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PREVALENCE OF *MYCOBACTERIUM TUBERCULOSIS* USING GENEXPERT AMONG TUBERCULOSIS SUSPECTED PATIENTS AT VICTORIA CHITEPO PROVINCIAL HOSPITAL FROM JANUARY 2024 TO DECEMBER 2024

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MEDICAL LABORATORY SCIENCE HONOURS IN THE COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES

2025

Abstract

Tuberculosis (TB) is a communicable disease that remains a significant global health challenge and is the leading cause of death from a single infectious agent. Despite the implementation of various WHO-recommended TB control strategies, substantial gaps persist in case detection and treatment, particularly in low- and middle-income countries. This study aimed to determine the prevalence of *Mycobacterium tuberculosis* among presumptive TB patients at Victoria Chitepo Provincial Hospital in Mutare, Zimbabwe, from January to December 2024. A retrospective cross-sectional study was conducted involving 1,200 TB-suspected patients. Data were collected from laboratory records using the GeneXpert MTB/RIF assay, a molecular diagnostic tool known for its rapid detection capabilities. Demographic and clinical information was extracted from patient records, focusing on variables such as age, gender, HIV status, and socio-demographic factors. Statistical analyses were performed using SPSS version 24, with logistic regression models applied to identify risk factors associated with TB infection. Out of the 1,200 patients suspected of having TB, *Mycobacterium tuberculosis* was identified in 401 individuals, yielding an overall prevalence rate of 33.4%. The analysis revealed significant demographic disparities, with males exhibiting a higher prevalence (20.2%) compared to females (13.2%). Key risk factors identified included age, with the highest incidence observed in the 30–44 age group. Notably, 57.9% of the TB-positive patients were co-infected with HIV, indicating a critical intersection between these two public health issues. Other risk factors associated with increased prevalence included illiteracy, smoking, and close contact with known TB cases, emphasizing the need for targeted interventions. The findings from this study underscore the persistent challenge of TB in Zimbabwe, particularly in the Mutare region, despite ongoing national and international control efforts. The high prevalence of *Mycobacterium tuberculosis*, particularly among vulnerable groups such as males and those co-infected with HIV, highlights the urgent need for enhanced case detection and management strategies. Tailored public health interventions focusing on high-risk populations, improved access to diagnostic services, and integration of TB and HIV treatment are essential. By addressing these factors, Zimbabwe can work towards reducing the burden of TB and improving overall health outcomes in affected communities. Early detection and effective management strategies must be prioritized to strengthen control measures and prevent the emergence of drug-resistant strains of TB.

Key words

Declaration

I declare that this dissertation is my original work except where sources have been cited and acknowledged. The work has never been submitted, nor will it ever be submitted to another university for the award of a degree.

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Acknowledgements

I would like to acknowledge Dr Susan L MUTAMBU who equipped me with the necessary skills for carrying out this research and for guiding me through every step of the way and Mr Eliot CHIKAKA for assisting in the statistical analysis. I also express my gratitude to Mr Chinheya (VICTORIA CHITEPO LABORATORY HOD BACTRIOLOGY), for permission to collect the necessary information as well as doing their best to assist. I am also indebted to my parents P Makande, C Gwetsayi and my siblings.

Acronyms and Abbreviations

TB	Tuberculosis
MTB/RIF	*Mycobacterium tuberculosis*/rifampicin
WHO	World Health Organisation
HIV	Human Immunodeficiency Virus
ZN	Ziehl-Neelsen

Definition of Key Terms

Diagnostics - the process of identifying a disease, condition, or injury based on signs, symptoms, medical history, and various tests.

GeneXpert - molecular diagnostic tool used primarily for the rapid detection of infectious diseases, most notably tuberculosis (TB) and its resistance to rifampicin (RIF)

Coinfection - refers to the simultaneous infection of an individual with two or more different pathogens

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CHAPTER 1 INTRODUCTION

1.1 Introduction

Tuberculosis (TB), a global health crisis driven by *Mycobacterium tuberculosis*, disproportionately affects low- and middle-income countries, necessitating early and accurate detection for effective management and improved patient outcomes. (World Health Organization, 2023) In Zimbabwe, the burden of TB is compounded by high HIV co-infection rates, prompting the National TB Control Program to implement strategies like the GeneXpert MTB/RIF assay for rapid diagnosis and rifampicin resistance detection. (Mugarisi, 2023) Despite the availability of GeneXpert, ongoing local monitoring of TB prevalence remains crucial for informing program management and resource allocation (World Health Organization, 2023). Addressing a gap in recent data, this study aim was to determine the prevalence of *Mycobacterium tuberculosis* among TB-suspected patients at Victoria Chitepo Provincial Hospital from January 2024 to December 2024 using the GeneXpert MTB/RIF assay. This provided important information for the hospital, district health authorities, the National TB Control Program to optimize TB diagnosis, treatment, and prevention strategies, contributing to the broader goal of reducing TB's burden in Zimbabwe. (Mugarisi, 2023**)**

1.2 Background to the Study

Tuberculosis (TB), an airborne infectious disease caused by *Mycobacterium tuberculosis*, poses a persistent global health challenge, affecting individuals of all ages and socioeconomic backgrounds (World Health Organization, 2024). While TB primarily affects the lungs, leading to pulmonary TB, it can also impact other parts of the body. Despite global efforts to combat the disease, the World Health Organization (WHO) recognizes TB as a leading cause of death worldwide, surpassing even

HIV/AIDS as a single infectious agent. Globally, millions contract TB annually, resulting in significant mortality, particularly in low- and middle-income countries. Although TB mortality and incidence rates are declining globally, the disease remains a major public health concern, demanding continued and focused interventions. In line with global trends, Zimbabwe has made strides in the fight against TB, with the estimated incidence rate decreasing from 242 per 100,000 in 2015 to 204 per 100,000 in 2022. This progress is attributed to the Second Republic's efforts to scale up preventative measures and provide care for those already infected1. These efforts include the development of a TB Preventive Therapy Acceleration Plan and the expansion of the TB diagnostic network through the deployment of portable, battery-powered diagnostic machines and GeneXpert machines. Despite these gains, TB remains a significant public health challenge in Zimbabwe, particularly among people living with HIV (PLHIV), who account for a substantial proportion of TB cases. In 2021, an estimated 29,945 people developed active TB in Zimbabwe, with PLHIV comprising a significant portion of these cases (World Health Organization, 2023). The country has one of the highest rates of TB/HIV co-infection globally, with approximately 70% of TB patients also being HIV positive (CDC, 2023). Despite improvements in treatment coverage, stigma and limited access to healthcare continue to hinder effective management of TB among PLHIV. Additionally, drug-resistant TB (DR-TB) remains a concern, requiring the implementation of new treatment regimen. The burden of TB in Zimbabwe is further exacerbated by socioeconomic factors. As highlighted by the WHO, poverty can lead to poor nutrition, overcrowded living conditions, and inadequate ventilation, increasing the risk of TB transmission. A 2018 national patient cost survey revealed that a significant percentage of TB-affected households in Zimbabwe face catastrophic costs due to the disease, forcing them to

borrow money or sell assets to cope with treatment expenses. (Ministry of Health and Child Care Zimbabwe, 2018)

Recognizing the need for targeted interventions, the Ministry of Health and Child Care (MoHCC) in Zimbabwe has implemented strategies such as targeted screening for active TB (TaS4TB) to detect missed cases among high-risk and hard-to-reach populations. These efforts aim to bring TB services closer to communities and improve access to diagnosis and treatment. However, challenges remain, including delayed diagnoses, limited access to new technologies, and the persistent problem of multi-drug resistance. Within Zimbabwe, specific regions may experience varying TB prevalence and challenges. While national-level data provides a broad overview, understanding the local TB situation in districts like Mutare is crucial for tailoring interventions and allocating resources effectively. Limited access to healthcare, socioeconomic disparities, and other local factors can influence TB transmission and treatment outcomes. Therefore, this study focused on Victoria Chitepo Provincial Hospital in Mutare, aiming to provide updated information on the prevalence of *M. tuberculosis* among TB-suspected patients in this specific setting. This local data is essential for informing targeted interventions and improving TB control efforts within Mutare District and the broader Manicaland Province.

1.2.2 Statement of the problem

Despite Zimbabwe's progress in TB control, a gap exists in current, localized data from the previous study which does not provide insights on Mycobacterium tuberculosis prevalence specifically for Mutare district for patients diagnosed at Victoria Chitepo Provincial Hospital, hindering effective resource allocation and targeted interventions within Mutare District. Understanding the present prevalence, as detected by Gene

Xpert, is crucial for optimizing TB case detection, addressing the potential for missed cases amidst challenges like HIV co-infection and drug resistance.

1.3 Research Objectives

1.3.1 Broad Objective

To determine the prevalence of pulmonary TB (PTB) among TB-suspected patients attending Victoria Chitepo Provincial Hospital) using the GeneExpert MTB/RIF from January 2024 to December 2024

1.3.2 Specific Objectives

1. To determine the prevalence of pulmonary TB (PTB) among TB-suspected patients attending Victoria Chitepo Provincial Hospital from January 2024 to December 2024
2. To analyse the demographic characteristics associated with TB infection among patients attending Victoria Chitepo Provincial Hospital from January 2024 to December 2024
3. To determine the prevalence of *Mycobacterium tuberculosis* and HIV co-infection among patients attending Victoria Chitepo Provincial Hospital from January 2024 to December 2024
4. To determine the residential factors associated with resistant TB infection among patients attending Victoria Chitepo Provincial Hospital from January 2024 to December 2024

1.4. Research Questions

1. What is the prevalence of pulmonary TB (PTB) among TB-suspected patients attending Victoria Chitepo Provincial Hospital from January 2024 to December 2024?

2. Which demographic characteristics are associated with TB infection among TB-suspected patients diagnosed with pulmonary TB at Victoria Chitepo Provincial Hospital from January 2024 to December 2024?
3. What is the prevalence of *Mycobacterium tuberculosis* and HIV co-infection among patients attending Victoria Chitepo Provincial Hospital from January 2024 to December 2024?
4. What are the residential factors associated with resistant TB infection among patients attending Victoria Chitepo Provincial Hospital from January 2024 to December 2024?

1.5 Study Justification

Tuberculosis (TB) remains a pressing global health threat, necessitating local research to guide effective control strategies. This study aimed to determine the prevalence of pulmonary TB among TB-suspected patients at Victoria Chitepo Provincial Hospital, addressing a critical data gap for targeted resource allocation. By analyzing demographic and geographic factors, the research will identify high-risk populations, enabling focused screening and prevention. Furthermore, assessing TB co-infection prevalence will inform integrated service delivery, given TB's role as a leading cause of death, for example among people with HIV. Ultimately, this context-specific evidence will bolster national TB control efforts and improve community well-being, conducted with utmost ethical consideration.

1.6 Study Limitations

The findings of this study may not be broadly applicable due to its focus on one hospital, a specific age group, and a limited timeframe. Using only one diagnostic test might underestimate TB cases, and the study design prevents proving cause-and-effect relationships between risk factors and TB.

1.7 Summary

This study investigated the prevalence of pulmonary tuberculosis (PTB) among TB-suspected patients aged 15 years and older attending Victoria Chitepo Provincial Hospital in Mutare District, Zimbabwe, between January 2024 and December 2024. The primary objective was to determine the overall prevalence of PTB using the GeneXpert MTB/RIF assay. Specific objectives included analyzing TB prevalence in relation to demographic (age, sex, occupation, education) and geographic (residential area) characteristics, as well as determining the prevalence of TB and HIV co-infection among patients Victoria Chitepo Provincial Hospital from January 2024 to December 2024.

The study was motivated by the ongoing global burden of TB and the need for localized data to inform effective control strategies, with particular attention to high risk groups. A cross-sectional design was employed, and findings were interpreted within the context of the study's limitations, including its focus on a single healthcare facility, a specific age group, a limited timeframe, and the use of a single diagnostic method. Ethical considerations was paramount throughout the study.

CHAPTER 2 REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter will provide a comprehensive review of existing literature relevant to tuberculosis (TB) prevalence, risk factors, and control strategies, both globally and within Zimbabwe. It synthesizes key findings from previous studies to establish a contextual framework for the present research at Victoria Chitepo Provincial Hospital. It will examine the global and regional burden of TB, trends in TB prevalence and risk factors in Zimbabwe. Ultimately, this review will highlight existing knowledge gaps and underscore the significance of the current study in contributing to a more nuanced understanding of the local TB epidemic.

2.2 TB Conceptual Framework

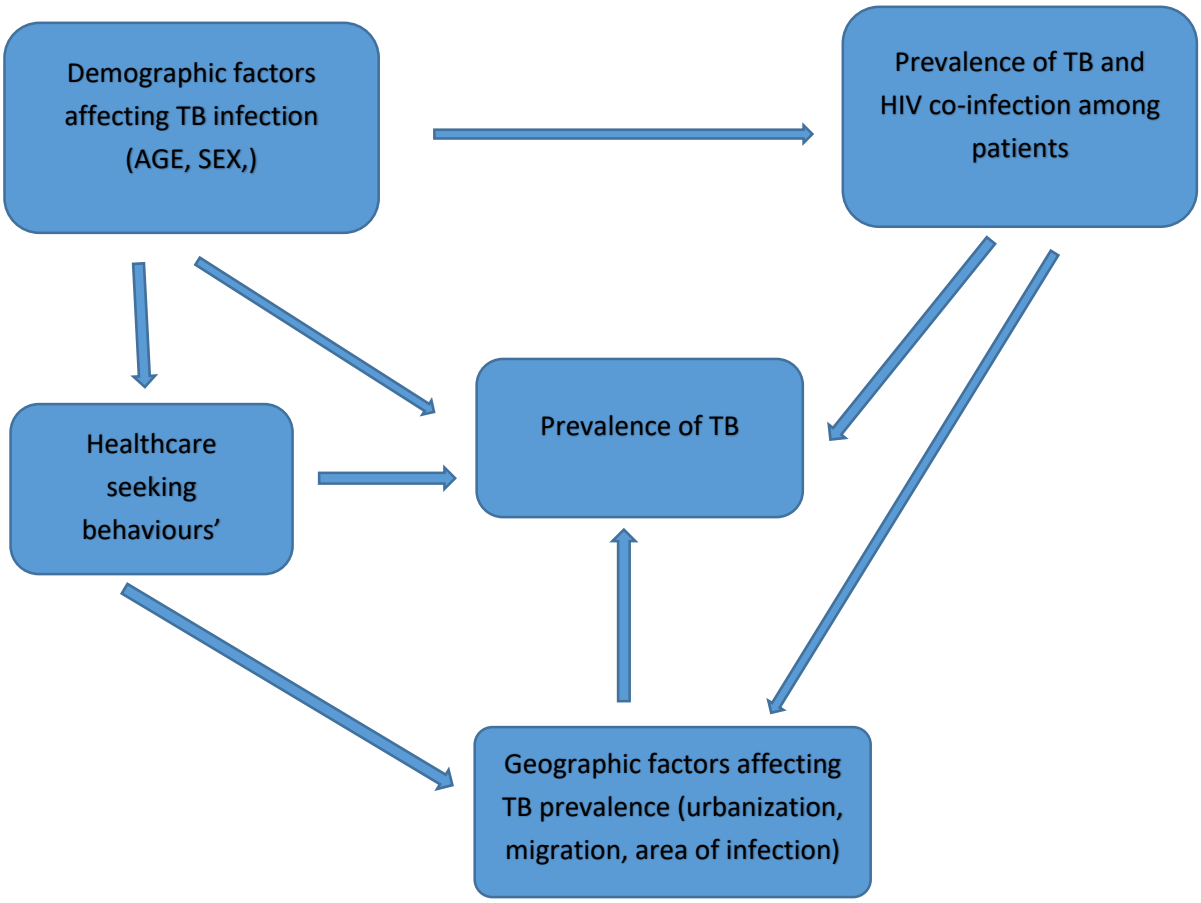

Figure 1: Conceptual framework

Certain demographic groups (e.g., older adults, males, specific racial/ethnic groups) often show higher TB rates of infection. HIV significantly increases the risk of developing active TB (Centers for Disease Control and Prevention, 2022). The impact of demographic factors on TB can be influenced by HIV prevalence within those groups, making these relationships interconnected Demographic and geographic factors both influence TB prevalence. Specific demographics are linked to higher TB rates. Similarly, geographic factors (urbanization, migration, area of infection) contribute to TB prevalence. In the conceptual framework, these factors are considered as influencing the likelihood of TB infection, making certain populations and regions higher risk (Centers for Disease Control and Prevention, 2023). Geographic factors influence HIV/TB co-infection by creating "hotspots"—specific areas with higher co-infection rates due to factors like poverty, urbanization, and ecological variables. These geographic conditions increase the risk of HIV, which in turn increases the risk of TB in those areas. The geographic factors show to influence healthcare-seeking behaviour as it can lead to the prevalence of tuberculosis (TB). Regions with high rates of poverty, urbanization, and limited healthcare access often experience higher TB incidence. For instance, Southeast Asia and Africa account for nearly 70% of global TB cases, with socioeconomic conditions such as low literacy rates and undernourishment significantly contributing to the risk (Zhang et al., 2024) This 233behaviour, in turn, can affect TB prevalence and outcomes. For example, if individuals in remote areas are less likely to seek prompt diagnosis and treatment due to distance, this could contribute to higher TB transmission rates in those areas

2.3 Relevance of the Conceptual Frame Work to the Study

This conceptual framework is essential for studying TB prevalence because it offers a structured approach to understanding the complex web of factors influencing TB

incidence. It acknowledges that TB is not solely a medical concern but is also shaped by demographic, geographic, and socioeconomic factors, as well as individual healthcare-seeking behaviours. By explicitly outlining the relationships between these factors, the framework guides the research by ensuring focused data collection and analysis, formulating research questions, contextualizing findings, and informing targeted intervention strategies. For example, it facilitates the exploration of how poverty, urbanization, healthcare access, and HIV co-infection intertwine to affect TB rates in specific geographic areas. Ultimately, by understanding the interplay of these variables, the framework allows for tailored public health interventions that address the unique needs of the community served by Victoria Chitepo Provincial Hospital, and add to body of scientific knowledge (Iran J Public Health. 2023 Dec;52(12)).

2.4 Literature Review

Tuberculosis (TB) remains a significant global infectious disease killer, surpassing COVID-19 (WHO, 2023). In 2023, approximately 10.8 million people worldwide contracted TB, marking an increase from 10.7 million in 2022 and 10.1 million in 2020 (WHO, 2023). The World Health Organization (WHO) reported 8.2 million new TB diagnoses in 2023, the highest number since global monitoring began in 1995, up from 7.5 million in 2022 (WHO, 2023). However, this number is still lower than the estimated total, leaving a gap of 2.7 million undiagnosed cases (WHO, 2023). Globally, TB prevalence in 1997 was estimated at 32%, affecting 1.86 billion people (Christopher Dye *et al*, 1997). In 2012, there were an estimated 12 million prevalent cases, equivalent to 169 cases per 100,000 population, a 37% decrease since 1990 (WHO, 2013). In 2023, TB caused 1.25 million deaths, including 161,000 among people with HIV (WHO, 2023.

Southeast Asia and the Western Pacific accounted for 58% of all TB cases in 2012, with Africa coming in second (27%), according to WHO (2013). Twenty-six (26%) of cases worldwide were in India, with China and South Africa being second and third, respectively (WHO, 2013). African nations have the highest incidence rates (Christopher Dye et al., 1997). Twenty-two nations accounted for 80 percent of all incident TB cases, with five Southeast Asian countries accounting for more than half of the cases (Christopher Dye et al, 1997).

In 2021, an estimated 2.5 million Africans contracted TB, resulting in about 500,000 deaths (WHO African Region, 2023). The region's high HIV burden contributes to the problem, with 20% of new TB cases occurring among people living with HIV/AIDS (WHO African Region, 2023). Some countries, such as Cabo Verde, Eswatini, and South Africa, have achieved at least a 50% reduction in TB cases (WHO African Region, 2023). However, Nigeria and the Democratic Republic of Congo (DRC) account for a significant proportion of global TB cases. Specifically, Nigeria accounts for 4.6% of global new cases, and the DRC accounts for 3.1% (WHO African Region, 2023). In South Africa, an estimated 56,000 people died of TB in 2023, and the country had an estimated 427 new TB cases per 100,000 people (WHO African Region, 2023). TB remains a major public health challenge in the WHO African Region, accounting for a disproportionate 23% of new cases and 31% of TB-related deaths worldwide (WHO African Region, 2023). Despite these challenges, approximately 70% of TB cases in the African region are now being diagnosed and treated, representing the highest case-detection rate ever achieved in the region (WHO African Region, 2023). This increase in diagnosis rates is attributed to concerted efforts by countries to address the disease. For example, Nigeria nearly tripled its case notifications over five years, reaching 285,000 cases in 2022, up from 106,000 in 2018 (WHO African Region,

2023). However, 40% of TB cases in Africa are still under-detected or under-reported, particularly among males aged 15 to 44 years (WHO African Region, 2023).

Zimbabwe faces a significant TB burden, compounded by a high HIV prevalence (Zimbabwe National TB Program, 2023). While earlier WHO estimates ranked Zimbabwe among countries with high TB prevalence in the world, a national TB prevalence survey conducted in 2014 provided a more accurate estimate. This survey reported that, for individuals aged ≥15 years, the bacteriologically confirmed TB prevalence was 344 per 100,000 population (95% CI 268–420), adjusted prevalence of smear-positive TB was 82/100,000 population (95% CI 47–118), and the overall all-ages, all-forms TB prevalence of 275/100,000 population (95% CI 217–334) (Ministry of Health and Child Care Zimbabwe, 2014).

TB prevalence is significantly shaped by various demographic factors, including origin of birth, race/ethnicity, age, sex, socioeconomic status, and geographic location. Non-U.S.-born individuals often face a higher TB risk (Centers for Disease Control and Prevention).(2023), while certain racial and ethnic groups experience disproportionately higher incidence rates. TB rates tend to be higher among adults, particularly older adults, and males generally account for a larger percentage of cases. Socioeconomic factors and geographic location also play a crucial role, with higher TB risk associated with low socioeconomic groups and urban regions. Other factors, such as smoking habits and marital status, have also been identified as contributors to TB risk, highlighting the complex interplay of demographic and socioeconomic variables in shaping TB prevalence. (WHO 2024, *Global Tuberculosis Report 2024*)

Zimbabwe's demographic profile reveals a youthful population and a gradual shift towards urbanization. In 2012, 41% of the population was under 15 years old,

presenting a high child dependency ratio (Zimbabwe National Statistics Agency, 2017). While largely rural with 68% residing in communal areas in 2017, urban populations are growing, with 45% of women and 43% of men residing in urban areas by 2024. The Shona people constitute the majority, at 80% of the population (Zimbabwe Demographic and Health Survey, 2022). Fertility rates are declining, with a total fertility rate of 3.8 in 2012, but are higher in rural areas (4.6 children per woman) compared to urban areas (3.1 children per woman). This evolving demographic structure presents both opportunities and challenges for Zimbabwe's development.

TB occurrence exhibits spatial heterogeneity across Zimbabwe, with hotspots detected in the central, western, and southern parts of the country from 2015 to 2018. These areas are characterized by artisanal mining activities and high poverty levels. Specifically, Chegutu, Kwekwe, and Mhondoro-Ngezi districts were persistently characterized by significant hotspots. The spatial distribution of TB notification rates is relatively higher in the central and southern parts of the country than in the east and northwestern regions2. Districts with high TB notification include Beitbridge, Buhera, Chirumhanzu, Gwanda, Hwange, Mwenezi, and Sanyati. Spatial analysis from 2015 to 2018 showed that the distribution of TB cases was more spatially clustered than would be expected in a random process (National TB control Program, Ministry of Health and Child Care Harare, Zimbabwe 2021). This necessitates prioritizing resource allocation in areas with the highest disease burden. Zimbabwe is one of the top eight African countries with the highest burden of TB, HIV, and drug-resistant TB. Since Zimbabwe's TB epidemic is largely driven by HIV, unfavourable outcomes in TB patients could be associated with HIV co-infection. In the WHO African Region, most TB cases in 2021 were in the WHO regions of South-East Asia, Africa (23%),

and the Western Pacific. (Tuberculosis in the WHO African Region: 2023 progress update)

2.5 Summary

This chapter explored the complex landscape of tuberculosis (TB), particularly in the context of Zimbabwe and Africa. It examines global and local TB prevalence, highlighting the significant burden of the disease, especially when compounded by HIV co-infection. The review delves into the demographic factors influencing TB, noting the disproportionate impact on certain age groups, genders, and populations, as well as the role of socioeconomic status. Finally, it addresses geographic disparities, identifying TB hotspots and emphasizing the need for targeted interventions. This sets the stage for understanding the multifaceted nature of TB and informing strategies for effective control and prevention.

CHAPTER 3 METHODOLOGY

3.1 Introduction

This chapter details the methodology used to determine the prevalence of *Mycobacterium tuberculosis* among TB-suspected patients at Victoria Chitepo Provincial Hospital from January 2024 to December 2024. It also outlines the research design, study population and sampling methods, data collection, data analysis techniques and ethical considerations implemented to ensure the rigor and validity of the findings.

3.2 Research Design

This study employed a retrospective cross-sectional design to determine the prevalence of *Mycobacterium tuberculosis* among TB-suspected patients at Victoria Chitepo Provincial Hospital between January 2024 and December 2024. This design was appropriate as it allowed for efficient analysis of existing, routinely collected GeneXpert results and patient data to assess the burden of TB and explore associations with patient characteristics. The retrospective nature utilizes readily available information.

3.3 Study Population

The study population consisted of patients who had been clinically suspected of having tuberculosis (TB) and have undergone testing with the GeneXpertMTB/RIF assay. The population included all patients whose sputum samples were tested using the GeneXpert MTB/RIF assay between January 2024 and December 2024. Data were drawn from documented laboratory and clinical records, focusing on individuals aged 15 years and older, regardless of gender or HIV status.

3.4 Study Setting

The study was conducted at Victoria Chitepo Provincial Hospital, a public healthcare facility located in Mutare, Manicaland Province, Zimbabwe. The hospital serves as a referral center for the province, providing healthcare services to a diverse population from both urban and rural areas. Its TB clinic is a key component of the hospital, offering TB screening, diagnosis, and treatment, including the use of the GeneXpert MTB/RIF assay for rapid TB detection. This setting was chosen due to its high patient volume, established TB diagnostic procedures, and its role in addressing the TB burden in the region.

3.5 Inclusion Criteria

The study included all patients, regardless of age and gender, suspected of having TB who underwent GeneXpert MTB/RIF testing at Victoria Chitepo Provincial Hospital between January 1, 2024, and December 31, 2024. Participants were included if their GeneXpert test results were available in the hospital laboratory records and if complete demographic and clinical data, encompassing age, sex, location, and HIV status were recorded in the TB clinic's patient registers or electronic medical records. These criteria ensured the inclusion of all relevant patients tested for TB during the specified period, with the availability of complete data necessary for the intended analysis.

3.6 Exclusion Criteria

Patients were excluded from the study if they were suspected of having TB but did not undergo GeneXpert MTB/RIF testing at Victoria Chitepo Provincial Hospital between January 1, 2024, and December 31, 2024. Additionally, patients whose GeneXpert test results were not located in the hospital laboratory records, those with incomplete demographic or clinical data recorded in the TB clinic patient registers or electronic

medical records, and duplicate records of the same patient were excluded to ensure the integrity and completeness of the data analysis.

3.7 Sample Size

In this retrospective study, a census sampling approach was utilized, incorporating all available data that aligns with the inclusion criteria. The aim was to include all patients suspected of having TB who underwent GeneXpert MTB/RIF testing at Victoria Chitepo Provincial Hospital between January 1, 2024, and December 31, 2024, provided complete GeneXpert results and relevant information were accessible for a in of 1200 patients. As such, no formal sample size calculation was performed; instead, the sample size was determined by the total number of patient records that satisfied the inclusion criteria during the specified period. While leveraging all available data maximizes statistical power and facilitates a thorough assessment of TB prevalence within this population, the limitations inherent to a census approach, such as potential biases related to the characteristics of patients seeking care at the hospital, were thoroughly acknowledged and addressed in the interpretation of the study findings.

3.8 Sampling Procedure

To identify all eligible participants, a comprehensive search of Victoria Chitepo Provincial Hospital's TB clinic records and laboratory database was conducted for the period between January 1, 2024, and December 31, 2024. The data collection process followed a systematic approach: **first**, all patient records within the specified timeframe were screened; **second**, each identified record was assessed against the inclusion and exclusion criteria, verifying TB suspicion, GeneXpert testing during the study period, and the availability of complete data; **third**, for eligible records, data were extracted using a standardized form, capturing demographics, HIV status, GeneXpert results, and other clinical information; **fourth**, a percentage of extracted

data were cross-checked for accuracy; and **finally**, all patient identifiers were removed, replaced with unique codes, and stored in a secure database, ensuring anonymity as well as confidentiality throughout the process.

3.9 Data Collecting Tools

Data for this study was collected through a structured medical record review, employing a pre-designed data extraction form to capture relevant variables from TB clinic patient registers/electronic medical records and GeneXpert machine records. The form gathered demographic data, medical history (including HIV status and previous TB treatment), clinical information, and GeneXpert test results, organized logically with clear definitions for each variable. To facilitate efficient data entry and analysis, the extracted data was recorded in a tabular format. This table included columns for each variable, allowing for easy sorting, filtering, and analysis. To ensure consistency and accuracy, the data extraction form was pilot-tested, and a coding manual provided a brief description of the best source of information within the medical record for each study variable. This systematic approach facilitated the efficient and reliable collection of data from medical records for subsequent analysis.

3.10 Pilot Study

Before commencing full-scale data collection, a pilot study was conducted, involving the review of 20-30 randomly selected medical records that meet the study inclusion criteria. These records were independently reviewed to ensure the clarity, feasibility, and reliability of the data extraction process. The pilot study aimed to assess the clarity and comprehensiveness of the data extraction form, evaluate the feasibility of the data extraction process, assess inter-rater reliability using Cohen's kappa coefficient (with a target value of >0.70) and identify any missing or irrelevant variables. Findings from the pilot study informed revisions to the data extraction form and procedures,

addressing ambiguities and inconsistencies, and if necessary, providing additional training to data extractors to enhance consistency; data collected during the pilot study was excluded from the final analysis.

3.11 Data Analysis and Organisation

First, data were compiled from patient records, focusing on demographics, clinical characteristics, and GeneXpert results. This information was organized in a spreadsheet, using Microsoft Excel. Descriptive statistics, including counts and percentages, were calculated to summarize the prevalence of *Mycobacterium tuberculosis*, as detected by GeneXpert, within the study population. This involved determining the proportion of GeneXpert positive results out of the total number of tests conducted. Further stratification was performed based on age, sex, and other relevant clinical variables to identify potential trends or patterns. For instance, the prevalence of TB was compared between different age groups or between males and females. Finally, a narrative summary was crafted to present the findings, highlighting key observations and potential implications for TB control efforts at Victoria Chitepo provincial hospital. While this approach is less sophisticated than statistical modelling, it offers a practical and accessible means of understanding the burden of TB within the constraints of available resources.

3.12 Ethical Consideration

Permission to conduct the study was sought from Africa University Research Ethics Committee (AUREC) and from the College of Health, Agriculture and Natural Sciences (CHANS) in the department of Health Sciences. Authority to access and use patient records was sought from Victoria Chitepo Provincial Hospital. The information that was accessed and used in this study was kept confidential and for this study only.

Patient information was strictly accessed only by the principal investigator and the supervisor hence assurance to anonymity and privacy of the study participants' information were maintained throughout the study. Identifiable information was anonymised to protect participants' identities, particularly given the stigma often associated with TB.

3.13 Summary

Chapter 3 has dealt with the research design, study setting, study population, inclusion and exclusion criteria. Explanations on how data were going be collected using a Medical Record/ Data abstraction form has been stated. Information was also provided on how the data collection instrument was pretested including information on ethical considerations, analysis and organization of data.

CHAPTER 4 DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents a comprehensive analysis and interpretation of data collected on the prevalence of *Mycobacterium tuberculosis* among tuberculosis-suspected patients at Victoria Chitepo Provincial Hospital from January to December 2024, using the GeneXpert diagnostic method. Serving as a critical component of this research, this chapter systematically analyses empirical evidence to address the research objectives established in the first chapter. Through statistical analysis and detailed interpretation, it bridges the gap between raw data collection and meaningful conclusions, providing insights into the prevalence and demographic patterns of tuberculosis as detected by GeneXpert. The chapter is structured to present findings through various analytical tools, including statistical tables, graphs, and narrative explanations

4.2. Demographic characteristics associated with TB infection among patients attending Victoria Chitepo Provincial Hospital

Table 1: Socio-demographic characteristics of study participants

Variables	**Categories**	**Frequency**	**Percentage (%)**
Gender	Male	756	63%
	Female	444	37%
Age categories	18–29	200	16.67%
	30–44	500	41.67%
	45–59	300	25%
	> 60	200	16.67%

Table 1 shows the socio-demographic data of 1200 study participants suspected with TB. It reveals a predominantly male population (63%) and a diverse age distribution. The age groups are as follows: 16.67% (200 participants) who are between 18–29 years, 41.67% (500 participants) between 30–44 years, 25% (300 participants) between 45–59 years, and 16.67% (200 participants) over 60 years. The mean age is approximately 39 years. The mode is the 30–44 years age category, indicating that this group had the highest frequency of participants. Overall, the study reflects a higher prevalence among males and a peak incidence in the middle-aged group.

4.3.1 Prevalence of pulmonary TB (PTB) among TB-suspected patients

Table 2: Overall TB results among suspected patients at VCPH

Gender N=401	Frequency		
	Positive Cases N (%)	**Negative Cases N (%)**	**Total N (%)**
Males	253(20.2)	503(42,8)	756(63%)
Females	148(13.2)	296(23,8)	444(37%)
Total	401(33,4)	799(72.6)	**1200(100)**

All % correct to dp

Total not needed

Table 2 shows the overall TB results among the total of 1200 patients suspected with TB at VCPH, the data shows that approximately 33.4% are positive cases, which translates to about 401 patients, and 66.6% are negative cases, totalling around 799 patients. This distribution indicates a significant majority of negative cases across the entire population. When broken down by gender, males constitute 63% of the total population (756 patients), with approximately 20.2% of the total being positive male cases (about 243 patients), and females make up 37% (444 patients), with about 13.2% of the total being positive female cases (approximately 158 patients). This suggests

that males have a higher prevalence of both positive and negative cases compared to females, which could imply differences in exposure, susceptibility, or reporting rates between genders.

4.3.2 Overall TB Prevalence among suspected patients

A total of 1200 patients were tested for Tuberculosis (TB). Four hundred and one (401) individuals tested positive. This indicates a prevalence rate of TB of 33.4%.

$$\text{Prevalence} = \frac{Number\ of\ Positive\ Cases}{Total\ number\ of\ Patients\ tesed} \times 100$$

$$\text{Prevalence} = 401 / 1200 \times 100$$

$$\text{Prevalence} = 33.4\%$$

The elevated TB prevalence rate of 33.4% represents a significant public health concern, reflecting the extent of TB infection in the population and highlighting the need for effective interventions.

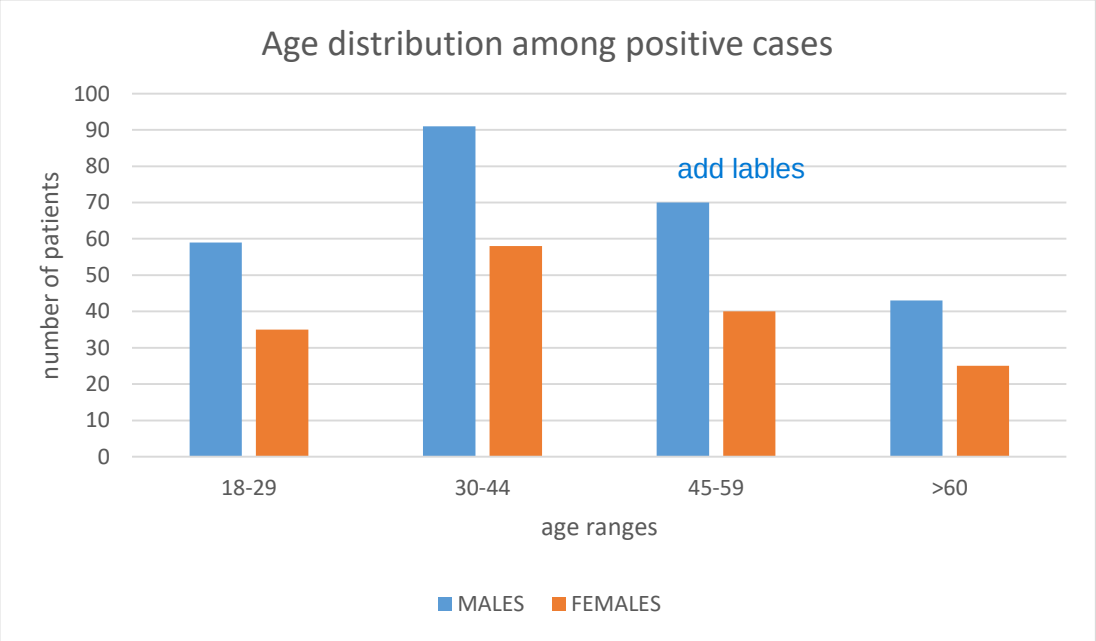

Figure 2: Age distribution among positive cases

The bar chart (Figure 2) illustrates the age distribution of positive cases among males and females across four age groups: 18–29, 30–44, 45–59, and >60. Overall, males

consistently have a higher number of positive cases compared to females in each age group. The highest number of positive cases is observed in the 30–44 age range, with approximately 90 males and 60 females affected. This is followed by the 45–59 age group, where around 80 males and 50 females are positive. In the younger age group (18–29), there are approximately 50 positive male cases and 40 female cases. The lowest number of positive cases is seen in the >60 age group, with approximately 40 males and 30 females affected. The data highlights that middle-aged individuals (30–44 years) are the most affected, particularly males, while older individuals (>60 years) have the lowest prevalence of positive cases. This trend suggests that age plays a significant role in the distribution of positive cases, with males being more affected across all age ranges.

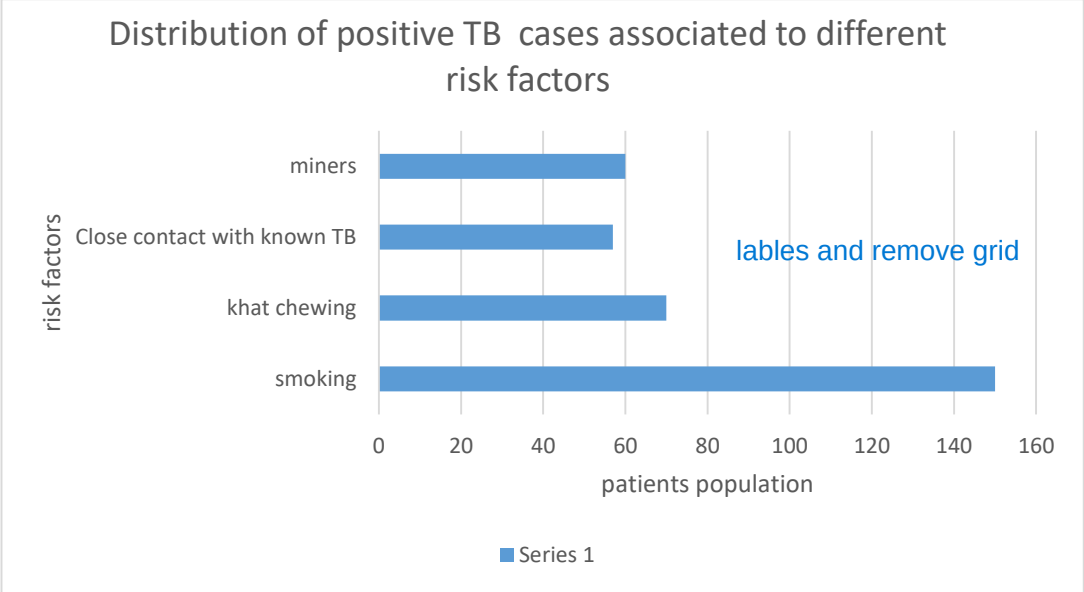

Figure 3: Distribution of positive TB cases associated to different risk factors

Figure 3 shows the distribution of positive TB cases among 1200 suspected patients reveals the prevalence of several key risk factors, recognizing that individuals may have multiple contributing factors. Smoking is the most prominent, affecting approximately 150 patients, representing 12.5% of the total suspected population. Khat

chewing is linked to around 75 cases, which is 6.25% of the total. Close contact with known TB cases and being a miner are each associated with roughly 60 positive TB cases, accounting for 5% each of the suspected population. It is important to note that these percentages reflect the presence of each risk factor and do not represent mutually exclusive groups; a single patient may be a smoker, chewer, miners and be in close contact with a known patient, so the sum may exceed 100% of the positive TB patients.

4.4 *Mycobacterium tuberculosis* and HIV co-infection among patients attending Victoria Chitepo Provincial Hospital

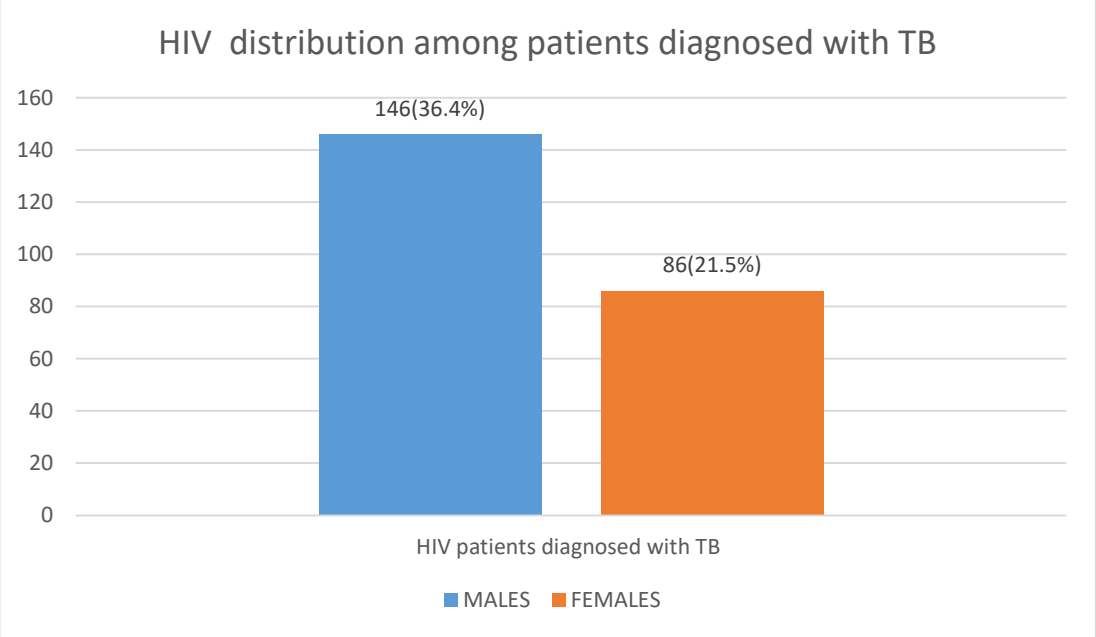

Figure 4: TB distribution on HIV among TB suspected patients

The graph (Figure 4) presents the distribution of HIV-positive patients diagnosed with tuberculosis (TB) at Victoria Chitepo Provincial Hospital, among a total of 401 TB patients. It shows that there are 146 male patients, accounting for approximately 36.4% of the total TB patients, and *86* female patients, representing approximately 21.5%. These patients are among 401 patients diagnosed with TB at Victoria Chitepo Provincial Hospital. Percentages are given against the total TB patients with HIV. This indicates a notable gender disparity in HIV prevalence among TB patients, with males

comprising a larger proportion of those co-infected with HIV. Overall, about **57.9%** of the TB patients are HIV-positive, highlighting the importance of targeted health interventions to address the specific needs of this population.

4.5 Residential factors associated with resistant TB infection among patients attending Victoria Chitepo Provincial Hospital

4.5.1 Overall distribution of resistant TB infection among TB positive patients.

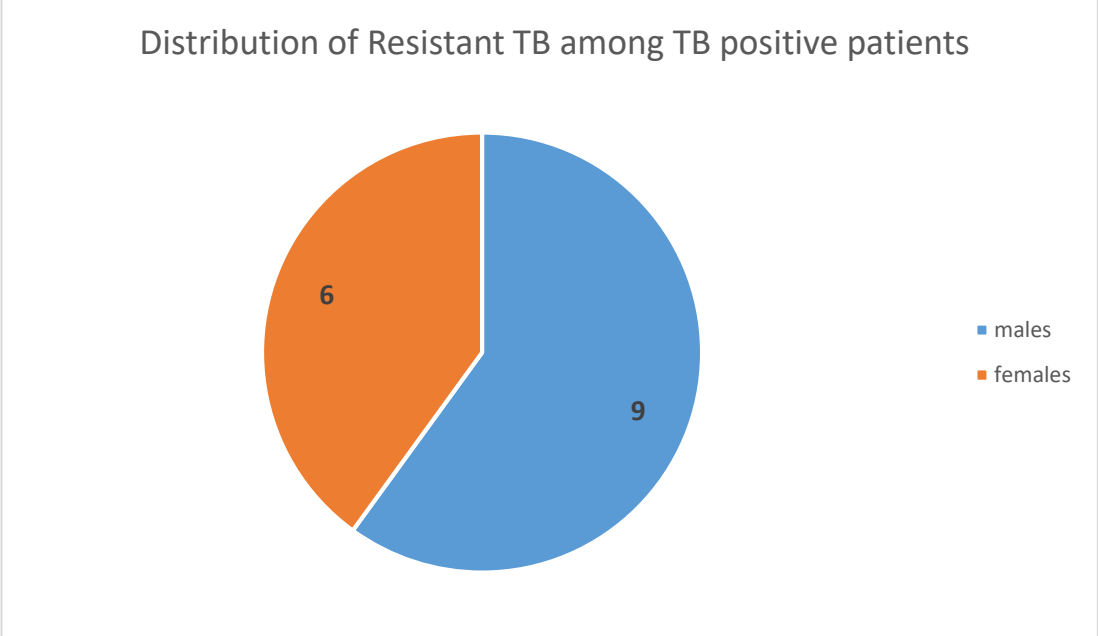

Figure 5: Overall distribution of resistant TB infection among TB positive patients

The pie chart (figure5) illustrates the distribution of drug-resistant TB cases by gender within the 401 TB-positive patients. Males account for 9 cases (60% of the resistant cases), while females account for 6 cases (40% of the resistant cases). Among the total 401 TB-positive patients, these 15 resistant TB cases (9 males + 6 females) represent approximately 3.74%. This indicates that drug-resistant TB affects a small, but critical, subset of the TB-positive population.

4.5.2 Residential distribution of resistant TB among TB positive patients

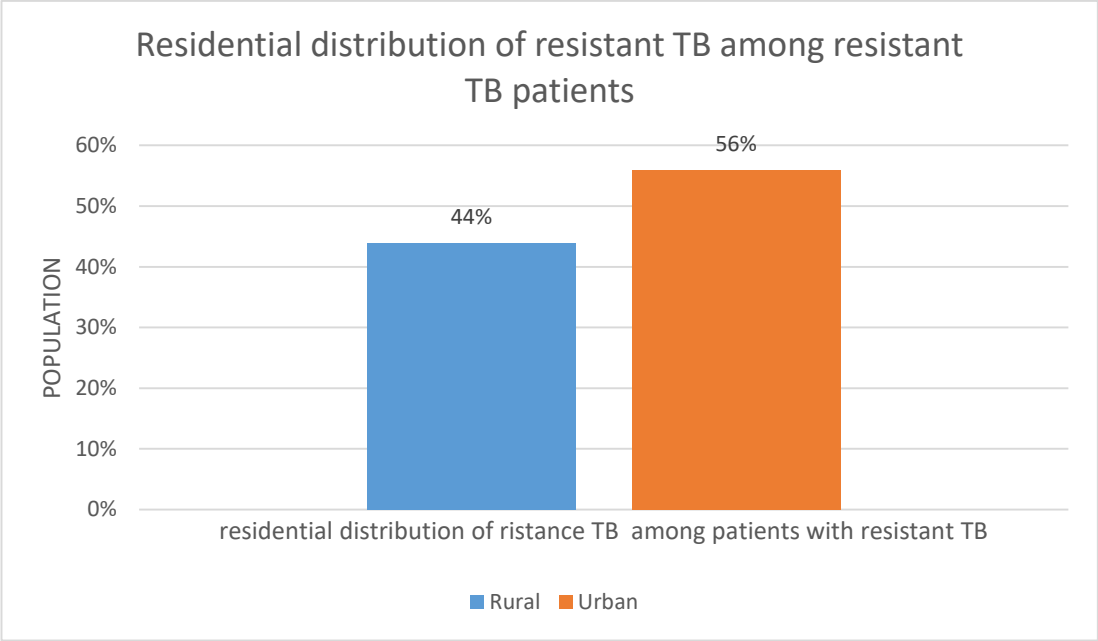

Figure 6: Residential distribution of resistant TB among resistant TB patients under study

Figure 6 shows the residential distribution of resistant TB among 401 TB-positive individuals, a subset of 15 patients were identified as having resistant Tuberculosis (TB). An analysis of this smaller group of resistant TB cases reveals a notable disparity in residential distribution: approximately 56% of these resistant cases reside in urban areas, while around 44% are located in rural settings. It's important to interpret these percentages cautiously, as they are derived from a limited sample size of only 15 resistant TB patients within the larger TB-positive population. The percentage N (%) Is the distribution of resistant TB among 15 resistant TB patients. Therefore, while this data suggests a potential trend of higher resistant TB prevalence in urban areas.

4.5.3 Specific residential distribution of resistant TB among resistant TB patients.

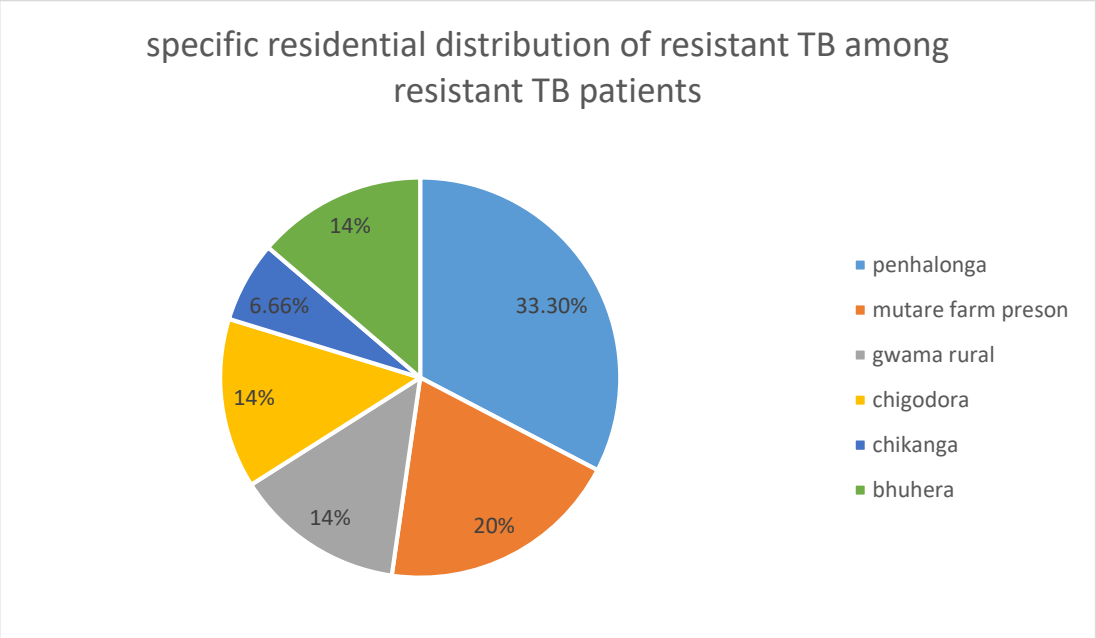

Figure 7: Residential distribution of resistant TB among resistant TB patients

Figure7 illustrates the residential distribution of resistant tuberculosis (TB) among 15 patients, revealing a concentration of cases in specific locations. Penhalonga accounts for the largest proportion, with approximately 5 patients (33.30%) residing there. Mutare Farm Prison represents the second-largest group, with about 3 patients (20%). Gwama Rural, Chigodora, and Chikanga each contribute approximately 2 patients, making up 14% each. Finally, Buhera has the smallest proportion, with 1 patient (6.66%). These findings highlight that Penhalonga and Mutare Farm Prison are key areas of concern, indicating that targeted interventions should prioritize these locations to effectively address the prevalence of resistant TB.

CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a detailed discussion of the main findings from the study on the prevalence of mycobacterium tuberculosis using Genexpert among tuberculosis suspected patients at Victoria Chitepo Provincial Hospital. It compares these findings with existing research to highlight similarities, differences, and emerging trends. The discussion is structured around the study objectives, focusing on significant results, potential gaps, and unexpected observations. Furthermore, we will explore the implications of these findings for public health, acknowledge the study's limitations, and offer conclusions and recommendations for future research and policy enhancements. Through this analysis, we aim to advance understanding and improve practices in drug detection and intervention strategies.

5.2 Discussion

5.2.1. The demographic characteristics associated with TB infection among patients attending Victoria Chitepo Provincial Hospital

The socio-demographic analysis of tuberculosis-suspected patients at Victoria Chitepo Provincial Hospital reveals a predominantly male population, accounting for **63%** of the total, which aligns with global trends where males are more frequently diagnosed with tuberculosis than females (WHO, 2022). This gender disparity is consistent with studies indicating that socio-economic and cultural factors often limit women's access to healthcare, leading to underdiagnoses and delayed treatment (Khan et al., 2017). The peak incidence in the **30–44** years age group is consistent with other research showing that tuberculosis often affects adults in their productive years, possibly due to increased exposure to risk factors such as occupational hazards, smoking, or

environmental exposures prevalent in this demographic (Lönnroth et al., 2010). Possible causes for these trends include differences in healthcare-seeking behaviours, social roles affecting contact with TB-infected individuals, and higher prevalence of risk factors like smoking and alcohol consumption among men (Holmes et al., 2011). Additionally, biological differences in TB risk between genders may also play a role (Bates et al., 2019). Comparing with existing research, our findings highlight the need for targeted interventions addressing gender disparities and improving healthcare access for women, as well as considering socio-economic influences that may contribute to these patterns (Hargreaves et al., 2011). Overall, these insights support the development of public health strategies tailored to the demographic characteristics of the population to effectively combat tuberculosis.

5.2.2. Prevalence of pulmonary TB (PTB) among TB-suspected patients attending Victoria Chitepo Provincial Hospital

The socio-demographic analysis of tuberculosis-suspected patients at Victoria Chitepo Provincial Hospital reveals a significant TB prevalence of 33.4% among 1,200 suspected patients, with approximately 401 positive cases in the year 2024. Males constitute 63% of the total population, with a higher prevalence of both positive and negative cases compared to females. This gender disparity aligns with broader trends observed in Zimbabwe and other parts of Africa, where male sex is a significant risk factor for TB due to differences in healthcare-seeking behaviors and exposure to risk factors such as occupational hazards and smoking (Holmes et al., 2011).

In Zimbabwe, the mining sector poses a significant risk for TB transmission due to excessive exposure to silica dust, poor living conditions, and high HIV prevalence in mining communities (World Bank, 2023). The risk of TB increases with the duration of mining activities, as prolonged exposure to silica dust weakens lung defenses,

making miners more susceptible to TB infection (Manyame-Murwira et al., 2020). Additionally, mining environments often facilitate the spread of TB due to crowded living and working conditions, where miners are more likely to come into contact with infected individuals (Frontiers in Tropical Diseases, 2021). Close contact with known TB cases is a significant risk factor, accounting for about **5%** of positive cases in the study population. This risk is particularly pronounced in mining communities, where shared living quarters and poor ventilation increase the likelihood of airborne transmission (The Herald, 2023).

Migration to mining sites further exacerbates TB risk. Miners often migrate from other areas, bringing with them diverse health challenges and increasing the risk of TB transmission. This migration disrupts healthcare access and continuity, leading to gaps in TB detection and treatment adherence, which can result in drug-resistant TB strains (PMC, 2011). In Southern Africa, the circular migration of miners across borders complicates TB management, as it disrupts treatment regimens and facilitates the spread of TB to other communities (IOM Blog, 2023).

The age distribution of positive TB cases, with a peak incidence in the **30–44** years age group among males, suggests prolonged exposure to high-risk environments. This age group is likely to have been exposed to occupational hazards over an extended period, increasing their susceptibility to TB. Lifestyle factors prevalent in mining communities, such as smoking and alcohol consumption, further exacerbate this risk. Smoking, in particular, is a significant risk factor, affecting approximately **12.5%** of the total suspected population, and is more common among men in these settings (Holmes et al., 2011). Khat chewing, while less prevalent than smoking, may also contribute to increased susceptibility due to its immunomodulatory effects,

particularly in older adults who may have age-related declines in immune function (Soboka et al., 2020).

Internationally, studies have shown that mining activities are associated with a high burden of TB, silicosis, and HIV. For instance, TB prevalence in miners is estimated to be around 3000–7000 per 100,000 population, which is about 3 to 10 times higher than in the general population (MDPI, 2024). In South Africa, the mining sector has been identified as a hotspot for TB transmission due to similar factors (Stop TB Partnership, 2012). The high prevalence of TB among miners is driven by factors such as silicosis, which increases the risk of TB infection by three to four times (MDPI, 2024).

In Zimbabwe, artisanal and small-scale miners face significant challenges, including limited access to healthcare services and high rates of TB, HIV, and silicosis (MSF, 2024). Efforts by organizations like Médecins Sans Frontières (MSF) aim to bridge these healthcare gaps through outreach programs, providing essential services directly to miners and empowering them with knowledge to protect themselves and their communities (MSF, 2024).

5.2.3. Prevalence of *Mycobacterium tuberculosis* and HIV co-infection among patients attending Victoria Chitepo Provincial Hospital

The distribution of HIV-positive patients diagnosed with TB among the 401 TB patients at Victoria Chitepo Provincial Hospital reveals a significant gender disparity, with 146 males (approximately 36.4%) and 86 females (approximately 21.4%) identified as HIV-positive. This finding is consistent with both local and international studies that highlight gender-specific differences in HIV and TB prevalence. In Zimbabwe, this disparity may be attributed to a combination of factors including delayed healthcare-seeking behaviors among men, occupational exposures, and

varying access to HIV testing and treatment services (NAC, 2024; PLoS Medicine, 2011). A study in Harare, Zimbabwe, found that men were more likely to be diagnosed with HIV at a later stage of infection compared to women, contributing to poorer health outcomes and increased TB risk (Open Forum Infectious Diseases, 2022). Internationally, similar trends have been observed, with men often facing barriers to HIV testing and care, resulting in higher rates of TB co-infection (Journal of Infectious Diseases, 2014). Biological factors may also play a role, as some studies suggest that men may have higher viral loads and faster disease progression if untreated, increasing their susceptibility to TB (Journal of Infectious Diseases, 2014). Addressing this gender disparity requires targeted interventions such as community-based HIV testing and treatment programs tailored to men, integrated TB and HIV services, and public health campaigns to promote earlier diagnosis and treatment (WHO, 2022). By understanding and addressing these factors, healthcare providers can work to improve TB/HIV co-infection management and reduce the burden of disease in Zimbabwe.

5.2.4. Residential factors associated with resistant TB infection among patients attending Victoria Chitepo Provincial Hospital

The residential distribution of drug-resistant tuberculosis (DR-TB) cases among 15 patients at Victoria Chitepo Provincial Hospital highlights critical trends that align with findings from both local and international studies. Among this subset of 401 TB-positive patients, approximately 56% of resistant TB cases were found in urban areas, while 44% were located in rural settings. This urban-rural disparity underscores the role of environmental, healthcare access, and socioeconomic factors in shaping the prevalence and distribution of DR-TB.

The higher proportion of DR-TB cases in urban areas is consistent with global trends. Urban settings often experience overcrowding, high population density, and increased

mobility, which facilitate the spread of Mycobacterium tuberculosis (MTB) and contribute to higher rates of drug resistance (Frontiers in Public Health, 2023). Additionally, urban areas may see more complex or advanced TB cases due to better diagnostic infrastructure that detects resistant strains more effectively (MedRxiv, 2024). However, urban poverty and social disadvantages, such as slum living conditions and poor ventilation, exacerbate TB transmission and treatment challenges (PMC, 2019).

The specific residential distribution within the study population shows that Penhalonga accounted for the largest proportion of DR-TB cases (33.3%), followed by Mutare Farm Prison (20%). Gwama Rural, Chigodora, and Chikanga each contributed 14%, while Buhera had the smallest share at 6.66%. The concentration of cases in Penhalonga may be linked to mining activities in the area, as mining is a well-documented risk factor for TB due to silica dust exposure, overcrowded living conditions, and poor healthcare access (World Bank, 2023). Similarly, Mutare Farm Prison reflects the global trend of high TB prevalence in correctional facilities. Prisons are reservoirs for TB due to overcrowding, poor ventilation, delayed diagnosis, and inadequate treatment adherence. Studies have shown that TB prevalence in prisons can be up to 100 times higher than in the general population (WHO Global Tuberculosis Programme, 2018).

In rural areas like Gwama Rural and Buhera, DR-TB cases may be underreported due to limited diagnostic capacity and healthcare access. Rural patients often face significant barriers such as long travel distances to health facilities and a lack of skilled healthcare providers with expertise in managing DR-TB (MedRxiv, 2024). However, rural living conditions may also act as a protective factor against DR-TB due to lower

population density and reduced transmission risks compared to urban areas (Frontiers in Public Health, 2023).

International studies provide further insights into risk factors for DR-TB. Poor treatment adherence, previous TB treatment history, close contact with DR-TB patients, smoking, and inadequate ventilation are significant contributors to drug resistance globally (Scientific Research Publishing, 2014). For example, studies from Ethiopia and China have highlighted that close contact with infected individuals and poor adherence to treatment regimens are major drivers of DR-TB prevalence (Admassu et al., 2024; Huai et al., 2022). In addition, migration has been identified as a key factor contributing to DR-TB prevalence in both urban and rural settings due to disruptions in treatment continuity (MedRxiv, 2024).

5.3. Conclusion

In conclusion, the findings from this study at Victoria Chitepo Provincial Hospital provide valuable insights into the complex interplay of factors influencing TB prevalence and drug resistance in Zimbabwe. The significant TB prevalence of 33.4% among suspected patients underscores the importance of robust screening and diagnostic efforts. The observed gender disparities, with males constituting a larger proportion of both TB-positive and HIV/TB co-infected individuals, highlight the need for targeted interventions that address healthcare-seeking behaviors, occupational exposures, and access to testing and treatment.

The high burden of HIV among TB patients (57.9%) underscores the critical need for integrated TB/HIV services. The geographic distribution of drug-resistant TB cases further emphasizes the influence of environmental and socioeconomic factors, with urban areas and specific locations like Penhalonga and Mutare Farm Prison emerging

as high-risk hotspots. These findings call for tailored strategies that address local conditions and vulnerabilities.

5.4. Recommendations

To effectively address TB in Zimbabwe, it's crucial to develop multifaceted, gender-specific HIV/TB interventions. These should go beyond simple awareness campaigns by actively addressing the barriers men face in accessing healthcare, such as using mobile clinics at workplaces, peer-led support groups, flexible clinic hours, and culturally-sensitive messaging that encourages early testing and treatment. For women, sustained access through existing channels like antenatal care is essential, while also addressing potential vulnerabilities stemming from gender-based violence or stigma. Additionally, integrating TB and HIV services is vital due to the high rate of co-infection. This involves co-locating clinics, training healthcare workers to manage both conditions, and implementing shared electronic health records to ensure coordinated care, while simplifying referral pathways to reduce the number of separate appointments required for patients.

Targeted interventions are also necessary for drug-resistant TB hotspots, using local knowledge to tailor strategies for each area. For instance, in mining communities like Penhalonga, addressing silica dust exposure through improved ventilation, providing regular screenings, and tackling overcrowding are key. Similarly, Mutare Farm Prison requires urgent action on overcrowding, improved sanitation, and intensified TB screening and treatment for inmates. Furthermore, recognizing that TB is influenced by socioeconomic determinants and occupational risks is important. Therefore, advocating for policies that promote better living conditions, reduce poverty, improve access to education and employment, and regulate occupational health and safety standards in high-risk industries like mining is essential.

Strengthening community engagement and education is also critical. This involves investing in community health workers who can provide culturally-sensitive education, dispel myths, reduce stigma, and connect individuals with healthcare services. Local leaders and community organizations should be involved in the design and implementation of interventions to foster community ownership. Moreover, improving data-driven decision-making and surveillance systems is necessary to monitor trends, evaluate program effectiveness, and allocate resources strategically. This includes using data to identify emerging hotspots, track treatment outcomes, and adapt interventions as needed. Conducting further qualitative research through in-depth interviews and focus group discussions with affected communities will help understand their experiences and challenges, informing more effective interventions.

Ultimately, sustained progress requires strong political commitment and adequate funding. Advocating for policy changes that prioritize TB control, increasing funding for research, prevention, and treatment programs, and promoting collaboration between government agencies, non-governmental organizations, and the private sector are essential steps. By implementing these holistic and evidence-based recommendations, Zimbabwe can significantly reduce the burden of TB, improve the health and well-being of its citizens, and move closer to the goal of TB elimination. These recommendations address the systemic challenges that fuel the epidemic, providing a comprehensive approach to tackling TB in the region.

5.6. Implications of the study

The implications of this study on TB in Zimbabwe are multifaceted and far-reaching. The findings underscore the urgent need for a comprehensive overhaul of the healthcare system to effectively manage TB and HIV co-infections, as well as drug-resistant TB. This involves integrating TB and HIV services, enhancing access to care,

and improving treatment outcomes through measures such as co-locating clinics, training healthcare workers, and implementing shared electronic health records. Furthermore, the study highlights that TB is deeply intertwined with socioeconomic factors and occupational risks, necessitating interventions that address poverty, improve living conditions, enhance education and employment opportunities, and regulate health standards in high-risk industries like mining. Community engagement is also crucial, requiring investment in community health workers who can provide culturally-sensitive education, reduce stigma, and connect individuals with healthcare services. Additionally, robust data collection and analysis are essential for monitoring trends, evaluating program effectiveness, and strategically allocating resources. This includes using data to identify emerging hotspots and adapt interventions accordingly. Ultimately, sustained progress demands strong political commitment and adequate funding, with advocacy for policy changes that prioritize TB control, increase funding for research and treatment programs, and foster collaboration between government agencies, NGOs, and the private sector. By addressing TB effectively, Zimbabwe can not only improve public health but also reap significant economic and social benefits by reducing the burdens on patients and their families.

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APPENDICES

Appendix 1: Gantt Chart Project Activities

	Month	August 2024				September 2024				October 2024				November 2024				December 2024				January 2025			
	Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Activity																									
Finalisation of proposal		→	→	→	→	→	→	→	→																
Proposal submission to AUREC										→	→	→	→												
Data Collection														→	→	→	→								
Data processing and analysis																		→	→	→	→				
Project writing																						→	→		
Project submission to AU																								→	→

Appendix 2: Budget

MATERIAL	**QUANTITY**	**COST (USD)**
TRANSPORT AND FOOD	-	80.00
FLASH DISK	1	25.00
INTERNET BUNDLES	3 Gb	10.00
REFRESHMENTS	-	20.00
TOTAL	**-**	**135.00**

Appendix 3: Socio-demographic characteristics of study participant suspected with TB.

Variables	Categories	Frequency	Percentage (%)
Gender	Male		
	Female		
Age categories	18–29		
	30–44		
	45–59		
	> 60		
Income			
Residence	Rural		
	Urban		
Marital status	Single		
	Married		
	Divorced		
Educational level	Illiterate		
	High school or lower		
	Collage and above		
Occupation	Employed		
	Unemployed		

Appendix 3: (continued) Socio-demographic characteristics of study participant suspected with TB.

Variables	Categories	Frequency	Percentage (%)
Smoke	Yes		
	No		
Khat chewing	Yes		
	No		
MTB result	Detected		
	Not detected		
Close contact with known TB	Yes		
	No		
History of imprisonment	Yes		
	No		
Frequent alcohol	Yes		
	No		
Status of HIV antibody test	Yes		
	No		

Appendix 4: Letter requesting for permission to conduct research at VCPHL

Dear Sir/Madam

Re: Permission to Conduct Research on prevalence of *Mycobacterium tuberculosis* using GeneXpert among tuberculosis suspected patients

My name is Achlove Tendai Makande, I am a Medical Laboratory Science student at Africa University

I am writing to kindly request permission to conduct my research at Victoria Chitepo Provincial Hospital from January to December 2024.The focus of my research is the prevalence of *Mycobacterium tuberculosis* using GeneXpert among tuberculosis suspected patients. The data collection will take place during regular laboratory hours, and I will ensure minimal disruption to routine operations. The project will be conducted under the supervision of Doctor S. L Mutambu. This study aims to determine the prevalence of pulmonary TB among TB-suspected patients at Victoria Chitepo Provincial Hospital, addressing a critical data gap for targeted resource allocation.

The findings of this research will be communicated through my dissertation and may also be submitted for publication in academic journals, contributing to the body of knowledge in microbiological diagnostics

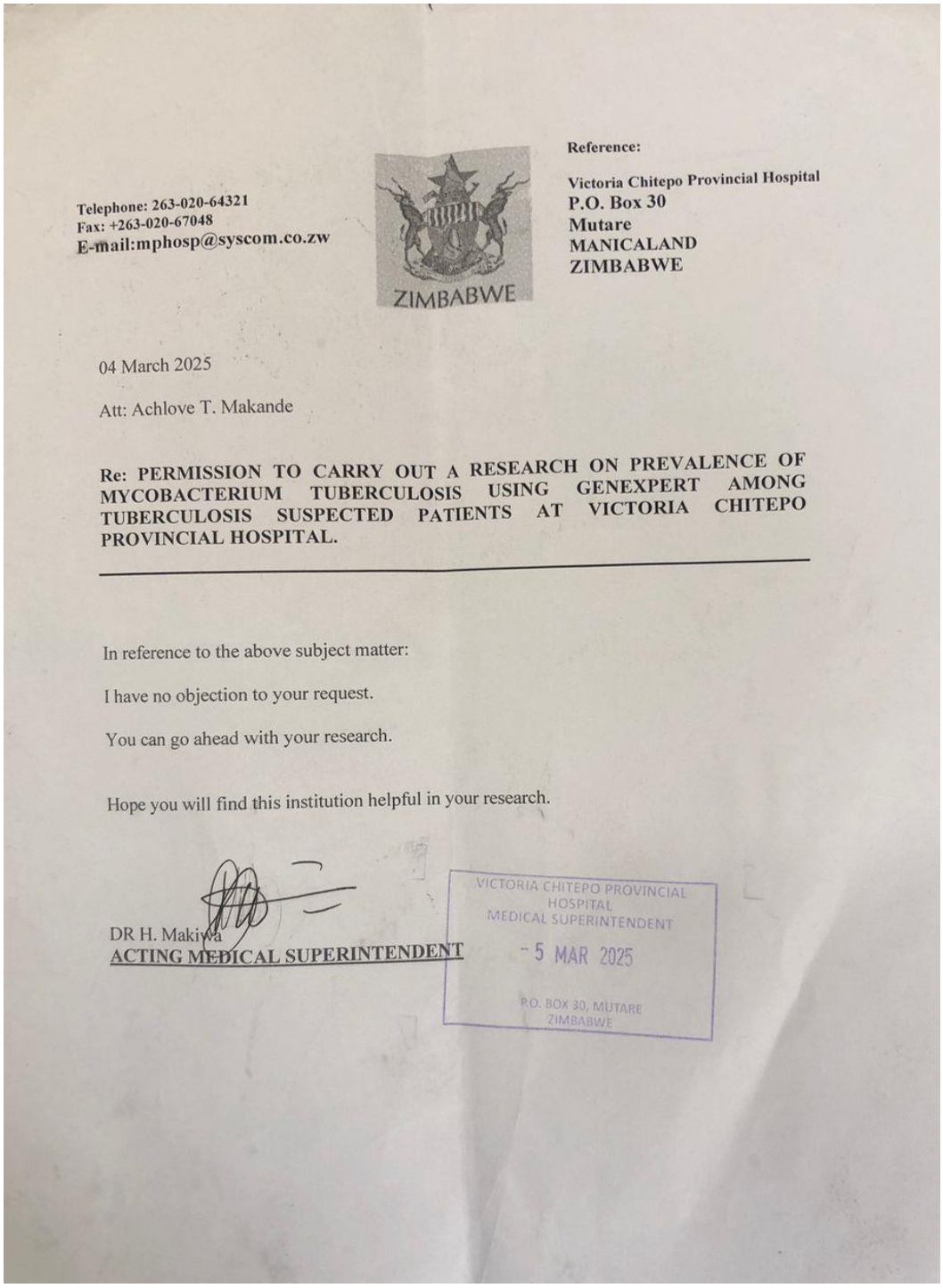
The permission letter should be on your organization's letter head, signed, and dated, specifically referring to my name and the title of my study for submission to AUREC, the regulatory body that looks at the scientific and ethical soundness of my proposal

Please let me know if you require any further information or documentation, at makandea@africau.edu or +263 78543d670. I look forward to your positive response.

Yours faithfully

Achlove Makande

Appendix 5: Study site Approval.



Telephone: 263-020-64321
Fax: +263-020-67048
E-mail:mphosp@syscom.co.zw

ZIMBABWE

Reference:

Victoria Chitepo Provincial Hospital
P.O. Box 30
Mutare
MANICALAND
ZIMBABWE

04 March 2025

Att: Achlove T. Makande

Re: PERMISSION TO CARRY OUT A RESEARCH ON PREVALENCE OF MYCOBACTERIUM TUBERCULOSIS USING GENEXPERT AMONG TUBERCULOSIS SUSPECTED PATIENTS AT VICTORIA CHITEPO PROVINCIAL HOSPITAL.

In reference to the above subject matter:

I have no objection to your request.

You can go ahead with your research.

Hope you will find this institution helpful in your research.

DR H. Makiwa
ACTING MEDICAL SUPERINTENDENT

VICTORIA CHITEPO PROVINCIAL HOSPITAL
MEDICAL SUPERINTENDENT
- 5 MAR 2025
P.O. BOX 30, MUTARE
ZIMBABWE

Appendix 6: AUREC approval.

"Investing in Africa's future"

AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)

P.O. Box 1320 Mutare, Zimbabwe, Off Nyanga Road, Old Mutare-Tel (+263-20) 60075/60026/61611 Fax: (+263 20) 61785 Website: www.africau.edu

Ref: AU 3708/25

12 March, 2025

ACHLOVE TENDAI MAKANDE
C/O Africa University
Box 1320
MUTARE

RE: ***PREVALENCE OF MYCOBACTERIUM TUBERCULOSIS USING GENEXPERT AMONG TUBERCULOSIS SUSPECTED PATIENTS AT VICTORIA CHITEPO PROVINCIAL HOSPITAL FROM JANUARY 2024 TO DECEMBER 2024***

Thank you for the above-titled proposal you submitted to the Africa University Research Ethics Committee for review. Please be advised that AUREC has reviewed and approved your application to conduct the above research.

The approval is based on the following.

a) Research proposal

- **APPROVAL NUMBER** AUREC 3708/25
  This number should be used on all correspondences, consent forms, and appropriate document
- **AUREC MEETING DATE** NA
- **APPROVAL DATE** March 12, 2025
- **EXPIRATION DATE** March 12, 2026
- **TYPE OF MEETING**: Expedited
  After the expiration date, this research may only continue upon renewal. A progress report on a standard AUREC form should be submitted a month before the expiration date for renewal purposes.
- **SERIOUS ADVERSE EVENTS** All serious problems concerning subject safety must be reported to AUREC within 3 working days on the standard AUREC form.
- **MODIFICATIONS** Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
- **TERMINATION OF STUDY** Upon termination of the study a report has to be submitted to AUREC.

Yours Faithfully

MARY CHINZOU
FOR CHAIRPERSON
AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE

Appendices 7: Supervisor approval letter.

"Investing in Africa's Future"
COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES
DEPARTMENT OF BIOMEDICAL AND LABORATORY SCIENCES

5 March 2025

Dear Ms Chinzou

RE: PREVALENCE OF *MYCOBACTERIUM TUBERCULOSIS* USING GENEXPERT AMONG TUBERCULOSIS SUSPECTED PATIENTS AT VICTORIA CHITEPO PROVINCIAL HOSPITAL FROM JANUARY 2024 TO DECEMBER 2024

I hope that I find you well. This letter serves to inform you that I am supervising Achlove Makande on the above project. I have walked with him during his proposal development and I believe that the proposal is now ready for AUREC review.

Thank you.

Dr S L Mutambu (PhD)
Senior Lecturer (DBMLS)

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