TUBERCULOSIS TREATMENT OUTCOME IN AN ANTIRETROVIRAL TREATMENT PROGRAMME AT LEBOWAKGOMO HOSPITAL, LIMPOPO PROVINCE

MASTER IN PUBLIC HEALTH

RG MONEPYA

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SPINE OF THE BOOK

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by

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MINI-DISSERTATION

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DEDICATION

A special dedication to my mother, Moloko Raesibe.

To my husband Kgothoane Stanley, for his understanding and unconditional support he has shown during this academic journey.

This is also dedicated to my children, Lerato, Lethabo and Lesego for them to know that education is the mother of success.

DECLARATION

I declare that TUBERCULOSIS TREATMENT OUTCOME IN AN ANTIRETROVIRAL TREATMENT PROGRAMME AT LEBOWAKGOMO HOSPITAL, LIMPOPO PROVINCE for the degree of Master in Public Health has not been previously submitted by me for a degree in this or any other university; that is my work in design and in execution, and that all material contained herein has been duly acknowledged. is my own work and that all the sources that I have used or qouted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other institution.

Ms Monepya RG 08 April 2022

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ABSTRACT

Background:

Tuberculosis(TB) and Human Immunodeficiency virus(HIV) continues to be a public health concern globally. There is no data on TB outcomes on HIV programme outcome in Lebowakgomo hospital of Limpopo Province. The main objective of this study was to determine the TB treatment outcomes in TB/HIV co-infected people at Lebowakgomo hospital in Limpopo Province.

Methodology:

A quantitative retrospective design was used in the study in which a sample size of 180 patients's files who are 18 years and above and TB/HIV co-infected were reviewed. A self-designed data collection tool was used to collect data. The tool covered variables such as age, gender, HIV status, CD4 cell count, type TB, duration on TB treatment and the outcome. Data was analysed using the STATA statistical software version 12 for Windows (STATA Corporation, College Station, Texas).

Results:

The majority of records were age group 35-44 years at 32%. There was a statistical significance differences ($p<0.001$) between males and females in relation to age groups. TB treatment success rate was 68.9% and mortality 16.9%. Females were more likely to complete TB treatment successfully than males. Overall age, gender, previous TB infections, TB type, duration on ART and CD4 Count were not significantly associated with treatment outcomes amongst TB/HIV co-infected people.

Conclusion:

This study has revealed that TB treatment success rate in HIV co-infected is lower (68.3%) than the WHO target of 85%.

Key concepts

Tuberculosis, Antiretroviral programme, Tuberculosis treatment outcome

Table of Contents

LIST OF FIGURES

ABBREVIATIONS

ARV	Antiretroviral
ATT	Anti Tuberculosis Treatment
CD4	Cluster of Differentiation 4
CXR	Chest Xray
DoH	Department of Health
DOT	Direct Observed Treatment
EMB	Ethambutol
HIV	Human Immunodeficiency Virus
INH	Isoniazid
IPT	Isoniazid Preventive Therapy
MDR	Multi Drug Resistant
MTB	Mycobacterium
NSP	National Strategic Plan
PHC	Primary Health Care
PTB	Pulmonary Tuberculosis
People living with HIV	People Living with Human Immunodeficiency Virus
RIF	Rifampin
STIs	Sexually Transmitted Infections
SA	South Africa
SSA	Sub-Saharan Africa
TB	Tuberculosis

TREC Turfloop Research Ethics Committee

WHO World Health Organization

DEFINITIONS OF CONCEPTS

Antiretroviral programme: It is a set of related measures of a therapy that consist of a combination of Antiretroviral (ARV) drugs to maximally suppress the HI virus and stop the progression of HIV disease (Stevenson & Linberg, 2015). In the current study antiretroviral programme refers to the programme that is offered by the Department of Health to people living with HIV for access of antiretroviral therapy with an aim to assist HIV positive patients to manage their conditions.

Tuberculosis: It is an infection of the lungs and/or other organ caused by bacteria Mycobacterium Tuberculosis, that spread from person to person through air (Hawker, Begg, Blair, Rentjies, Weinburg et al., 2012). In the current study, tuberculosis will be referred as it is above.

Tuberculosis control: It is a combination of measures aimed at minimizing the risk of TB transmission within populations (WHO, 2019). In the study TB control refers to the strategies that are implemented by government for the control and manage TB.

HIV: According to Hawker et al (2012) Human Immunodeficiency Virus is a retrovirus that infects cells of the immune system, destroying or impairing their function. It is spread from person to person as a result of exposure to infected blood or tissues. In the current study, HIV will be refereed as it is above

Tuberculosis treatment outcome: Refers to the results or effects of TB medications given to people living with TB, to assess the effectiveness (WHO, 2019). In the current study, tuberculosis treatment outcome will refer to the results or effects of medications given to people diagnosed with TB such as cure, death, successful treatment completion, treatment defaulters or treatment failure.

1. CHAPTER 1

1.1 INTRODUCTION AND BACKGROUND

HIV and TB infections are the leading cause of morbidity and mortality globally. TB has a serious and alarming burden on the antiretroviral therapy (ART) which is the HIV treatment. HIV infection has originated in Eastern Africa (EA) between 1910 and 1950 by the transmission of a precursor virus from a chimpanzee, moreover it has now spread across the world (Frederick & Southwick, 2008). The Sub-Saharan Africa (SSA) remains the epicenter of the epidemic as 3 to 4 million new infections occur annually and 30 million Africans are living with HIV (Frederick & Southwick, 2008). In 2017, approximately 65% of all new HIV infections occurred in sub-Saharan Africa (George, Cawood, Puren, Khanyile, Gerritsen & Govender et al., 2020).

TB is a major contributor to the global burden of disease, causing more than a million deaths annually (Kyu, Maddison, Henry, Ledesma, Wiens & Reiner et al., 2018). Given an emphasis on equity in access to diagnosis and treatment of tuberculosis in global health targets, evaluations of differences in tuberculosis treatment outcomes are crucial (Ledesma, Ma, Vongpradith, Maddison, Novotney & Biehl et al., 2021). TB is an important contributor to morbidity and mortality globally. Despite of being preventable and treatable, tuberculosis is the leading cause of death in communities. agent. The Sustainable Development Goals (SDGs) and the WHO End TB Strategy have defined targets for ending the tuberculosis epidemic that aim to reduce tuberculosis mortality by 95% and incidence by 90% by 2035 (Rowley & Mugala, 2021).

WHO, 2019 reported that about 1% of the population of about 50 million develop active TB disease each year and out of 500 000 incident cases in South Africa (SA), it is estimated that about 330 000, 66% of people have both HIV and TB infection (WHO Report, 2018)

The overall goal of the National Strategic Plan (NSP) of South Africa is to eliminate HIV, TB and Sexually Transmitted Infections (STIs) as public threats by the year 2030. TB and HIV co-infection rate in SA is nearly 60% which implies that the country is TB epidemic

and is directly linked to HIV incidence and prevalence. However, the TB treatment which allowed cure for a period of six months, was observed in 1980 and there are a variety of outcomes with regard to TB treatment and ART (Malaza, Smith, Mdaka, Haynes & Shezi, 2016).

TB and HIV are infectious diseases that seem to be accounting for most deaths (Jamal Saad Al-Rahamneh, 2017), that worries a lot as TB is curable and treatable. It affects most of the people as it is an infectious disease that spread from person to person by an inhalation of the nuclei Mycobacterium tubercle (Frederich & Southwick, 2008; Harding, 2020). The study conducted in Ethopia, revealed that TB was believed to be an opportunistic disease that can affect the ART programme which can further affect the treatment outcome (Sinshaw, Alemu, Fekadu & Gizachew, 2017). HIV infection is the primary reason for the failure to meet tuberculosis control targets (at least 85 % cure rate among new sputum smear positive TB cases) in countries with high HIV infection. This is attributable to factors such as over diagnosis of sputum smear negative TB, under diagnosis of sputum smear-positive TB (Djouma, Noubom, Ngomba, Donfack, Kouomboua & Saah, 2015), low cure rates, high morbidity, mortality (Beyene, Geresu & Mulu, 2016) and default rates during treatment, and atypical clinical presentation of TB in HIV infected patients (Huerga, Ferlazzo, Wanjala, Bastard, Bevilacqua & Ardizzoni et al., 2019).

Tanue et al.,(2019) cited in the study conducted in Fako Division of Cameroon, that there is a high TB treatment outcome success rate among TB/HIV co-infected patients and yet still below the WHO target of 85%.Factors associated with successful TB treatment outcome were found to be receiving ART and Clotrimoxazole prophylaxis. Furthermore, it was reported that patients treated with Bedaquiline ad linezolid containing regimen were found to have an improved treatment outcome and survuval rates in Drug Resistance-TB HIV patients (Padayatchi et al.,2020). It implies that TB/HIV co-infected patients for an improved treatment outcomes, prophylaxis regimen need to be considered and an early initiation of both TB and HIV treatment.

Moreover, HIV infection leads to diagnostic challenges and delays in identifying TB that profoundly impacts treatment outcome (Shaweno & Worku, 2012; Sinshaw et al., 2017)

The international community has committed to ending the TB epidemic by 2030. This will require multi-sectoral action with a focus on accelerating socio-economic development, developing and implementing new tools, and expanding health insurance coverage (Harries, Lin, Kumar, Satyanarayana, Takarinda, Dlodlo & Zachariah et al., 2018). South Africa has one of the largest antiretroviral treatment (ART) programmes globally and therefore it is critical that investigations into the TB treatment outcomes amongst patients on ART programme be scientifically conducted. Therefore, the current study aimed to investigate the TB treatment outcomes on both males and females whose ages ranges from 18 years and above Lebowakgomo hospital, who are TB/HIV co-infected patients, on TB and ART programmes.

1.2 RESEARCH PROBLEM

The international community has committed to ending the TB epidemic by 2030. This will require multi-sectoral action with a focus on accelerating socio-economic development, developing and implementing new tools, and expanding health insurance coverage. South Africa has one of the largest ART programmes globally. However, despite the existence of medications that can control HIV and reduce viral transmission, HIV it is still a leading cause of death and health threat to millions of South Africans. HIV-positive TB patients are a challenge to TB services, as they are more likely to have diagnostic delays, are more likely to be infectious for longer and, if not properly managed, may also have poorer TB treatment outcomes. Therefore, HIV infection has the potential to profoundly impact on TB treatment outcomes and is often the main reason for failure to meet control targets in high HIV settings (Nglazi, Bekker, Wood & Kaplan, 2015).

Limpopo is one of provinces most affected by TB and approximately 55% of TB patients in the province were HIV-positive (Houlihan, Mutevedzi, Lessells, Cooke, Tanser & Newell, 2010). The researcher in the current study is based in a clinical setting and she is concerned about the TB treatment outcomes on ART. The researcher observed that

TB/HIV co-infected patients on treatment are down referred to PHC, but on completion of treatment they need to be discharged from the hospital. further observed that some of the patients do not show up or are lost to follow up during treatment. The motive to conduct this study was that, there is no study conducted at Lebowakgomo hospital based on the TB outcomes on PLHIV. TB and HIV affect every person. However, the observation raised a concern that the researcher aimed to investigate the TB treatment outcomes on TB/HIV co-infection as TB treatment is not a life-long treatment and yet treatable.

1.3 LITERATURE REVIEW

Literature review allows the identification of the previous research which enhanced the research topic and the methodology intended for the study. In this literature review, the following themes were discussed: Successful TB treatment outcomes among TB/HIV co-infected patients, unsuccessful TB treatment outcomes among HIV/TB co-infected patients, timing of antiretroviral therapy and TB treatment outcome in TB/HIV co-infection, the effects of HIV on TB, the TB treatment outcomes and adherence among people living with HIV, cure rates for TB in people living with HIV, public health interventions to improve tuberculosis treatment outcomes amongst HIV positive patients. Detailed literature review will be resented in Chapter 2.

1.4 PURPOSE OF THE STUDY

1.4.1 Aim of the study

The study aimed at investigating the TB treatment outcomes on ART programme aim to develop strategies to control TB in Antiretroviral.

1.4.2 Objectives of the study

- To determine the outcomes of TB treatment in PLHIV
- To determine the association between Tuberculosis treatment outcomes, socio-demographics and ART outcomes amongst TB/HIV co-infected patients.

1.5 RESEARCH QUESTION

- What are the TB treatment outcomes in TB/HIV co-infected people at Lebowakgomo hospital in Limpopo Province of South Africa?

- Is there association between TB treatment outcomes and ART outcomes?

1.6 RESEARCH METHODOLOGY

The current study utilized the quantitative, cohort retrospective design to help the researcher to address the research question in terms of collection and analysis of data. According to Barrett & Noble (2019), cohort study is a type of longitudinal study that approach on following the research participants over a period of time. The detailed methodology will be presented in Chapter 3 which will include the sample and population of the study, data collection method, the achievement on reliability and validity of the study and the measures to minimize bias and data analysis.

1.7 ETHICAL CONSIDERATIONS

Research ethics played an important role, striving to make possible that any research study is conducted in due ethical procedures. (Khan, Tareen & Sultan, 2016). The ethical aspects in this study were considered; permission to conduct a study was obtained from the University of Limpopo's Turfloop Research Ethics Committee (TREC) and then from the Provincial Department of Health in Limpopo Province. The detailed ethical considerations will be described in Chapter 3.

1.8. SIGNIFICANCE OF THE STUDY

Investigating TB treatment outcomes on ART will add to the value of public health knowledge base. The Department of Health will be able to use the findings in developing the strategies to control TB and to develop protocols and guidelines for successful treatment outcomes. The recommendations could be used to modify the treatment modalities in TB/HIV co-infection patients. The study would contribute to the eradication of TB and also contribute to minimize the number of deaths that are related to TB/HIV.

1.8 OUTLINE OF CHAPTERS

- Chapter 1: This chapter comprises the study's introduction, background and the research framework
- Chapter 2: This chapter comprises the literature review of the research

- Chapter 3: The chapter describes the research methodology, study design and setting
- Chapter 4: This chapter presents and discusses the findings of the research
- Chapter 5: The chapter provides a summary of the results, limitations, recommendations, an conclusion the context of the research aim and objectives.

1.10 CONCLUSION

This chapter outlined an orientation to the study, research problem, literature review, research methodology and the ethical considerations related to the study. The following Chapter 2 will discuss the literature review. Chapter 3 will present the research methodology employed; chapter 4 highlighted the presentation and interpretation of the study's research findings, and Chapter 5 presents a summary of the study and recommendations emanating from the results of this study.

2 CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

This chapter will present literature review, which enables the provision of a comprehensive overview of literature related to theme/method and synthesizes prior studies to strengthen the foundation of knowledge. Paul & Criado (2020) cited that literature review allows the researcher to identify and synthesize relevant literature to compare and contrast the findings of prior studies in a domain that allow the readers with a state of the art understanding of the research topic, help to identify research gaps which will facilitate future research pastures In this study, literature review focuses on successful TB treatment outcomes among TB/HIV co-infected patients, unsuccessful TB treatment outcomes among HIV/TB co-infected patients, timing of antiretroviral therapy and TB treatment outcome in TB/HIV co-infection, the effects of HIV on TB, the Tuberculosis treatment outcomes and adherence among PLHIV, cure rates for TB in PLHIV and public health interventions to improve tuberculosis treatment outcomes amongst HIV positive patients .

2.2 Successful TB treatment outcomes among TB/HIV co-infected patients

TB is regarded as the leading cause of death for HIV-infected patients, furthermore HIV is also a risk factor for developing active TB. The co-infection has emerged as a major public health threat throughout the world and have the worse treatment outcomes. The increased unsuccessful outcome among TB/HIV patients requires urgent public health interventions Fekude (2020). According to Dravid (2019), in 2016, 10.4 million cases of TB were reported to WHO worldwide wherein India accounted for 2.8 million cases of global TB burden and approximately 0.5 million die annually because of TB and that is a very high number of death rate. Jacobson, Moll, Friedland & Shenoi (2015) cited that TB remains a major public health threat worldwide. Moreover, HIV pandemic has significantly contributed to the rising TB prevalence. South Africa is the fifth in TB incidence globally and the first in number of TB/HIV coinfection cases with 65% of TB patients co-infected with TB/HIV. However, HIV programmes operated separately as vertical treatment models, integration of TB and HIV services has been identified as a way to improve diagnosis and treatment for both HIV and TB. The giving of TB/HIV treatment jointly it was observed to be of better results.

According to Dravid (2019), the use of ART with IPT was initiated after the publication of 2011 WHO IPT guidelines, a subset of patients was initiated on IPT in addition to ART later excluding active TB. Concurrent Co-trimoxazole prophylaxis and ART during TB treatment outcomes for HIV patients beginning TB treatment at hospital level had a high treatment success rate (completion or cure). One in ten patients with low CD4 count at the start of TB treatment had evidenced of mortality in co-infected patients. Identification of patients earlier in the course of the disease in a form of case finding cases and testing programs and to ensure that all the patients are starting treatment timeously is essential in helping reduce TB mortality in co-infected patients. Moreover, it was seen that there was a high rate of defaults among TB/HIV co-infected patients down-referred to PHCs, of which there were loss to follow up at time of linking to PHC, therefore effective referring systems between PHC and hospitals is vital. Down referral need to be done earlier during the course of treatment (Jacobson, Moll, Friedland & Shenoi, 2015). The addition of BDQ and LZD to the treatment regimen improved mortality greater than two-fold (17.2% vs.41.0%)

The global TB control is slowly improving, hence the burden of drug-resistant TB (DR-TB) remains unacceptably high. In patient-level meta-analysis, the aggregate MDR-TB cure rates were 61% with 14% mortality and the outcomes were substantially worse among patients with HIV co-infection (Padayatchi et al 2020). According to the 90 90 90 TB strategy, this is far less than the strategy expectations with high mortality and further it implies that the treatment outcome is not successful. The treatment success rate in the study was found to be 66.2% amongst patients treated with Bedaqueline. For the successful treatment outcome, ART must be provided to all HIV-infected tuberculosis patients, furthermore a good nutritional status to be assured in all HIV-infected TB patients (Ismail et al,.2013).

2.3 Unsuccessful TB treatment outcomes among HIV/TB co-infected patients

Despite the availability of effective diagnosis tool and treatment, TB remains the top cause of death as a single infectious disease. The retreated TB cases and inadequate treatment adherence are found to be associated with unsuccessful outcomes. Patient’s behaviours

and attitudes towards the disease were found to be the major factors that could affect treatment adherence (Ejeta et al., 2018). Types of TB, functional status, WHO staging, history of opportunistic infection showed statistically significant association with TB treatment outcome among the TB/HIV co-infected patients, wherein those with retreatment category has shown a higher unsuccessful treatment rate (23.1%) than the new TB cases (11.9%). Furthermore, the smear positive PTB patients had a higher unsuccessful treatment rate (18.9%) than EPTB (14.3) and smear negative PTB (6.7%) DR-TB is historically associated with poor treatment outcomes and mortality with HIV co-infection (Tola et al., 2019).

Several studies have found a lower TB treatment success rate among co-infected patients and the use of ART has seen as a substantial impact on the reduction of mortality and morbidity among co-infected patients. Improved health systems needed to assist patients in successfully linking to the primary care level without delay (Engelbrecht, Kigozi, Chikobvu, Both, & van Rensburg, 2017). Various countries in Sub-Saharan Africa their reviews on the effect of HIV disease on TB treatment results, have shown the unsuccessful results of TB treatment among TB/HIV co-infected patients compared with TB patients without HIV infection. The handling of the defaulted cases for TB treatment might have contributed to the increased effect of unsuccessful treatment outcome. Other studies have reported that coinfection of TB/HIV drug interactions had more side effects treatment outcomes. Kelantan study showed that smoking is one of the factors associated with unsuccessful treatment outcome among TB/HIV co-infected patients. As smoking damages the lungs, thereby causing the vulnerability to acquire TB. Moreover, low CD4 count is significantly associated with unsuccessful treatment outcomes where it resulted from the late initiation of ART during TB treatment, the low CD4 counts suggest a high viral load of which the immune system of the body is lowered or weakened (Azeez, Ndege & Mutambayi, 2018).

2.4 Timing of antiretroviral therapy and TB treatment outcome in TB/HIV co-infection.

TB remains one of the most common oppotunistic infections among the people living with HIV/AIDS (Chelkeba et al., 2020. The timing of ARV and TB treatment are of important as the two happen to be affecting one another. Previous studies showed reductions in HIV-associated mortality and morbidity among TB/HIV co-infected individuals who start ART early and was asscіated with increased survival. The WHO (2020) revised guidelines which recommend the initiation of ART among TB/HIV co-infected patients, irrespective of CD4 cell count, within eight weeks of starting TB treatment. For the treatment of TB/HIV infection, the guidelines recommend the initiation of the ART within two weeks of the start of TB treatment and the provision of the ARV drugs Tenofovir, Lamividine and Efavirez (TDF/3TC/EFV) to ART-naïve patients, the guidelines further recommend both the provision of Isoniazid preventive therapy (IPT) for pre-ART patients to reduce the incidence of TB, and intensified TB case finding (ICF) for all patients in pre-ART and ART follow-up to enable early diagnosis and treatment of TB (Tweya et al., 2014).

The success of TB control is threatened by the increase in HIV associated TB. 9.6 million patients globally were estimated to have developed TB of whom 12% were co-infected with HIV. 33% died while undergoing anti-tuberculosis treatment (ATT). The high mortality rate is a concern considering that TB can be successfully cured with standard ATT regimens and a long-term ART therapy that can successfully manage HIV. According to Chelkeba et al (2020) Integrated therapy is crucial for HIV-infected patients with TB as TB-related mortality in HIV-infected patients is high during the first few months of TB treatment. Early ART was associated with lower risk of overall mortality and TB treatment failure compared with late ART. All TB-HIV patients are initiated on ART and cotrimoxazole preventive therapy in line with National AIDS Programme guidelines. Patients starting ART before ATT results in unsuccessful outcomes (Thi, Shewale & Harries 2016). This implies that patients who are TB/HIV co-infected need to be initiated on both TB and ART immediately, to have successful treatment outcomes. TB/HIV co-infected patients are started on ART regardless of CD4 cell count.

2.5 The effects of HIV on TB

According to (Winter et al,2020) HIV infection increases susceptibility to TB disease by increasing the rate of progression from latent TB infection to active disease. There is evidence that overall, TB may be less infectious in patients who also have HIV. Wales and Northern Ireland, conducted a retrospective study in England, it was found that PTB patients with HIV seemed to transmit disease less than individuals without the co-infection.

Some people with HIV infection will have a negative test result even if they are infected with TB microorganisms due to the effects of immune system reaction to the tests, furthermore people with HIV who test negative for TB may need further medical evaluation, especially if they have symptoms of TB disease (CDC, 2020). If a person is infected with HIV, it is important to know if a person have TB infection as HIV weakens the immune system. If a person has HIV, it is very important to get a TB test so that they be treated both.

The relative risk of TB doubles in the first year after HIV infection, when CD4 counts are still preserved and continues to increase during the years after seroconversion as CD4 counts decrease. HIV increases the risk of progression to active TB in both primary TB infection and the reactivation of latent TB. HIV further impairs the ability of the immune response to contain TB. The immediate initiation of TB/HIV is suggestive. In people with latent TB, HIV infection accelerates and facilitates the progression to reactivate TB (Thi, Shewale & Harries, 2016).

The clinical presentation of TB in HIV-infected persons has been reviewed, patients presents with subacute systemic and respiratory symptoms, including fever, weight loss, cough. HIV- infected patients with high CD4 counts have clinical manifestations of TB similar to those of TB patients without HIV infection. As the CD4 counts falls below 200 cells/µl, HIV-infected patients with Pulmonary TB (PTB) are more susceptible to have atypical CXR findings, including pleural effusion, lower or middle lobe infiltrates. TB in a patient with HIV is curable. A study conducted from Cote d'Ivoire showed that the mortality

rates for co-infected patients whose CD4 counts were less than 200 cells/µl was higher 10% than those with CD4 count of between 200 and 499 cells/µl 4% after the initiation of TB treatment (Kwan & Ernst 2011).

2.6 The Tuberculosis treatment outcomes and adherence among people living with HIV

Adherence refers to the completeness with which patients follow medical instructions, however it can have an important influence on treatment outcomes (Vernon, Fielding, Savic, Dodd & Nahid, 2019). TB and HIV co-infection challenges treatment and worsens the outcome of TB treatment (Tanue et al,2019). Alipanah, Jarlsberg, Miller, Linh, Falzon et al, (2018) cited that adherence to treatment is challenging, regarding the complexity, tolerability and long duration of treatment regimens that are currently available; having the intensive phase (daily medication for two months) and the continuation phase (daily medication for 4 months). In severe forms of TB or complicated diseases like (Meningitis, TB bones/joints, milliary TB) treatment may be extended to 9 months (2 months intensive and 7 months' continuation phase). That is quite a long duration of which a patient might not tolerate if there are no supporting systems such as reminder services and tracer teams (Department of health South Africa, 2017).

Low adherence increases the risk of poor outcomes which include treatment failure, relapse and development of drug resistance. Interventions need to be identified that are most likely to improve adherence and outcomes, of which they will be discussed in public health interventions (Alipanah et al., 2018). Tuberculosis non-adherence is the major challenge in TB treatment which leads to multidrug as well as extended drug-resistant TB. In the study conducted in Northwest Ethiopia, it was found that the non-adherence in anti-TB treatment are drug side effects, forgetting to take medication, being away from home, missing date of appointment, lack of transportation cost, lack of social support and poor communication between patients and health care providers and stock out of medicines. Moreover, it resulted in length severity of illness, death, disease transmission and drug resistance. As a clinical observation some patients stop taking their medication as a results of not coping with drug side effects (Mekonnen & Azagew, 2018).

There are several factors that are associated with TB incidence among HIV positive individuals including limited functional status, very low CD4 count (less than 50 cells/µl), inappropriate vaccinations, cigarette smoking, non-adherence to drugs and severe immunosuppression. In 2011, the country introduced Isoniazid Preventive Therapy (IPT) among PLHIV which appeared to be effective at reducing the TB incidence upon the immediate initiation of the therapy, that is an evidence of decreased TB infections (Mollel, Maokola, Todd, Msuya & Mahanda, 2019). In 2017, data from countries in which 94 % of PLHIV/TB coinfection live, reported that 77% of HIV positive people on TB treatment were successful in their TB treatment. South Africa show an up to 90% reduction in TB risk among people living with HIV who have latent TB infection (UNAIDS 2019). This implies that the treatment outcomes were successful due to association of factors, such as the immediate initiation of the TB/HIV treatment.

The WHO defines TB treatment success as documented cure or completion of anti-TB therapy whereas unsuccessful outcomes include death, treatment failure, and default from care loss to follow-up. HIV/TB-co-infected people are less likely to have successful treatment outcomes (Carlucci, Blevis, Kipp, Lindegren, Renner et al., 2017). Study concluded that treatment outcomes are favourable when patients are carefully referred from hospitals to clinics. Poor communication referring systems between hospitals and Primary Health Care (PHC) can lead to high defaulter rate and loss to follow-up patients (Jacobson, Moll, Friedland & Shenoi, 2015). Hence, those who are infected will complicate and consequently die. TB and HIV are strongly linked, PLHIV with low CD4 count are more susceptible to active TB. PLHIV are 30 times more likely to develop TB, which increases the progress of HIV/AIDS disease, consequently the TB recurrence to those who were previously diagnosed and treated for TB (Trinh, Nguyen, Nguyen, Nguyen, Sintchenko et al., 2015). TB patients co-infected with HIV have poorer treatment outcome as compared to non-co-infected patients (Sinshaw et al., 2017).

2.7 Cure rates for TB in PLHIV

TB can be treated if treatment is greatly adhered to as recommended. It is a common opportunistic infection in people living with HIV/AIDS. The rates of deaths and lost to follow-up may also affect the success of TB treatment. Studies have been conducted with different success cure rates of TB treatment. The overall success rate of the study done in sub-Saharan Africa was 78.6%, of which it was regarded as higher than previous studies conducted in Africa (Ethopia 28.9%, Nigeria 48.8%, Ghana 64.0% and Cameroon 60.8%) (Tanue et al., 2019). The dissimilarity might be due to the difference in number of the study participants involved in the various study. HIV has been reported as the cause of death in almost 30 million people globally and can lead to acquired immunodeficiency syndrome (AIDS)-related diseases. Further studies have also revealed that *Mycobacterium tuberculosis* (MTB) is influential in public health and is responsible for the most common life-threatening opportunistic infections in patients with HIV worldwide (Roshanaei et al., 2014; Pontali, Sotgiu, Centis, D'Ambrosio, Spanevello et al., 2015; Letang, Ellis, Naidoo, Casas, Sánchez et al., 2020).

The higher case-fatality rate of TB in HIV-infected individuals is likely due to a combination of several factors associated with HIV coinfection; the rapid progression of the disease due to the failure of immune responses to restrict the growth of Mycobacterium tuberculosis (MTB), delayed diagnosis and treatment of TB infection. The number of deaths related with co-infection of tuberculosis (TB) and HIV remains inappropriately high worldwide. The survival probability of patients with period of infection onset to TB after 3, 5 and 10 years post diagnosis of HIV were 72%, 62.5%, and 44.3% respectively. Cotrimoxazole preventive therapy had significant effect on the survival of patients so that the patients without preventive therapy were 8 times at risk of death more than patients using cotrimoxazole preventive therapy (Roshanaei et al., 2014).

A study by Roshanaei, Ghannad, Poorolajal Mohraz and Molaeipoor (2017) showed that Cotrimoxazole preventive therapy had significant effect on the survival of patients and patients living without cotrimoxazole preventive therapy were 3.68 times at risk of mortality more than patients using cotrimoxazole preventive therapy. It implies that

Cotrimoxazole has a significant effect on TB outcomes. Kwan and Ernst (2011) reported that principles of TB drug treatment in HIV-infected patients are the same as those for HIV-uninfected patients, daily Rifampin (RIF) a part of 4 drug combination regimen during the initial 2-month phase of treatment is critical and life-saving and during the continuation phase of 4 months given 3 times weekly as part of a 2 drug regimen. In the continuation phase RIF lowers failure and relapse rates and further prevents the development of rifampin resistance. The use of daily RIF in both the initial and continuation phases of treatment improves survival and reduces treatment failure rates, TB relapse and the development of acquired drug resistance in HIV-infected patients with pulmonary TB.

2.8 Public health interventions to improve tuberculosis treatment outcomes amongst HIV positive patients

The separation of HIV and TB services in primary healthcare services in SA hampers TB case finding in patients who are co-infected with HIV and TB (Sinai et al,.2018) The WHO has recommended a Policy on Collaborative TB/HIV activities where it expect the policy to be implemented by a broad base of stakeholders which include the TB-control and HIV programmes, the nongovernmental organisations, communities and private sectors. In determining the HIV prevalence among TB patients and among people living with HIV, WHO has recommended the surveillance of HIV among people living with TB and TB among PLHIV in all the countries (WHO 2012).

According to Sinai et al (2018), the Ideal Clinic initiative, is aiming at the integration of TB and HIV which also strives for an integration of clinical service management' (ICSM) which means that chronic conditions (including HIV and TB) are supposed to be managed by one team. A delay in diagnosis and treatment of TB may worsen the disease, increase mortality and enhance transmission, and contribute to severity and complications of illness that may result in poor unsuccessful treatment outcomes in the community. Gebreegziabher et al., 2016. That implies that interventions need to be thoroughly considered to prevent the poor treatment outcomes. Early ART initiation improves survial in HIV/TB patients, enabling the linkage between HIV and TB treatment programmes and improving adherence. National recommended guidelines, people living with TB or newly

diagnosed PLHIV should immediately be initiated on TB and HIV treatment (WHO, 2012). Currently health care institutions have initiated the strategy 90 90 90 for both TB and HIV, 90% of all people living with HIV will know their status, 90% of people diagnosed with HIV infection will receive sustained antiretroviral therapy and 90% of all receiving ARV will have viral suppression (Malaza et al., 2016).

The WHO collaborative policy further recommend several models of integrated TB and HIV service delivery which state that entry via TB services suggest referral for HIV testing and care; entry via HIV service and referral for screening, diagnosis and treatment of TB. In government health care institutions every patient is screened for TB and HIV and all these services are offered at a single facility (WHO, 2012). The other activity that public health has intervened on is children living with HIV with failure to thrive, fever or current cough or history with a TB case, are evaluated for TB and they are given Isoniazid Preventive Therapy (IPT) for the prevention of TB if the evaluation shows no TB (WHO, 2012).

Public health programs have used a variety of strategies to improve adherence at the health system level, by improving coordination and logistics around TB treatment delivery and training health care providers on new treatment guidelines on TB treatment. Direct Observed Treatment (DOT), being one of the most commonly used adherence interventions wherein a family member, health care worker or community worker observes, reminds and monitor the patient taking TB medications. Other interventions focus on TB; its prevention and treatment that assist patients in making informed decisions in taking the full responsibility on the disease. Patients tracers assist in reminding patients to keep appointments and taking of actions where a patient has missed an appointment. Reminder systems operate in a form of phone calls, home visits and short message service (SMS), wherein a patient can be immediately contacted (Alipanah et al., 2018).

2.9 CONCLUSION

The chapter discussed the literature review of the study. The next Chapter 3 will discuss the research methodology.

3 CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter 2 discussed the literature review of the study. In this chapter ,research methodology describes the path through which researchers need to conduct

their research and it also shows how the research outcome at the end will be obtained in line with meeting the objective of the study (Sileyew, 2019). This chapter covered the research method, research design, the processes of data collection that were used during the research process including the internal and external validity.

3.2 Research design

It is a specific procedure for collecting and analysing numerical data. It can be used to find patterns and averages, make predictions, test causal relationships, and generalize results to wider populations (Bhandari, 2020). It is aimed at providing an appropriate framework for the study and determines how relevant information for a study will be obtained (Sileyew, 2019). This study employed the quantitative study method. This method enabled the researcher to use the statistical analysis methods to test relationships between variables.

3.3 Study site

The setting of the study was in Lebowakgomo hospital, a district hospital. They were targeted from the TB and ART clinics register and notification books. Lebowakgomo hospital is located in the Lepelle Nkumpi and it is about 2km East of Lebowakgomo Legislature offices. Lepelle Nkumpi is situated within the Capricorn district. Lebowakgomo hospital mostly caters people from rural areas. The map below displays the Local, District and Provincial boundaries. The institution selected is the only district hospital in the Lepelle Nkumpi sub-district, wherein all the feeder clinics and the two hospitals around, refer patients to. The researcher observed a lot of patients on daily basis waiting at TB clinic for consultation, that raised a concern for the need to investigate.

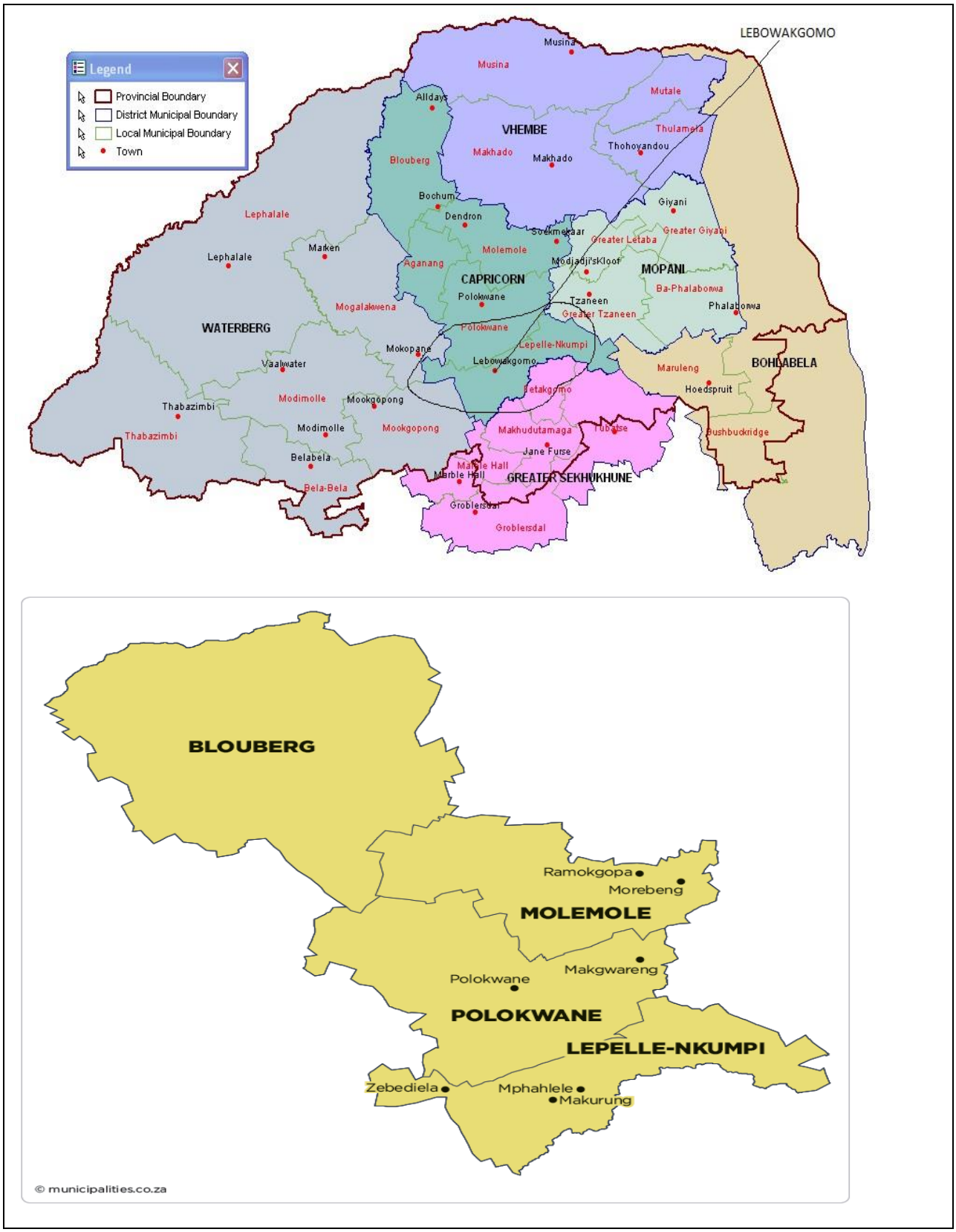
Legend
Provincial Boundary
District Municipal Boundary
Local Municipal Boundary
Town
LEBOWAKGOMO
Musina
Mutale
Thulamela
Thohoyandou
VHEMBE
Makhado
Alldays
Blouberg
Bochum
Dendron
Giyani
Greater Giyani
Greater Letaba
Lephalale
Marken
Molemole
Aganang
CAPRICORN
Polokwane
Modjadji'skloof
MOPANI
Ba-Phalaborwa
Tzaneen
Greater Tzaneen
Phalaborwa
Mogalakwena
WATERBERG
Mokopane
Lepelle-Nkumpi
Lebowakgomo
Maruleng
BOHLABELA
Hoedspruit
Vaalwater
Modimolle
Mookgopong
Thabazimbi
Belabela
Bela-Bela
Makhuduthamaga
Tubatse
Jane Furse
Marble Hall
GREATER SEKHUKHUNE
Groblersdal
Bushbuckridge
BLOUBERG
Ramokgopa
Morebeng
MOLEMOLE
Makgwareng
Polokwane
POLOKWANE
LEPELLE-NKUMPI
Zebediela
Mphahlele
Makurung
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Figure 1.1 Map of Limpopo Province, including Lepelle Nkumpi Municipality (Municipal Demarcation Board, 2016)

3.4 Research design

The researcher employed the cohort retrospective study design that allowed the determination of the outcome of TB treatment in PLHIV and the association between Tuberculosis treatment outcomes and ART outcomes amongst TB/HIV co-infected patients. The design enabled the researcher to gather information from secondary data that is patients' records. According to Barrett & Noble (2019), cohort study is a type of longitudinal study that approach on following the research participants over a period of time. The study approach enabled the researcher to follow patients who were on both TB treatment and ART, however that enabled the researcher to measure outcomes.

According to Scallan (2014), the approach enabled the researcher to describe the trends between the variables (Creswell, Ebersohn, Eloff, Ferreira, Ivankova et al., 2017). Adams & Lawrence (2015) cited that, retrospective cohort study the researcher used medical records of patients who already have the disease. The approach enabled the researcher to follow-up participants and measure the outcome during the period by using the pre-existing information to identify participants and trace them forward to determine incidence outcomes (Klebanoff & Snowden 2018).

3.5 Study population

A target population for the study was all the records of TB/HIV co-infected patients on 2019 spreadsheet, then to the SPSS 19 version for analysis for cleaning and organizing data and it was stored safely in a hard disk drive **Sampling**

This is the process of selecting the study participants, hence it involves the study population wherein participants are sampled. The population of interests to the proposed study was all the files of adults aged from 18 years and above who are living with HIV on ART and on TB treatment at Lebowakgomo hospital in 2019 - 2020. The target population was 180 records. The sample size was calculated using the (Krejcie & Morgan small sample technique)

Equation $n = \frac{N}{1+ N(e)(e)}$: N= population size =340, e=sampling error=0,05, n= sample size

$= 340 / 1+ 340(0,05x0.05)$

$= 180$

Therefore, the sample size is 180

3.6.1 Inclusion criteria

Files of males and females with TB/HIV co-infection, from 18 years and above visited the Lebowakgomo hospital from 2019 to 2020 were included. A list of the files of people living with HIV was compiled from the TB register book, of which it had the following information, file number, names, age, gender, adress, HIV and TB statuses and the dates tested. The list with file numbers was given to the records registrar.

3.6.2 Exclusion criteria

All records which had incomplete information were excluded, that is those who had TB/HIV co-infection without any TB nor HIV treatment information and with no outcome.

3.7 Data collection

Duggal (2021), defined data collection as the process of gathering, measuring and analysing accurate data from a variety of relevant sources to address the research problems, answer the questions and evaluate the outcomes.

The secondary data collection method was employed. The study used data that has already been collected, that is patients' records. Data was collected using a checklist which was developed. The checklist consists of section A (demographic information) and section B (medical information and treatment outcomes). The data collection instrument is attached as Annexure 3. The development of the tool was guided by the research problem and objectives. The list with file numbers which was compiled from the TB register book, was given to the records registrar a day before the data collection. All the

files were retrieved within 10 days wherein 18 files were retrieved each day, and the researcher worked on them the same day were returned to the filing room.

3.8 Data analysis

Johnson (2021) described data analysis as a process of cleaning, transforming and modelling data to discover useful information for decision making. Data from the records was line-listed, cleaned and verified for easier capturing. Data was captured in an Excel spread sheet coded on the following variables; age in years, gender, types of TB, duration on TB treatment, HIV status, duration on ART and treatment outcomes. The Stata Statistical Software15 was utilized to identify frequencies and percentages. Consultation with the biostatistician from UL was done prior the analysis whereby comparisons, differences and associations were identified. Data analysis helped in identifying patterns and trends for interpretation, and the statistical analysis was employed in descriptive and inferential analysis.

3.8.1 Descriptive statistics

The tables and graphs were produced containing descriptive statistics and also provided comparison of records. Tables outlined socio demographic data while the frequencies and proportions from the graphs were used in comparing and describing categorical data such as gender, this study utilized a pie chart graph to present age for TB patients who are on ART in years. The measures of central tendencies (mean, mode and median) were used to describe continuous data such as treatment outcomes. This data was outlined in a table (treatment outcome in relation to gender and age) and a bar graph outlined the overall treatment outcomes outlined of the study in percentages.

3.8.2 Inferential statistics

The risk factors of TB treatment outcomes were analysed using univariate logistic regression. Co-variates assessed were all treatment outcome categories such as successful completion rate, defaulter rates, treatment failure rates, loss to follow rates, transfer out rates and mortality rates. The t-tests was utilised to determine the

associations between TB treatment outcomes and ART outcomes amongst TB/HIV co-infected patients.

3.9 Reliability and validity

3.9.1 Reliability

Walliman (2018) described reliability as the degree of trustworthiness of the assessment tool to organize data and ideas to enhance understanding. To ensure reliability the researcher collected data from the first 10 records of TB/HIV co-infected patients, the data yielded the same results. According to the researcher 180 records was a large sample that produced reliable results.

3.9.2 Validity

Validity is described as the quality of an argument to correctly draw conclusions (Walliman, 2018). In the study internal validity was ensured in terms of patients' files, the information was densely reached, files sampled contained all the information that needed for the study. Every information documented had a signature and the rank for the attending practitioner. In terms of the external validity, the research study can be applied to other situations. The data collected was analyzed in the next chapter and the results will enhance the formulation of policies and strategies in order to control TB and HIV. Moreover, the study can be further researched in developing an outcome concept model.

3.9.2.1 Content-related validity

The data collection tool used was able to measure what it is supposed to measure (Moule & Goodman, 2014). The data collection instrument was not changed during the collection of data, the same instrument was used throughout the process of collection, hence the internal validity for collection of data was high. In the study the researcher ensured that the tool contained all the information needed from the participants for the study. To guarantee the validity of the tool ten files of people living with HIV and TB, were reviewed with data collection tool and similar responses were identified about four times.

3.9.2.2 Criterion-related validity

The data analysis was done through descriptive and inferential statistics; the validity of the data collection tool was measured by comparing the findings. The findings were compared using tables and graphs and the researcher was able to interpret and analyse the findings. The study aimed at investigating the tuberculosis treatment outcomes on ART outcomes and the focus was on the objectives of the study which enabled the researcher to determine the outcome of TB treatment in PLHIV and to determine the association between Tuberculosis treatment outcomes and ART outcomes amongst TB/HIV co-infected patients.

3.9.2.3 Construct validity

It is the extent to which the questionnaire is able to measure the criterion or construct validity. In the study the data collection tool used, enabled the researcher to collect data that was indicative of the aim of the study which was to investigate the TB treatment outcomes on ART outcomes (Flick 2015).

3.10 Bias

It occurs when a person has an inclination for something or somebody and cannot make a neutral judgement that will influence the results (Bertram & Christiansen 2014). According to Adams & Lawrence (2015).

3.10.1 Sampling bias

Avoiding sampling bias, all participants meeting the inclusion criteria had an equal opportunity to participate in the study. As the researcher was allocated a private room during data collection no staff members had an opportunity to give information on participants.

3.10.2 Selection bias

In the study, selection bias was avoided by not allowing other staff avoid to identify and choose patients that falls within the inclusion criteria. All the information captured was the information reviewed from the files as to avoid the selection bias. The analysed data with

the biostatistician assistance was recognised and recorded. There will be no participants were interviewed.

3.11 Ethical considerations

The current study was conducted in line with the South African Health Act **61 of 2003,** to comply with the norms and standards, or guidelines, set for the conducting of research in terms of the National Health Act (Senkubuge & Mayosi, 2012).

3.11.1 Ethical clearance and permission to conduct the study

Ethical clearance is an evidence the research proposal was granted an ethical approval, that further gives the researcher a go ahead to collect data (Amon,Baral, Beyrer & Kass, 2012). The proposal was presented at Department of Public Health, and submitted to the School of Healthcare Sciences and the Faculty of Health Sciences before it was submitted to Turfloop Research Ethics Committee (TREC) at University of Limpopo for ethical clearance. The approved proposal together with TREC certificate were submitted to the Department of Health to seek permission to conduct the study and use of data within patients' files of Lebowakgomo hospital. The permission to utilise the recordsfrom the Department of Health and the hospital Chief Executive Officer (CEO) was granted.

3.11.2 Respect for person

It defines the protection of participants from the researchers who need to ensure that participants were assured that their personal information was protected, that included to maintain privacy, confidentiality and allowing participants to remain anonymous. Researcher ensured that participants are protected from physical, emotional and mental harm (Amon, Baral, Beyrer & Kass, 2012).

In terms of documents and participant's records, the information collected was treated with confidentiality. The data was not being linked to any identifying information (name, address) that the data sources have supplied. The researcher was the only one involved in collecting data from the patients' files. There was no written informed consent signed as only participants' records were used.

3.11.3 Protecting the rights of the institution

Protection of the institution in a research study entailed the respect and dignity that required the researcher to ensure that the collection of data was not conducted without the institutional knowledge regarding the ethical clearance letter and the application to conduct a study. The decision that the institution may opt for with regard to the study was respected (Amon, Baral, Beyrer & Kass, 2012). A formal letter attached as annexure 4 was sent to the Department of Health and the Hospital Chief Executive Officer (CEO) with the proposal for permission to conduct the study. The letter was sent after ethical clearance was issued by the TREC at UL. The ethical clearance approval letter was attached to the letter.

3.11.4 Scientific integrity of the research

Kretser, Murphy & Beruzzi et al (2019) defined scientific integrity as an active adherence to the ethical principles (honesty, trustworthiness) and professional standards that are essential for the practice of the study. It involved the intellectual honesty and personal responsibility for ones' actions, that was in proposing and performing research. Scientific integrity depends on a set of foundational expectations that all science should be built upon to maintain trust.

The researcher ensured the scientific integrity throughout the study by adhering to professionalism during data collection and reporting of results. The researcher acknowledged the authors to ensure that the words or ideas were from others. The acknowledgement was in a form of text referencing and at the list of references. The researcher avoided plagiarism. The researcher also ensured the respect for anonymity and confidentiality of information retrieved from participants' files. The secondary data was collected with the file numbers to retrieve the records. No names were used to retrieve the files. The researcher was the only person who collected data in an allocated single office selected for data collection. The hospital policy regarding the data sharing and the confidentiality to protect the patients' records was adhered to in terms of not sharing the information collected to other people who were not involved in the research

study. The files were immediately returned to the filing department after data collection. The researcher collected 18 files on each day at 08h00 and data was collected on 18 files every day in an office which was provided and returned to the filling room the same day at 17h00, the files were kept for 9 hours.

3.12 CONCLUSION

Research method, research design, data collection and analysis, internal and external validity for the study were discussed. Ethical issues related to the data collection were adhered to throughout the data collection process. The next chapter 4 will discuss the results presentation, analysis and interpretation.

4 CHAPTER 4: RESULTS

4.1 Introduction

The previous chapter 3 discussed the research method, research design, data collection and analysis. This chapter describes the discussion, presentation, analysis and interpretation of the research findings guided by the research question posed in the study. Data was analysed to determine the TB treatment outcome in PLHIV and the association between TB treatment outcomes and ART outcomes in TB/HIV co-infected patients in Lebowakgomo district hospital of the Limpopo province. Data was collected from the hospital patients' records and 180 patient's files were retrieved and reviewed, further information was collected from the TB/HIV Primary Health Care database.

Data analysis entails a quality check and alignment of information collected during the study (Molder, Jablonski, Letcher & Hall et al, 2021). It includes the calculation of frequencies of variables and differences between variables (Dudovskiy, 2018).

4.2 Data management and analysis

Data was collected using the data collection tool for each patient records. After the process was finalized, the data was captured in a line listing form then exported to Microsoft Excel 2019 spreadsheet, then to the SPSS 19 version for analysis for cleaning and organizing data and it was stored safely in a hard disk drive. Descriptive statistics provided a comparison of records. Tables outlined socio demographic data while the frequencies and proportions from the graphs were used in comparing and describing categorical data such as gender and age. The measures of central tendencies (mean, mode and median) used to describe continuous data such as treatment outcomes. The risk factors of TB treatment outcomes were analysed using univariate logistic regression. Co-variates assessed were all the treatment outcome categories such as successful completion rate, defaulter rates, treatment failure rates, loss to follow and mortality rates. Further associations were done using the t-test. The t test was utilized to determine the associations between TB treatment and the ART programme. All records of patients with TB/HIV coinfection from 18 years and older were eligible for inclusion in the current study. The records which were retrieved it was found that for all the age groups there was a

(68.3%) of treatment completion and those who are more likely to be infected with TB/HIV are age group 35-44 at (33.2%) and (3.3%) had MDR-TB.

4.3 Research results

4.3.1 Demographics of TB patients on ART

Figure 4.1 below shows the demographics of TB patients who are on ART with mean age of 43 years and visited Lebowakgomo hospital for health care services during 2019 and 2020. The results presented below are constrained by the limited data available and the assumptions made. The results show the majority of patients in age group 35-44 years at 32% followed by age group 18-34 years at 26.1%, 45-54 years at 23.9%, 55-64 years at 15% and ≥65 years at 2.8%.

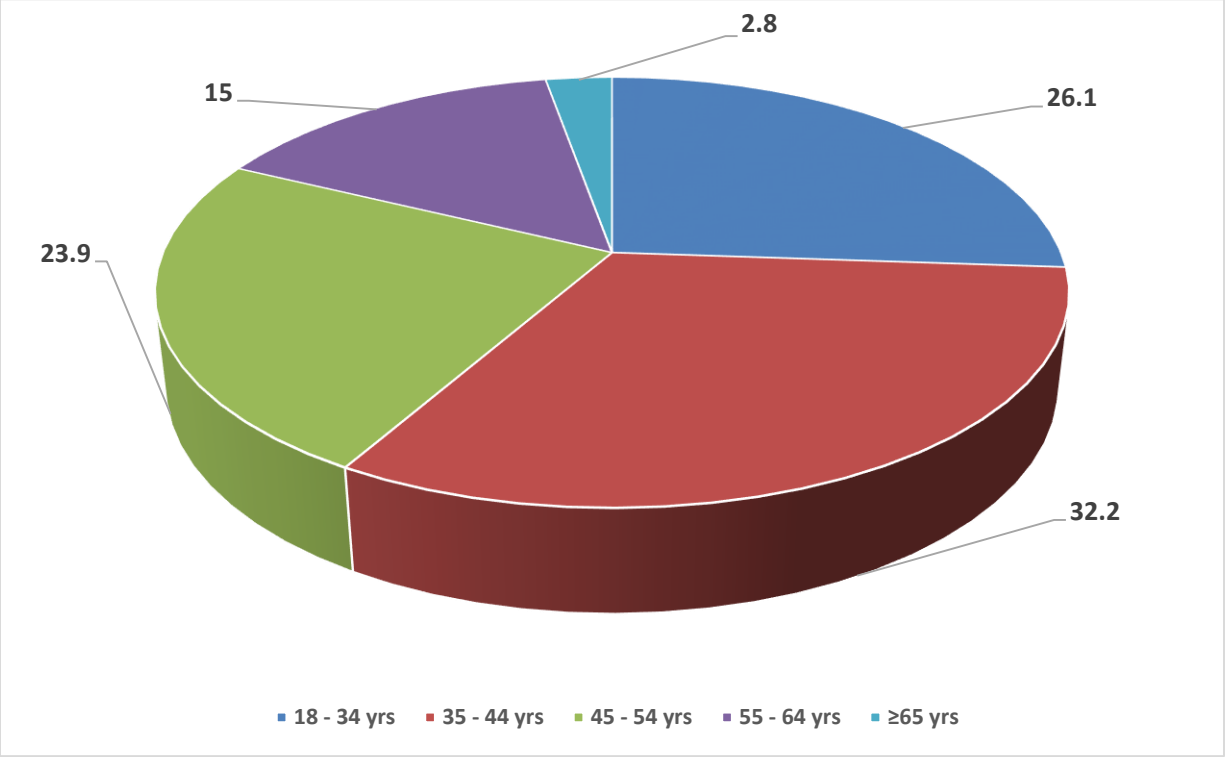

Figure 4.1: Age TB patients who are on ART in years

4.3.2 Demographics of TB patients stratified by age groups

Table 4.1 presents the demographics of TB patients stratified by age groups. The results show the majority of females of age group (35 – 44) at 37.9% more infected with TB than males of the same age group at 24.7%, followed by females of age group 18-34 years at 33.0% more infected than males of the same age group at 16.9%. The majority of males of age groups 45-54 and 55-64 years are 36.4% and 18.2% more infected with TB compared to females of the same age groups at 14.6% and 12.6% respectively. The table further shows that males of ≥65 years are 3.9% more infected compared to females of the same age group at 1.9%. This study shows that there was a statistical significance difference ($p<0.001$) between females and males as presented in Table 4.1 below.

Majority of patients in age group 35-44 years took TB treatment for 6 months and less at 40.6%, followed by age group 45-54 years at 28.1%, age group 18-34 years at 18.8% and age group 55-64 and ≥65 years at 6.3%. Age group 35-44 years took treatment for 6 months and more at 30.4%, followed by age group 18-34 years at 27.7%, age group 45-54 years at 23.0%, age group 55-64 years at 16.9% and age group ≥65 years at 2.0%. Statistical significance difference ($p=0.229$) between treatment duration of 0-6 months and 6 months and more. The current study shows the statistical significance difference (p 0.437) between the CD4 count done and not done as presented in Table 4.1 below. Majority of patients in age group 18-34 years had low CD4 count at 32.5%, followed by age group 35-44 years at 31.3%, age group 55-64 years at 20.0% and ≥65 years at 15.0%. Less patients in age group 18-34 and 55-64 years had high CD4 category at 25.0% each. Approximately 33% of age group 35-44 years were not done CD4 count, followed by age group 45-54 at 27.6%, age group 18-34 years at 22.4% and age group 55-64 and ≥65 years at 13,2 % and 45 respectively. Tests rejected were seen at age groups 18-34 years and 35-44 years at 50.0% respectively. There were 37.7% patients of age group of 18-34 years who had high viral load compared to all other groups followed by age group 35-44 years at 31.9%, age group 45-54 years had an undetectable copies of viral load at 100.0%. There were 32.7% of age group 35-44 years, followed by age group 55-64 at 28.6%, the least being ≥65 years at 3.1%.

Table 4.1: Demographics of TB patients stratified by age groups

	Age group in years					
	18 - 34	35 - 44	45 - 54	55 - 64	65	*P-value*
	n (%)	n (%)	n (%)	n (%)	n (%)	
Gender						
Female	34 (33.0)	39 (37.9)	15 (14.6)	13 (12.6)	2 (1.9)	<0.001
Male	13 (16.9)	19 (24.7)	28 (36.4)	14 (18.2)	3 (3.9)	
Duration on ART						
0-6months	6 (18.8)	13 (40.6)	9 (28.1)	2 (6.3)	2 (6.3)	0.229
6months +	41 (27.7)	45 (30.4)	34 (23.0)	25 (16.9)	3 (2.0)	
CD4						
0	26 (32.5)	25 (31.3)	16 (20.0)	12 (15.0)	1 (1.3)	0.437
1	2 (15.4)	4 (30.8)	2 (15.4)	4 (30.8)	1 (7.7)	
2	0 (0.0)	1 (20.0)	4 (80.0)	0 (0.0)	0 (0.0)	
3	1 (25.0)	2 (50.0)	0 (0.0)	1 (25.0)	0 (0.0)	
Not done	17 (22.4)	25 (32.9)	21 (27.6)	10 (13.2)	3 (4.0)	
rejected	1 (50.0)	1 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Viral load						
<20	0 (0.0)	2 (33.3)	2 (33.3)	1 (16.7)	1 (16.7)	0.161
20 -50	1 (20.0)	2 (40.0)	1 (20.0)	1 (20.0)	0 (0.0)	
>50	26 (37.7)	22 (31.9)	10 (14.5)	10 (14.9)	1 (1.5)	
Not done	20 (20.4)	32 (32.7)	28 (28.6)	15 (15.3)	3 (3.1)	
undetected	0 (0.0)	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	

4.3.3 The type of TB diagnosed

Figure 4.2 represents the types of TB diagnosed amongst the patients in the current study and three types were identified as Pulmonary TB, Extra Pulmonary TB and Multi Drug Resistance TB. There was an equal percentage of PTB and EPTB of 48.3% which is a high percentage compared to 3.3% percentage of those with MDR-TB. It indicates that most patients are infected with PTB and EPTB (treatment can take up to nine months) that MDR-TB.

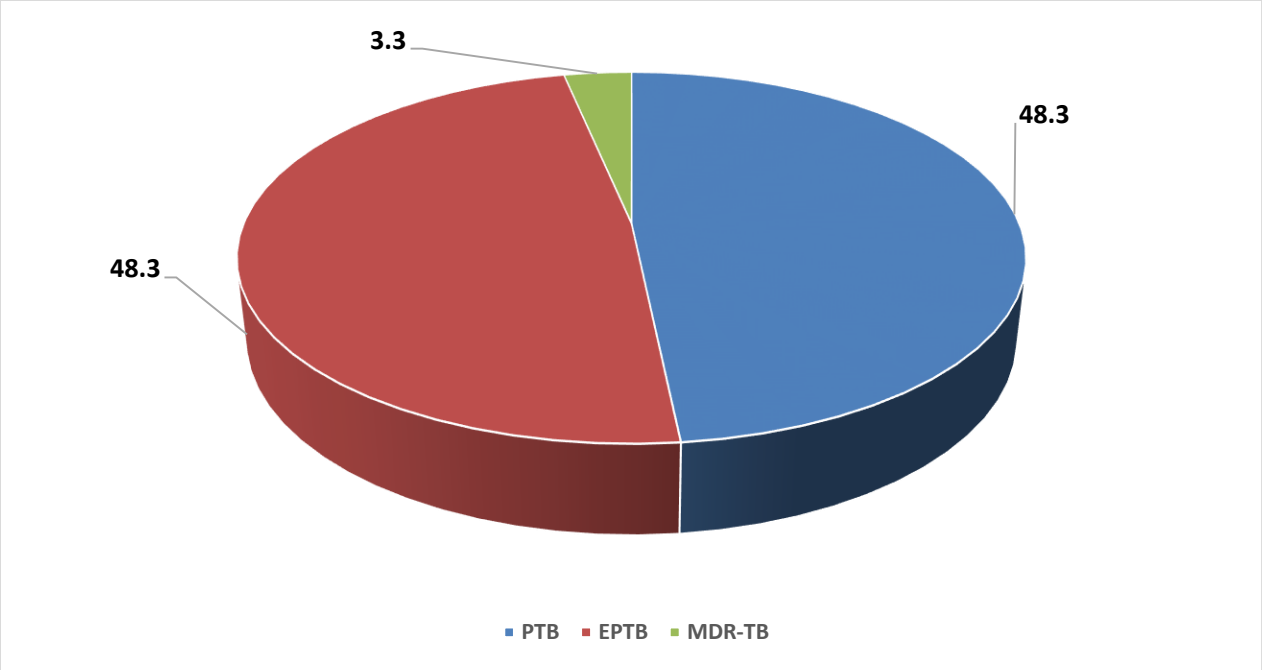

Figure 4.2: The types of TB diagnosed

Table 4.2 presents the Types of TB and treatment duration in relation to age group. To determine the outcome of TB treatment in PLHIV, it was done in relation to the type of TB and the duration of TB treatment. 48.3% of age group 45-54 years had PTB followed by age group 18-34 at 20.7%, those between 55-64 years had 17.2% which is higher than 3.5% of those ≥65 years. In relation to EPTB an increased percentage was identified within age groups 45-54 years and 55-64 years with 31% respectively. Age group ≥65 years at a very low percentage of 3.5% of EPTB, which implies that they are not mostly infected by EPTB when compared with age group 45-54 years. MDR-TB has infected only age group 35-44 years at 100.0% compared to all other age groups. In respect to treatment duration, more patients had TB treatment for 6 months followed by those had treatment more than 6 months compared to those who had treatment for less than 6 months.

Table 4.2 Types of TB and treatment duration in relation to age group

		Age group in years					*P-value*
		18 - 34	35 - 44	45 - 54	55 - 64	≥65	
		n (%)	n (%)	n (%)	n (%)	n (%)	
TB type							
	PTB	6 (20.7)	3 (10.3)	14 (48.3)	5 (17.2)	1 (3.5)	0.112
	EPTB	3 (10.3)	7 (24.1)	9 (31.0)	9 (31.0)	1 (3.5)	
	MDR-TB	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	
TB treatment duration							
	6 months	5 (23.8)	2 (9.5)	11 (52.4)	2 (9.5)	1 (4.8)	0.057
	<6 months	0 (0.0)	3 (30.0)	2 (20.0)	5 (50.0)	0 (0.0)	
	>6 months	2 (10.5)	7 (36.8)	4 (21.1)	5 (26.3)	1 (5.3)	

4.3.4 TB treatment outcome in PLHIV

Figure 4.3 shows a bar graph which compares the treatment outcomes in terms of percentages. It shows that those who completed treatment successfully are more (68.3%) with those who did not. 16.1% died during the period of treatment, those who defaulted they are 9.4%, followed by the loss to follow with 3.9% the least being 2.2 % of those who were transferred out to other institutions. It implies that the defaulter rate and those who died during the TB treatment are relatively high.

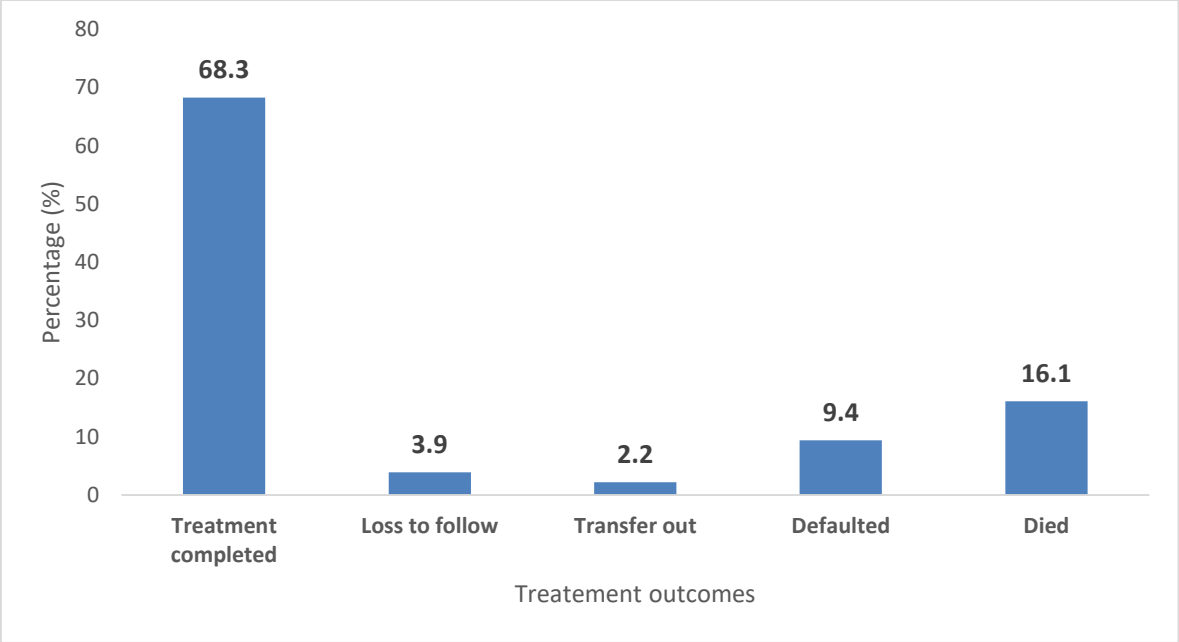

Figure 4.3: Treatment outcomes

Table 4.3 below represents the treatment outcome in relation to gender and age group. Of the 68.3% of treatment completion 73 (70.9%) were females and males counted 50 (64.9%). More females (17.5%) are identified within those who died compared to males (14.3%). Males are 11.7% more likely to default TB treatment compared to females at 7.8%. Furthermore, males have been identified as more loss to follow at 5.2% compared to females at 2.9%. Age group 18-34 years are 74.5% more likely to complete the TB treatment compared with other age groups, followed by the age group 45-54 years (72.1%). Age group 35-44 years are 6.9 % more likely to be loss to follow as compared to age group 45-55 with 2.3%. Patients within age group ≥65years and 45-54 are most likely to default treatment at 20.0 % and 16.3% respectively as compared to all other groups. Age group 55-64 years are 33.3% more likely to die during TB treatment as compared to age group 45-54 years at 7.0%. There is a relatively low percentage of ≤3.7% of patients transferred out to other institutions for TB treatment.

Table 4.3 Treatment outcome in relation to gender and age

		Treatment Outcome					
		Treatment completed	Loss to follow	Transfer out	Defaulted	Died	*P-value*
Gender							
	Female	73 (70.9)	3 (2.9)	1 (0.9)	8 (7.8)	18 (17.5)	
	Male	50 (64.9)	4 (5.2)	3 (3.9)	9 (11.7)	11 (14.3)	0.476
Age group in years							
	18 - 34 yrs	35 (74.5)	1 (2.1)	0 (0.0)	6 (12.8)	5 (10.6)	
	35 - 44 yrs	39 (67.2)	4 (6.9)	2 (3.5)	2 (3.5)	11 (19.0)	
	45 - 54 yrs	31 (72.1)	1 (2.3)	1 (2.3)	7 (16.3)	3 (7.0)	0.225
	55 - 64 yrs	15 (55.6)	1 (3.7)	1 (3.7)	1 (3.7)	9 (33.3)	
	≥65 yrs	3 (60.0)	0 (0.0)	0 (0.0)	1 (20.0)	1 (20.0)	

4.3.3 4.3.5 The association between Tuberculosis treatment outcomes and ART outcomes amongst TB/HIV co-infected patients.

Table 4.4 below presents the association between TB treatment outcomes, socio-demographics and ART outcomes in TB/HIV co-infected patients. Overall age was not significantly associated with treatment outcomes but only TB/HIV co-infected people aged 55 – 65 years were 4.2 time more likely to die as compared to other groups at *p-value =0.022.* Gender, previous TB infections, TB type, duration on ART and CD4 Count were not significantly associated with treatment outcomes amongst TB/HIV co-infected people. However, males were 4 times more likely to be lost to follow-up, 1.6 times more likely to be transferred out, 1.8 times more likely to defaulters. TB/HIV co-infected people who were previously infected with TB were 4.2 more likely to default from treatment and 1.7 times more likely to die while on treatment. TB/HIV co-infected people who were diagnosed with extra pulmonary TB were 2 times more likely to be transferred out, 1.5 times more likely to be defaulters and 1.5 times more likely to die while on treatment. TB/HIV co-infected people who were on treatment for more than 6 months were 1.7 times more likely to transfer-out, 1.3 times more likely to default from treatment and 2.1 times more likely to die while on treatment. TB/HIV co-infected people who had CD4 count of less than 200 at initiation of ART were 1.4 times more likely to complete treatment, 1.1 times more likely to default from treatment.

Table 4.4 Univariate Logistic Regression to determine the association of TB treatment outcome and ART outcome

	Treatment completed	Lost to follow up	Transfer out	Defaulted	Died
Age group in years	OR(95%CI)	OR(95%CI)	OR(95%CI)	OR(95%CI)	OR(95%CI)
18 – 34	Ref	Ref	Ref	Ref	Ref
35 – 44	0.7 (0.3 – 1.7)	0.9 (0.1 – 10.7)	0.2 (0.05 – 1.3)	3.4 (0.4 – 31.6)	1.9 (0.6 – 6.1)
45 – 54	0.9 (0.3 – 2.3)	0.6 (0.1 – 10.3)	1.3 (0.4 – 4.3)	1.1 (0.07 – 18.1)	0.6 (0.1 – 2.8)
55 – 64	0.4 (0.2 – 1.2)	–	0.3 (0.01 – 2.3)	1.8 (0.1 – 29.5)	4.2 (1.2 – 14.3)*
≥65	0.5 (0.1 – 3.5)	–	1.7 (0.2 – 17.9)	–	2.1 (0.2 – 22.7)
Gender					
Females	Ref	Ref	Ref	Ref	Ref
Males	0.8 (0.4 – 1.4)	4.0 (0.4 – 40.5)	1.6 (0.6 – 4.3)	1.8 (0.4 – 8.4)	0.8 (0.3 – 1.8)
Previous TB infection					
No	Ref	Ref	Ref	Ref	Ref
Yes	0.8 (0.3 – 2.4)	–	–	4.2 (0.8 – 23.6)	1.7 (0.5 – 5.6)
TB type					
PTB	Ref	Ref	Ref	Ref	Ref
EPTB	0.6 (0.3 – 1.0)	0.9 (0.1 – 6.0)	2.0 (0.8 – 5.2)	1.2 (0.3 – 4.8)	1.5 (0.7 – 3.2)
Duration of ART					
< 6 months	Ref	Ref	Ref	Ref	Ref
> 6 months	0.5 (0.2 – 1.4)	0.6 (0.06 – 6.4)	1.7 (0.4 – 7.8)	1.3 (0.2 – 11.3)	2.1 (0.6 – 7.3)
CD4 Count					
>200	Ref	Ref	Ref	Ref	Ref
<200	1.4 (0.5 – 3.9)	–	0.7 (0.1 – 3.6)	1.1 (0.1 – 10.4)	0.7 (0.2 – 2.5)

Values are reported as odds ratios (95%CI), *Significant at *p<0.05;* **Significant at *p<0.005;* ***Significant at *p<0.001*

4.4 Overview of research findings

The TB treatment outcomes in TB/HIV co-infected people in the current study was found not good at both genders with females at 70.9% and males at 64.9% on treatment completion with an overall treatment completion of 68.3% which is far less than the 90 90 90 strategy in TB and HIV, furthermore 16. 1% of mortality rate is high.

4.5 CONCLUSION

Data management, analysis and presentation of results by tables, graphs and charts was done in this chapter. Summary, recommendations and conclusion will be discussed in the following Chapter 5.

5 CHAPTER 5: DISCUSSION, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

In the previous chapter, the findings of the current study were presented and interpreted. In this chapter, the results of this study are discussed and compared to the relevant literature to address the study objectives which are:

- To determine the outcome of TB treatment in people living with HIV in Lebowakgomo hospital.

  The study revealed that those who completed treatment successfully are more at 68.3% with 16.1% died during the period of treatment, defaulted 9.4%, followed by the lost to follow up at 3.9%. In the current study there is a high rate of deaths and lost to follow. The overall TB treatment success rate in HIV co-infected patients was lower compared to the World Health Organization target of 85%

- To measure the burden of TB/HIV co-infection and TB treatment

  The overall TB treatment success rate in HIV co-infected patients in this study was lower (68.3%) compared with other previous studies**.** It is also not in line with the global milestone target set at >90% for 2025. In the study it was revealed that there are still deaths rate (16.1%) during the period of treatment.

- To determine the association between TB treatment outcomes and ART outcomes amongst TB/HIV co-infected patients.

  The current study findings revealed that overall age was not significantly associated with treatment outcomes but only TB/HIV co-infected people aged 55 – 65 years were 4.2 time more likely to die as compared to other age groups. The current study findings further revealed that TB/HIV co-infected people who were previously infected with TB were also 4.2 more likely to default from treatment leading to unsuccessful treatment outcome.

Therefore, this chapter will be divided into the following sub-sections:

- Introduction
- Demographics of TB patients on ART
- Demographics of TB patients stratified by age groups

- TB treatment outcome in types of TB
- TB treatment outcome in PLHIV
- Limitations of the study
- Recommendations
- Conclusion

5.2 Demographics of TB patients on ART

The current study revealed that the majority of patients in age group 35-44 years at 32% are highly infected with TB and HIV. Study conducted in Northern Tanzania, (Mollel et al.2019) cited that the majority of males of age group 35-44 years are co-infected with TB/HIV at 95% CI) 2.08(1.77-2.45). The two studies concur on the same grounds.

The majority of males of age groups 45-54 and 55-64 years are 36.4% and 18.2% more infected with TB compared to females of the same age groups at 14.6% and 12.6% respectively. The table further shows that males of ≥65 years are 3.9% more infected compared to females of the same age group at 1.9%. The current study revealed that males are highly infected with TB/HIV at 58.9 %, the study concurs with (Dravid et al,2019) that males were highly infected with TB/HIV at 72.5% than females. Mollel et al (2019) concluded that females are more infected with TB/HIV at 53.6% which differs with the current study.

5.3 Demographics of TB patients stratified by age groups

The current study revealed that majority of patients (82%) with TB had treatment for 6 months and more of which it symbolizes that they were diagnosed with PTB and defaulted, EPTB and MDR-TB. The study also revealed that 18% of TB patients took <6 months on TB treatment which was caused by treatment defaulter, loss to follow and death. Majority of patients in age group 18-34 years had low CD4 count at 32.5%, followed by age group 35-44 years at 31.3%, age group 55-64 years at 20.0% and ≥65 years at 15.0%. Less patients in age group 18-34 and 55-64 years had high CD4 cat at 25.0% each. The current study revealed that low CD4 cell count is associated with high viral load and it was mostly observed in all age groups. Wolday & Kebede et al (2020)

concluded that low CD4 count is independantly associated with an increased risk of incident TB despite viral suppression. 76.6% of patients who developed TB occurred within five year of ART initiation, with CD4 cell count of lower than 200 was associated with increased risk of incident TB (Wolday & Kebede et al. 2020). There are 37.7% patients of age group of 18-34 years who had high viral load compared to all other groups followed by age group 35-44 years at 31.9% , age group 45-54 years had an undetectable copies of viral load at 100.0%. A viral load implies that there is low CD4 cell count.

5.4 TB treatment outcome in types of TB

In terms of TB types, PTB (smear-negative and smear-positive pulmonary TB) accounted 63.3% and EPTB 36.7% Worku et al ,2018. This study has revealed that there is an equal percentage of 48.3% of PTB and EPTB each, whereas there is a 3.3% of MDR-TB. The current study contradicts with Worku et al study which had a high rate of 63.3% for PTB patients with a very low rate of 36.3% EPTB compared with 48.3% of the current study. This current study is contrary to previous studies with 23.9% presented with EPTB (Fekude et al 2020). On the other hand (Tola et al,.2019) PTB patients had higher unsuccessful treatment outcomes (18.9%) than EPTB (14.3%). In terms of duration taken on different types of TB; in the current study patients who took 6 months on treatment were found to be 33.3%, more than 6 months' duration 30.2%, <6 months 15.9% of which implies that they did not complete treatment, any TB treatment duration starts at 6 months. Hirasen & Berhanu et al (2018) cited that 31% of TB patients were not able to complete TB treatment due to death and loss to follow-up outcomes.

The study of Torres et al,.2019, concluded that the success rate for the treatment of drug-sensitive TB in adults was 80%, of which America had the lowest treatment success rate, 76% and Ocean had the highest, 84%, in the current study it was found that the success rate was the lowest with 68%. The success rate for the current study was based on all types of TB identified; PTB, EPTB and MDR-TB. As the study revealed an equal value of PTB and EPTB (48% respectively) with the treatment success rate of 68% it differs with the Holden et al,.2019 study conducted in Denmark, with the overall treatment success rate of PTB of 81% of which is the highest compared to the current study.

The findings of this study had no satisfactory treatment outcome as compared to the National TB treatment survey which was 96% success rate. The successful treatment outcome in this study was lower than studies conducted in the Tigray region (90%), Southern Ethiopia (85%), Northern Ethiopia (94%), Eastern Ethiopia (93%) and Debretabour hospital (87%). On the other hand, this study has a higher success rate than a study conducted in India (60%), North Shoa (63.6%) and Ethopian city administrative hospitals (55.8%). The variation is because of the difference in study subjects, in India the study subjects were MDR-TB patients whereas in the current study were PTB, EPTB and MDR-TB. Getie & Alemnew,2020.

Different prevalence of unsuccessful TB treatment was reported in different studies such as Afar which had a prevalence of 18.2%, West Ethiopia had 17.5%, Central Africa had 27.6% while India had 14%. In contrary, the current study revealed a higher unsuccessful treatment rate of 32% (loss to follow 3.9%, transfer out 2.2%, defaulted 9.4% and died 16.1%). A variety of studies had a very low unsuccessful treatment outcome Southern Ethiopia 14.8% and Arsi Zone, Central Ethiopia 16.4% and the discrepancy with the current study was that all types of TB were included in the subjects whereas in Ethiopia they did not include EPTB in their study subjects (Wen et al,.2018). Among 19.3% patients with unsuccessful treatment outcomes, 10.25 died, 5.3% were lost to follow-up,3.6% had outcomes not evaluated while the remaining failed treatment (Tok et al,.2020).

5.5 TB treatment outcome in people living with HIV

The study revealed that those who completed treatment successfully are more at 68.3% with 16.1% died during the period of treatment, defaulted 9.4%, followed by the lost to follow up at 3.9%. In the current study there is a high rate of deaths and lost to follow as compared to Tola et al (2019) study. According to Tola et al (2019) 56.7% of TB/HIV co-infections completed their TB treatment, 7.7% died, 1.7% were lost to follow up from their treatment, whereby they had an overall of 86.8% of the TB/HIV co-infected patients who had successful TB treatment outcome and 13.2% patients had unsuccessful TB outcome.

The study revealed that of the 68.3% of treatment completion 73 (70.9%) were females and males counted 50 (64.9%), 29% of females had unsuccessful treatment rate whereas males had an increased rate of 35% unsuccessful treatment. In contradiction Tola et al (2019) concluded that the treatment success rate was similar between male (87.6%) and female (86.2%) patients, 12.4% unsuccessful treatment rate in male and 13.8% unsuccessful treatment rate in females.

A successful treatment outcome was achieved at 78.6%, 9.5% lost to follow- up, 6.9% died and 3.5% transferred out (Tanue & Nsagha et al, 2019) in contrary the current study has revealed a lower successful treatment outcome (68.3%) and lower lost to follow up (3.9%) and a much higher 16.9% of death rate compared to Tanue et al (2019). The overall rate of treatment success of the current study was lower than studies conducted by Mekonnen et al (86.2%), Gebremariam et al., (87.3%), Ejeta et al (85.2%), Endries et al (94.8%), Wolku et al., (90.1%) and Twenya et al., in Malawi (86%) Fekude et al (2020).

5.6 The association between Tuberculosis treatment outcomes and ART outcomes amongst TB/HIV co-infected patients

The current study findings revealed that overall age was not significantly associated with treatment outcomes but only TB/HIV co-infected people aged 55 – 65 years were 4.2 time more likely to die as compared to other groups at *p-value =0.022.* This is in contrary to the findings of a study conducted in Northeast Ethiopia as age of the patient was found to be having a significant association with tuberculosis treatment outcome and patients whose age was less than 24 years were nearly five times more likely to have a successful treatment outcome than the patients whose age was greater than 45 years old (Getie, & Alemnew, 2020). Gender, previous TB infections, TB type, duration on ART and CD4 Count were not significantly associated with treatment outcomes amongst TB/HIV co-infected people in the current study. These findings are in contrary to the findings from a study conducted in Free State Province of South Africa, as there were significant associations amongst the TB-HIV co-infected group in terms of sex, age, disease classification, CD4 count and an unsuccessful TB treatment outcome ($p < 0.001$) (Engelbrecht et al., 2017).

The current study findings further revealed that TB/HIV co-infected people who were previously infected with TB were 4.2 more likely to default from treatment which is contrary to the findings of a study conducted in Karnataka, India as co-infected patients demonstrated lower rates of treatment default (Shastri, Naik, Shet, Rewari & De Costa, 2013). The current study findings suggest that the national ART guidelines with emphasis on adherence and counseling support are not playing a significant role as there are more defaulters and loss-to-follow up therefore affecting positive treatment outcomes. TB/HIV co-infected people who were diagnosed with extra pulmonary TB were 2 times more likely to be transferred out, 1.5 times more likely to be defaulters and 1.5 times more likely to die while on treatment. A study conducted in southern Ethiopia reported similar results to the current study as PTB cases in this study was associated with a higher treatment success (Wondale, Medihn, Teklu, Mersha, Tamirat & Ameni, 2017). This could be due to the easier accessibility of the drugs to the TB bacilli as the granuloma is usually burst in PTB cases as compared to extra pulmonary TB cases.

5.7 Limitations of the study

The major limitation of the study is basically related to the use of retrospective secondary data. The socio-economic characteristics (income, family size educational status, living conditions, distance to the health facility, adherence level, knowledge and attitude about the disease, behavioural factors like cigarette and alcohol intake) and the presence of other comorbidities might have an impact on treatment outcome of TB/HIV co-infected patients. Moreover, some patients were transferred out to other facilities outside the district where it is difficult to track what happened thereafter. The study only involved public hospital patients, private patients were not involved and the results are only based on public setting. The other limitation was that this study was limited to 1-year period of which 5 years might have yield a different result. The health facility under study in some of medical records treatment outcome was not recorded. TB/HIV co-infected patients who started ART before initiating TB treatment, and those who started ART while being treated for TB, were included in the same sample, which may introduce bias.

5.8 RECOMMENDATIONS

5.8.1 Policies

The study has revealed that there is paucity of data on TB/HIV treatment outcomes. Reviewing of policies on TB and HIV data recording and policy on transfer of TB/HIV co-infected patients to PHC with standard operating procedures need to be considered as TB/HIV co- infection continues to be a public health concern. There need to be effective collaborative TB control strategies encompassing other diseases including HIV, and a continuing improvement of health system to be clearly stipulated in guidelines. TB/HIV policies need to be reviewed annually and made available to all Health care systems.

5.8.2 Health facilities

The current study has revealed that there are still increased numbers of TB/HIV co infected patients who does not adhere to the treatment modalities, the study strongly recommends Lebowakgomo hospital to develop strategies to encourage clients to adhere to treatment. TB treatment facilities should give special attention to those TB-HIV co-infected patients with a higher risk of unsuccessful TB treatment outcome. The TB ward nurses and manager, the infection control team and the TB Medical Doctors health facility under study of Lebowakgomo hospital should develop strategies and standard operating procedures to record the final treatment outcome of transfer-out cases and the strategies to reduce the burden of TB/HIV co-infection need to be strengthened (facilitation of health education on community radio stations, outpatient departments). There need to be an integrated and coordinated TB control program that include active case surveillance, effective care, early identification and prompt initiation of treatment for both TB and HIV. The facility TB focal person and TB staff (nurses and doctors) need to apply approach strategies in communities for earlier diagnosis and better follow up for patients. Consultation and communication with General Practitioners and specialists should be conducted to optimize ultimate treatment outcomes. The Lepelle Nkumpi TB coordinator need to facilitate and coordinate the tracer teams for TB patients to monitor and make follow-up.

5.8.3 Research

Research need to be conducted on evidenced based model on the timing of antiretroviral therapy and TB treatment outcomes in TB/HIV co-infection. Furthermore, research need to be conducted in order to help improve tuberculosis control nationally which will focus on the treatment and prevention of multi drug resistant tuberculosis in TB/HIV co-infection.

5.9 CONCLUSION

TB is still a public health problem especially among HIV patients. The overall TB treatment success rate in HIV co-infected patients in this study was lower compared with other previous studies**.** It is also below the World Health Organization target of 85% and yet not in line with the global milestone target set at >90% for 2025.

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Annexure 1: Data collection tool

Section A: Demographic information

Mark with X

1. **Age in years**_____
2. **Gender**

Male	**Female**

Section B: Medical information

1. **HIV Status**

Positive	
Negative	

2. Treatment

ART	**Yes**
	No

3. Duration on ART

0-6months	
months+	

4. CD4 Cell Count

At start of treatment

0-200 cell/mm3	
200 and above	

At completion of TB treatment

0-200 cell/mm3	
200 and above	

5. Viral load at start of treatment

0-100 copies	
100 and above	
Undetectable	

6. Viral load at treatment outcome

0-100 copies	
100 and above	
Undetectable	

7. Type of Tuberculosis diagnosed

PTB	Yes	**MDR-TB**	Yes	**Extra PTB**	Yes
	No		No		No

8. Method of TB diagnosis

AFB Smear positive	
Gene xpert MTB/RIF positive	
Chest Xray	

9. Treatment

PTB	Yes	**MDR-TB**	Yes	**Extra PTB**	Yes
	No		No		No

10. Duration on treatment

6 months	
9months	

11. Outcome

Treatment completion	
Cured	
Died	
Defaulted	

Annexure 2: Letter to request permission to use secondary data from Department of Health

PO Box 2042
GROOTHOEK
0628
18 March 2021

The District Executive Manager

Limpopo Department of Health

Private Bag X9302

POLOKWANE

0700

Dear Sir/Madam

Request for permission to use secondary data for a study research

I am a student at the University of Limpopo (UL) currently registered for Masters' Degree in Public Health. I hereby request permission to use secondary data for the study at Lebowakgomo hospital.

The title of the study is: **Tuberculosis treatment outcome in an antiretroviral treatment programme at Lebowakgomo hospital, Limpopo Province.** My research supervisor is Dr E Maimela. The aim of the study is to investigate the Tuberculosis treatment outcomes and implications of TB on ART outcomes; with an aim to develop strategies to control TB in Antiretroviral.

I require secondary data from the TB notification registers, files of patients who are on Anteritroviral therapy and having Tuberculosis. Special focus will be on files of males and females from 18 years and above. Attached are the research proposal and the ethical clearance certificate from UL.

Thank you in anticipation of a positive response

Kind Regards

Monepya Refilwe Gift

Email:refilwemonepya@gmail.com

Cell number: 072 327 2226

Annexure 3: Letter to request permission to use secondary data from Lebowakgomo Hospital

PO Box 2042
GROOTHOEK
0628
27 May 2021

The Hospital CEO

Lebowakgomo Hospital

Private Bag X14

CHUENESPOORT

0737

Dear Sir/Madam

Request for permission to use patients'files for a study research

I am a student at the University of Limpopo (UL) currently registered for Masters' Degree in Public Health. I hereby request permission to use patients' files for the study at Lebowakgomo hospital.

The title of the study is: **Tuberculosis treatment outcome in an antiretroviral treatment programme at Lebowakgomo hospital, Limpopo Province.** My research supervisor is Dr E Maimela. The aim of the study is to investigate the Tuberculosis treatment outcomes and implications of TB on ART outcomes; with an aim to develop strategies to control TB in Antiretroviral.

I require secondary data from the TB notification registers, files of patients who are on Anteritroviral therapy and having Tuberculosis. Special focus will be on files of males and females from 18 years and above. Attached are the research proposal, the ethical clearance certificate from UL and the permission letter received from Limpopo Department of Health.

Thank you in anticipation of a positive response

Kind Regards

Monepya Refilwe Gift

Email:refilwemonepya@gmail.com

Cell number: 072 327 2226

Annexure 4: TREC Approval from University of Limpopo

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:
makoetja.ramusi@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: 17 February 2021

PROJECT NUMBER: TREC/13/2021: PG

PROJECT:

Title: Tuberculosis treatment outcome in an antiretroviral treatment programme at Lebowakgomo hospital, Limpopo Province

Researcher: RG Monepya
Supervisor: Dr E Maimela
Co-Supervisor/s: Dr TS Ntuli
School: Health Care Sciences
Degree: Master of Public Health

PROF P MASOKO
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.**

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Annexure 5: Approval letter from Limpopo Provincial Department of Health

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

Department of Health

Ref : LP_2021-03-003
Enquires : Ms PF Mahlokwane
Tel : 015-293 6028
Email : Phoebe.Mahlokwane@dhsd.limpopo.gov.za

Refilwe Monepya

PERMISSION TO CONDUCT RESEARCH IN DEPARTMENTAL FACILITIES

Your Study Topic as indicated below;

Tuberculosis treatment outcome in an antiretroviral treatment programme at Lebowakgomo hospital, Limpopo province

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 institution supervisor/s a week before the study is conducted.
    b. In the course of your study, there should be no action that disrupts the routine services, or incur any cost on the Department.
    c. After completion of study, it is mandatory that the findings should be submitted to the Department to serve as a resource.
    d. The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
    e. The approval is only valid for a 1-year period.
    f. If the proposal has been amended, a new approval should be sought from the Department of Health
    g. Kindly note that, the Department can withdraw the approval at any time.

    Your cooperation will be highly appreciated

pp Head of Department — Date 19/05/2021

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

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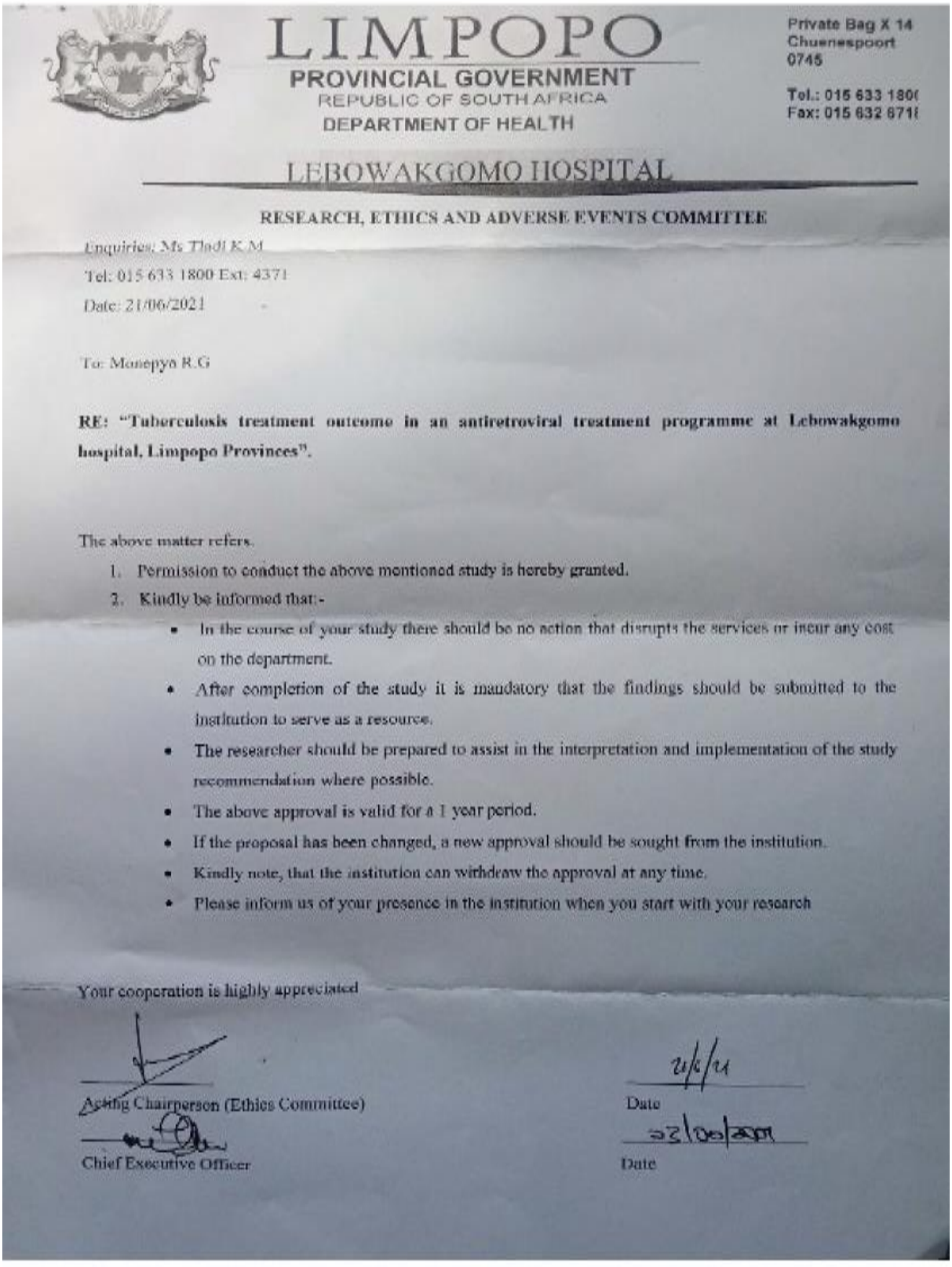
Annexure 6: Approval letter from Lebowakgomo Hospital



LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF HEALTH

Private Bag X 14
Chuenespoort
0745

Tel.: 015 633 180(
Fax: 015 632 671(

LEBOWAKGOMO HOSPITAL

RESEARCH, ETHICS AND ADVERSE EVENTS COMMITTEE

Enquiries: Ms Thodi K.M
Tel: 015 633 1800 Ext: 4371
Date: 21/06/2021

To: Monepya R.G

RE: "Tuberculosis treatment outcome in an antiretroviral treatment programme at Lebowakgomo hospital, Limpopo Provinces".

The above matter refers.

1. Permission to conduct the above mentioned study is hereby granted.
2. Kindly be informed that:-
   - In the course of your study there should be no action that disrupts the services or incur any cost on the department.
   - After completion of the study it is mandatory that the findings should be submitted to the institution to serve as a resource.
   - The researcher should be prepared to assist in the interpretation and implementation of the study recommendation where possible.
   - The above approval is valid for a 1 year period.
   - If the proposal has been changed, a new approval should be sought from the institution.
   - Kindly note, that the institution can withdraw the approval at any time.
   - Please inform us of your presence in the institution when you start with your research

Your cooperation is highly appreciated

Acting Chairperson (Ethics Committee) — Date 21/6/21

Chief Executive Officer — Date 23/06/2021

Annexure 7: Evidence of language editing

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0700 Tel: 074 8666 914 • Fax: 0864154022

Date: 08 November 2021

To Whom it May Concern

I hereby confirm that I have proof-read the document entitled: "Tuberculosis treatment outcome in an antiretroviral treatment programme at Lebowakgomo Hospital, Limpopo Province" authored by RG Monepya TK with student number 9911715 from University of Limpopo. The document has been edited and proofread for grammar, spelling, punctuation, overall style and logical flow. Considering the suggested changes that the author may or may not accept, at her discretion, each of us has our own unique voice as far as both spoken and written language is concerned. In my role as proof-reader I try not to let my own "written voice" overshadow the voice of the author, while at the same time attempting to ensure a readable document.

Please refer any queries to me.

Rapetsoa DB