Huicho, L, Trelles, M, Gonzales, F, Mendosa, W& Miranda, J. (2009). Mortality profile in a country facing epidemiological transition: An analysis of registered data. *BMC Public Health* 9: 47 (https//doi.org/10.1186/1471-2558-9-47).

Jen MH, Bottle A, Majeed A, Bell D, & Aylin P (2009) Early In-Hospital Mortality following Trainee Doctors' First Day at Work. PLoS ONE 4(9): e7103. https://doi.org/10.1371/journal.pone.0007103

Lenti MV, Croce G, Brera AS, Ballesio A, Padovini L, Bertolino G, Di Sabatino A, Klersy C, & Corazza GR, DOI: https://doi.org/10.7861/clinmed.2022-0176Clin Med January 2023

Kabudula CW, Tollman S, Mee P, Ngobeni S, Silaule B, Gómez-Olivé FX, Collinson M, Kahn K & Byass P (2014) Two decades of mortality change in rural northeast South Africa, Global Health Action, 7:1, DOI: 10.3402/gha.v7.25596

Kanjala, C, Alberts, M, Byass, P & Burger. S (2010). Spatial and temporal clustering of mortality in Dikgale HDSS in rural northern South Africa. *Globe Health Action*, 3:1, DOI: 10.3402/gha. v3i0.5236.

Kanjala, Denna Michael, Jim Todd, Emma Slaymaker, Clara Calvert, Raphael Isingo, Alison Wringe, Basia Zaba & Mark Urassa (2014) Using HIV-attributable mortality to

assess the impact of antiretroviral therapy on adult mortality in rural Tanzania, Global Health Action, 7:1, DOI: 10.3402/gha.v7.21865

Kershaw, C, Williams, M, Kilaru, S, Zash, R, Kalenga, K, Masole, F, Shapiro, R & Barak, T. (2019). Audit of early mortality among patients admitted to the general medical ward at a district hospital in Botswana. *Annals of Global Health* 85(1):22, 1-8 (http//doi.org/10.5334/oagh.1354).

Kim, Y, Kim, S.W, Chang, H.H, Kwon, K.T, Bae, S & Hwang, S. (2020). Trends of Cause of Death among Human Immunodeficiency Virus Patients and the Impact of Low CD4 Counts on Diagnosis to Death: a Retrospective Cohort Study. *J Korean Med Sci*. 35(41): e355. https://doi.org/10.3346/jkms.2020.35.e355.

Kochanek, K.D, Murphy, S.L, Xu J, Arias E. (2019). Deaths: Final Data for 2017. *Natl Vital Stat Rep*. 68(9):1-77. PMID: 32501199.

Lamprecht, D.J, Martinson, N & Variava, E (2023). Effects of HIV on mortality among hospitalised patients in South Africa. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10157426/#

Lawn, S.D, Harries, AD, Anglaret, X, Myer, L, & Wood, R. (2008). Early mortality among adults accessing antiretroviral treatment programmes in sub-Saharan Africa. *AIDS London, England)*, 2215), 1897-1908. https://doi.org/10.1097/QAD.0b013e32830007cd.

Li Y, Zeng X, Liu J, et al. Can China achieve a one-third reduction in premature mortality from non-communicable diseases by 2030? BMC Med 15, 132 (2017). https://doi.org/10.1186/s12916-017-0894-5

Mabaso, M, Makola, L & Naidoo, L. (2019). HIV prevalence in South Africa through gender and racial lenses: results from the 2012 population-based national household survey. *Int J Equity Health* 18, 167 (2019). https://doi.org/10.1186/s1239-019-1055-6.

Malangu, H, Ntuli, S, & Alberts, M. (2014). Causes of death in patients treated at a tertiary hospital in Limpopo province- a retrospective study 2008-2010. *Southern African Journal of Infectious Diseases* 29(2):80-86, (https://doi.org/10.1080/23120053.2014.11441575).

Maphanga, W.R.M. (2009). *An Epidemiological study of natural deaths in Limpopo*. MMED (Health Studies). University of Limpopo, Polokwane.

Maponya, F. (2013). 'Hospital staff on warpath'. *Sowetan 8 February*. (online). Available at: https://www.sowetanlive.co.za/amp/news/2013-02-08hospitalstaffonwarpath/. Date accessed 01 09 2017.

Marco J, Barba, R, Plaza, S, Losa, J.E, Canora, J & Zapatero, A. (2010). Analysis of the mortality of patients admitted to internal medicine wards over the weekend. *American Journal of Medical Quality* 25(4):312-318. (http://www.sagepub.com/journals Permissions.nav).

Marinda, E., Simbayi, L., Zuma, K. (2020). Towards achieving the 90-90-90 HIV targets: results from the south African 2017 national HIV survey. *BMC Public Health* **20**, 1375 (2020) https://doi.org/10.1186/s12889-020-09457-z

May, M.T, Vehreshild, J, Trickey, A, Obel, N, Reiss, P, Bonnet, F. (2016). Mortality according to CD4 count at the start of combination antiretroviral therapy among HIV infected patients followed up for 15 years after the start of treatment: Collaborative Cohort Study. *Clinic Infect*.

Mfinanga S, Chanda D, Kivuyo SL, Guinness L, Bottomley C, Simms V, Chijoka C, Masasi A, Kimaro G, Ngowi B, Kahwa A, Mwaba P, Harrison TS, Egwaga S, and Jaffar S. RESTART trial team, Cryptococcal meningitis screening and community-based early adherence support in people with advanced HIV infection starting antiretroviral therapy in Tanzania and Zambia: an open-label, randomised controlled trial. Lancet. 2015 May 30; 385(9983):217-82. doi:10.10.16/S0140-6736 (15)60164-7

Myer L, Smith, E & Mayosi, BM. (2012).Medical inpatient mortality at Groote Schuur Hospital, Cape Town, South Africa, 2002-2009. *South African Medical Journal* 2013; 103(1)28-31. DOI:10.716/SAMJ.6285

Naidoo, A. (2009). *Trends in Adult Medical admissions at Tambo Memorial Hospital between 2005 and 2007*. MPH (Health Studies) dissertation. University of Witwatersrand, Johannesburg.

Nasir N, Jamil B, Siddiqui S, Talat N, Khan FA, and Hussain R (2015). Mortality in sepsis and its relationship with gender. Pak J Med Sci. 2015Sep-Oct; 31(5): 1201-1206. doi:10.12669/pjms.315.6925 PMCID:PMC4641283 PMID:26649014

Niv Y, Berkov E, Kanter P, Abrahmson E, & Gabbay U. Early in-hospital mortality in internal medicine wards (within 24 hours): a potential quality indicator or a variable affected by multiple factors? Harefuah. 2017 Apr;156(4):242-245. Hebrew. PMID: 28551929.

Nojilana B, Bradshaw D, Pillay-van-Wyk V, Msemburi W, Somdyala N, Joubert JD, & Groenewald P. Persistent burden from on-communicable diseases in South Africa needs strong action. S Afr Med 2016; 106 (5):436-437. DOI:10.16/SAMJ.2016.106i510776.

Otieno G, Whiteside YO, Achia T, et al. Decreased HIV-associated mortality rates during scale-up of antiretroviral therapy, 2011ï 2016. *AIDS*. 2019;33(15):2423ï 2430. 10.1097/QAD.0000000000002374 [PubMed] [CrossRef] [Google Scholar]

Pillay-van Wyk V, Msemburi W, Laubscher R, Dorrington RE, Groenewald P, and Bradshaw. HIV/AIDS mortality trends pre and post ART for 1997-2012 in South Africa-have we turned the tide? S Afri Med J. 2019 Dec5;109(11b):41-44. Doi: 10.7196/SAJ.2019.v109i11b.14283. PMID:32252867.

Pillay-van Wyk V, Msemburi W, Laubscher R, Dorrington RE, Groenewald P, Glass T et al (2016). Mortality trends and differentials in South Africa from 1997 to 2012: second

National Burden of Disease Study. *Lancet.* DOI: https://doi.org/10.1016/S2214-109X(16)30113-9

Prin M, Ji R, Kadyaudzu C, Li G & Charles, A. (2020). Associations of day of week and time of day of ICU admission with hospital mortality in Malawi. *Trop Doct*. 50(4):303-311. DOI: 10.1177/0049475520936011. Epub 2020 Jul 9. PMID: 32646293.

Sanclemente C, Barcons M, Moleiro MA, et al. Hospital mortality in an Internal Medicine service. An Med Interna 2004;21:317ï 21.PubMedGoogle Scholar

Sharp, A.L, Choi, H & Hayward, RA. (2013). Don't get sick on the weekend: an evaluation of the weekend effect on mortality for patients visiting US EDs. *Am J Emerg Med*. 31(5):835-7.doi: 10.1016/j.ajem.2013.01.006. *Epub 2013* Mar 1. PMID: 23465873.

Sheppard, M. (2004). *Appraising and using Social Research in Human Services: An introduction for social work and Health Professionals*. London: Jessica Kingsley Publishers.

Smith, C.J, Ryom, L, Weber, R, Morlat, P, Pradier C, Reiss P, Kowalska JD, de Wit S, Law M, el Sadr W, Kirk O, Friis-Moller N, Monforte Ad, Phillips AN, Sabin CA, Lundgren JD; D:A:D Study Group. (2014). Trends in underlying causes of death in people with HIV from 1999 to 2011 (D:A:D): a multicohort collaboration. *Lancet* 384(9939): 241-8. doi:10.1016/S0140-6736(14)60604-8. PMID: 25042234.

Smolin B, Levy Y, Sabbach-Cohen E, Levi L, Mashiach T. Predicting mortality of elderly patients acutely admitted to the Department of Internal Medicine. Int J Clin Pract 2015; 69:501ï 08.CrossRefPubMedGoogle Scholar

Sun, J, Girling, A.J, Aldridge, C, Evison, F, Beet, C, Boyal, A, Rudge, G, Lilford, R.J & Bion, J. (2019). Sicker patients account for the weekend mortality effect among adult emergency admissions to a large hospital trust. *BMJ Quality & Safety* 28: 223-230.

Statistics South Africa. (2014). Mortality and causes of death in South Africa, 2013. Findings from the death notification. (Online). Available from: https://statssa.gov.za/publications/P03093/P0309032014. Accessed 30012021.

Statistics South Africa. (2018). Mortality and causes of death in South Africa, 2017: Findings from the death notification. (Online). Available from: https://statssa.gov.za/publications/P03093/P030932018. Accessed 29012021.

Statistics South Africa. (2019). Estimating completeness of adult mortality data at a subnational level. (Online). Available from: https://www.statssa.gov.za. Accessed 30012021.

Statistics South Africa. *Mid-year population estimates 2022 [homepage on the Internet]*. [cited 2022 Sep 13]. Available from: https://www.statssa.gov.za

Stewart, K, Choudry MI, Buckingham, R. (2016). Learning from hospital mortality. *Clin Med*. 16:530. 10.7861/clinmedicine.16-6-530.

Struwig, F.W & Stead, GB. (2001). *Planning, designing, and reporting research*. South Africa: Pearson Education.

Sousa L, Marques AR, Burmester I, Apolinári I, Brandão I (2017) Mortality at a Portuguese Internal Medicine Service: Is Patient Allocation a Determinant Factor? J Palliat Care Med 7:306. doi:10.4172/2165-7386.1000306

UNAIDS data 2021 | *UNAIDS [homepage on the Internet]*. [cited 2023 Aug 02]. Availablefrom: https://www.unaids.org/en/resources/documents/2021/2021_unaids_data

Wajanga, BMK, Webster LE, Peck RN, Downs JA, Mate K, Smart LR, &, Fitzgerald DW. (2014). Inpatient mortality of HIV-infected adults in sub-Saharan Africa and possible interventions: a mixed methods review. *BMC Health Serv Res* 14:627. https://doi.org/10.1186/s12913-014-0627-9.

Whitfield, M.J & Blitz, J.J. (2000). Hospital mortality meeting-are they essential. *SA Fam Pract* 22(1):7-9.

WHO. *Global status report on non-communicable diseases 2014.* Geneva;WHO;2014. Google Scholar

7. ANNEXURES

7.1 ANNEXURE A: RESEARCH SCHEDULE

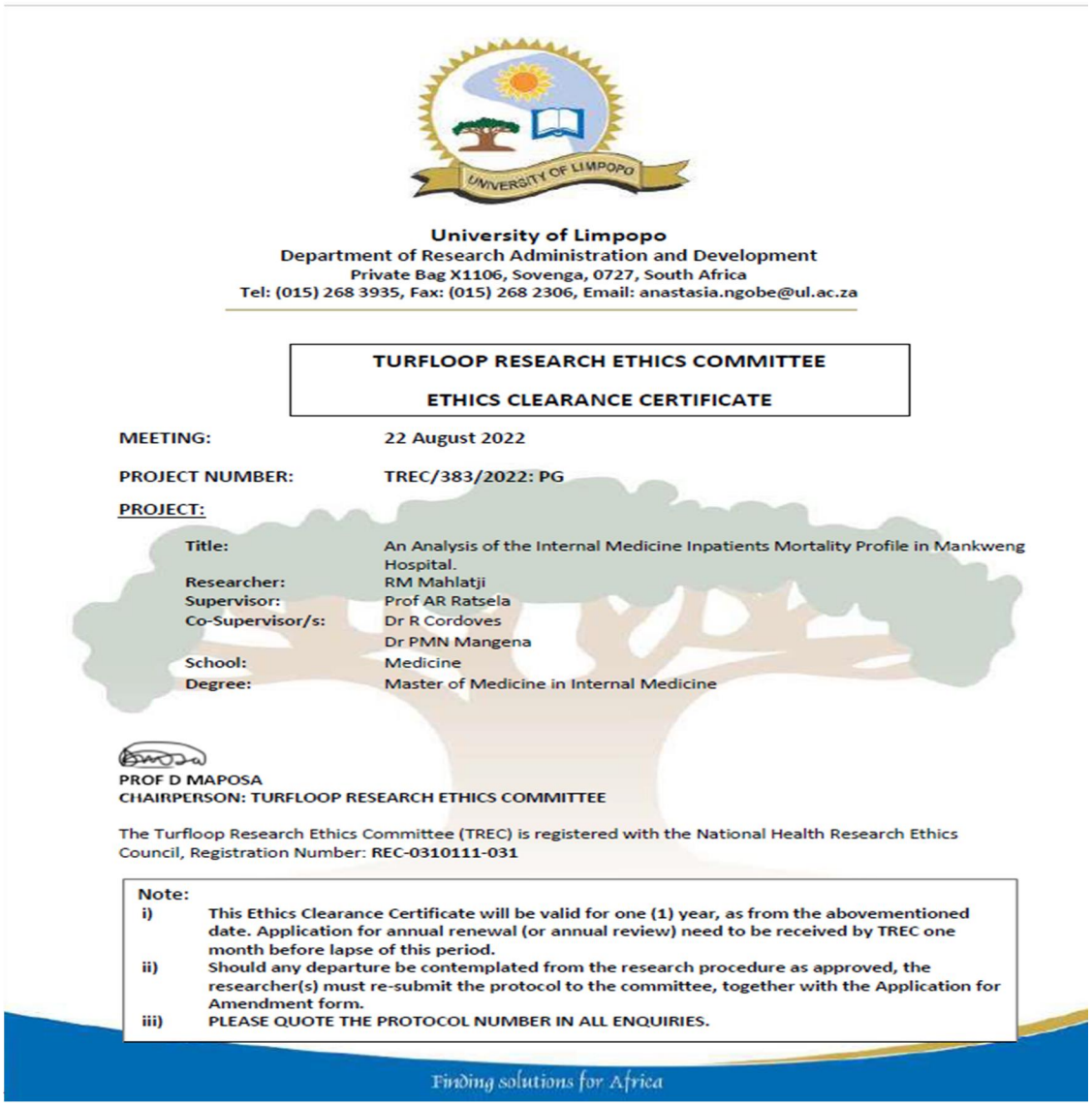
The research schedule is as follows:

Year	**2022**											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Develop protocol	x											
Meeting with supervisor	x	x	x	x	x	x	x	x	x	x	x	x
Protocol corrections	x	x										
Submission to Senior Degree Committee		x	x									
Submission to ethics committees			x	x								
Data collection						x	x					
Data analysis								x	x			
Submission of final copy									x	x		

7.2 ANNEXURE B: DATA COLLECTING TOOL QUESTIONNAIRE

SECTION A Biographic data								
Patientôs identification number:								
1. Age	<35		35-60			>60		
2. Sex			M			F		
3. Admission date			4. Admission time					
5. Day of the week								
5.1Week day (Mon 8h00-Frid 16h00)					5.2Weekend (Fri 16h00- Mon 8h00)			
Mon	Tues	Wed	Thurs	Fri	Fri	Sat	Sun	Mon
6. Date of death			7. Time of death					
8.No of days from admission to death			9. Death within 48 hours of admission		YES			
					NO			
SECTION B Cause of death								
10. Cause of death								
10.1 Communicable								
TB	HIV/ AIDS	Malaria	Influenza	Pneumonia	Diarrhea	Liver disease	Others	
10.2 Non-communicable								
DM	Renal failure	Hypertensive diseases	COPD Asthma	Other chronic lung disease	Haematological malignancy	Other malignancies	CVA	Ischemic heart disease	Others
10.3 Unnatural causes								
Homicide	Suicide	Falls	Poisoning	Overdoses	Drowning	Others		
SECTION C Investigations								
11. HIV ELISA POSITIVE			YES					
			NO					
12. CD4 in cells/mm³								
a. <50		b. 51-99		c. 100-199		d. >200		
13. On ARVs		YES		NO				

7.3 ANNEXURE C: TREC ethics approval



University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: 22 August 2022

PROJECT NUMBER: TREC/383/2022: PG

PROJECT:

Title:	An Analysis of the Internal Medicine Inpatients Mortality Profile in Mankweng Hospital.
Researcher:	RM Mahlatji
Supervisor:	Prof AR Ratsela
Co-Supervisor/s:	Dr R Cordoves Dr PMN Mangena
School:	Medicine
Degree:	Master of Medicine in Internal Medicine

PROF D MAPOSA
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

i) This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.

ii) Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.

iii) PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

Finding solutions for Africa

7.4 ANNEXURE D: Department of Health Limpopo approval letter

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

Department of Health

Ref : LP_2022-09-028
Enquires : Ms PF Mahlokwane
Tel : 015-293 6028
Email : Phoebe.Mahlokwane@dhsd.limpopo.gov.za

REBECCA MAHLAKO MAHLATJI

PERMISSION TO CONDUCT RESEARCH IN DEPARTMENTAL FACILITIES

Your Study Topic as indicated below;

AN ANALYSIS OF THE INTERNAL MEDICINE INPATIENT MORTALITY PROFILE IN MANKWENG HOSPITAL

1. Permission to conduct research study as per your research proposal is hereby Granted.
2. Kindly note the following:
   a. Present this letter of permission to the Office Clinical Executive Director a week before the study is conducted.
   b. This permission is **ONLY** for **Mankweng Hospital**
   c. In the course of your study, there should be no action that disrupts the routine services, or incur any cost on the Department.
   d. After completion of study, it is mandatory that the findings should be submitted to the Department to serve as a resource.
   e. The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
   f. **The approval is only valid for a 1-year period.**
   g. If the proposal has been amended, a new approval should be sought from the Department of Health
   h. Kindly note that, the Department can withdraw the approval at any time.

Your cooperation will be highly appreciated

PP **Head of Department** 24/10/2022 **Date**

Private Bag X9302 Polokwane
Fidel Castro Ruz House, 18 College Street. Polokwane 0700. Tel: 015 293 6000/12. Fax: 015 293 6211.
Website: http/www.limpopo.gov.za

The heartland of Southern Africa – Development is about people!

7.5 ANNEXURE E: Mankweng Hospital approval letter

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH
MANKWENG HOSPITAL

Ref: S5/3/1/2
Enq: Modula MC
Tel: 015 286 1042/1022
Email:motlatso.modula@dhsd.limpopo.gov.za
From: HR Training and Development

TO: REBECCA MAHLAKO MALATJI

REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT MANKWENG HOSPITAL

1. The above matter has reference.
2. This is to confirm that the CEO has granted you permission to conduct research on

   "AN ANALYSIS OF THE INTERNAL MEDICINE INPATIENT MORTALITY PROFILE IN MANKWENG HOSPITAL"

3. We wish you all the best with your research.

Yours in service delivery

Director: Corporate Services
Mr. Sibuyi MV

02/11/2022
Date

Acting Chief Executive Officer
Dr. Muila SL

03/11/2022.
Date

DEPARTMENT OF HEALTH
MANKWENG HOSPITAL
HRD
03 NOV 2022
PRIVATE BAG X111
SOVENGA 0727
LIMPOPO PROVINCE

Private Bag X1117, SOVENGA, 0727 Tel: 015 286 1000 Fax: 015 267 0206
Houtbos Road, Sovenga
Restricted
The heartland of Southern Africa – development is about people!

7. 6 ANNEXURE F: Results

Table 7.6.1: Association between communicable diseases (CDs) and gender

	GENDER		P- value
CD	**Male**	**Female**	
HIV			**0.766**
No	61 (55%)	62 (53%)	
Yes	50 (45%)	55 (47%)	
TB			**0.009**
No	88 (79.3%)	107 (91.5%)	
Yes	23(20.7%)	10(8.5%)	
Pneumonia			**0.398**
No	70 (63.1%)	80 (68.4%)	
Yes	41 (36.9%)	37 (31.6%)	
Diarrhea			**0.790**
No	101 (91%)	113 (96.6%)	
Yes	10 (9%)	4 (3.4%)	

Table 7.6.2.: Association between non-communicable diseases (NCDs) and gender

NCDs	**Gender**		**P value**
	Male	**Female**	
Renal failure			**0,451**
No	69 (62.2%)	67 (57.3%)	
Yes	32 (37.8%)	50 (42.7%	
HT			**0.476**
No	87(78.4%)	87 (74.4%)	
Yes	24 (21.6%)	30 (25.6%)	
DM			**0.842**
No	88(79.3%)	94 (80.3%)	
Yes	23(20.7%)	23 (19.7%)	
Liver diseases			**0.851**
No	105 (94.6%)	110(94.0%)	
Yes	6(5.4%)	7 (6.0%)	
COPD/Asthma			**0.014**
No	101(91.0%)	115(98.3%)	
Yes	10(9.0%)	2 (1.7%)	
Haematological malignancies			**0.063**
No	109 (98.2%)	109(93.2%)	
Yes	2 (1.8%)	8 (6.8%)	
CVA			**0.246**
No	102(91.9%)	102(87.2%)	
Yes	9(8.1%)	15(12.8%)	
Other malignancies			
No			**0.790**
Yes	101 (91.0%)	113(96.6%)	
	10 (9.0%)	4 (3.4%)	

Table 7.6.3 Association between age and causes of death (n=228)

	AGE GROUPS			P -value
CDs	**<35**	**35-60**	**>60**	
HIV				**<0.001**
No	7(21.9%)	33(35.1%)	83(81.4%)	
Yes	25(78.1%)	61(64.9%)	19(18.6%)	
Pneumonia				**0.552**
No	28 (68.8%)	58 (61.7%)	70 (68.6%	
Yes	10(31.3%)	36(38.3%)	32 (31.4%)	
TB				**0.013**
No	25(78.1%)	75(79.8%)	95(93.1%)	
Yes	7(21.9%)	19(20.2%)	7(6.9%)	
Diarrhea				**0.154**
No	30(93.8%)	85(90.4%)	99(97.1%)	
Yes	2(6.3%)	9(9.6%)	3(2.9%)	
NCDs				
Renal failure				**0.027**
No	23(81.3%)	53(56.4%)	57(55.9%)	
Yes	6(18.8%)	41(43.6%)	45(44.1%)	
HT				**<0.001**
No	32(100.0%)	77(81.9%)	65(63.7%)	
Yes	0(0.0%)	17(18.1%)	37(36.3%)	
DM				**<0.001**
No	31(96.9%)	87(88.3%)	68(66.7%)	
Yes	1(3.1%)	11(11.7%)	34(33.3%)	
CVA				**0.029**
No	32(100%)	86(91.5%)	86(84.3%)	
Yes	0(0%)	8(8.5%)	16(15.7%)	
Liver diseases				**0.592**
No	31(96.9%)	87(92.6%)	97(95.1%)	
Yes	1(3.1%)	7(7.4%)	5(4.9%)	
COPD/Asthma				**0.075**
No	32(100.0%)	91(96.8%)	93(91.2%)	
Yes	0(0.0%)	3(3.2%)	9(8.8%)	
Haematological malignancies				**0.040**
No	28(87.5%)	90(95.7%)	100(98.0%)	
Yes	4(12.5%)	4(4.3%)	2(2.0%)	

Table 7.6.4 Association between day of the week and causes of death (n=86)

	WEEKDAY		P value
CDs	**NO**	**YES**	
HIV			**0.660**
No	75(52.8%)	48(55.8%)	
Yes	67(47.2%)	38(44.2%)	
Pneumonia			**0.108**
No	99(69.7%)	51(59.3%)	
Yes	43(30.3%)	35(40.7%)	
TB			**0.181**
No	118(83.1%)	77(89. %)	
Yes	24(16.9%)	9(10.5%)	
Diarrhea			**0.682**
No	134(94.4%)	80(93.0%)	
Yes	8(5.6%)	6(7.0%)	
NCDs			
Renal failure			**0.303**
No	81(57.0%)	55(64.0%)	
Yes	61(43.0%)	31(36.0%)	
HT			**0.660**
No	107(75.4%)	67(77.9%)	
Yes	35(24.6%)	19(22.1%)	
CVA			**0.639**
No	126(88.7%)	78(90.7%)	
Yes	16(11.3%)	8(9.3%)	
DM			**0.825**
No	114(80.3%)	68(79.1%)	
Yes	28(19.7%)	18(20.9%)	
Liver diseases			**0.262**
No	132(93.0%)	83(96.5%)	
Yes	10(7.0%)	3(3.5%)	
COPD/Asthma			**0.747**
No	134(94.4%)	82(95.3%)	
Yes	8(5.6%)	4(4.7%)	
Haematological malignancies			**0.137**
No	138(97.2%)	80(93.0%)	
Yes	4(2.8%)	6(7.0%)	