Knowledge of the Students Regarding Pulmonary Tuberculosis at a Selected Tertiary Institution in Vhembe District of Limpopo Province

By

Neluheni Joseph

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Department of Advanced Nursing Science
School of Health Sciences

University of Venda

Supervisor: Dr Luhalima T R

Co-Supervisor: Dr Malwela T

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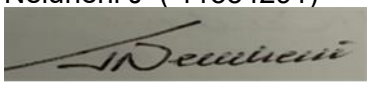
DECLARATION

I, NELUHENI JOSEPH, hereby declare that the proposal entitled, ***"Knowledge of the students regarding pulmonary tuberculosis at a selected tertiary institution in Vhembe district of Limpopo"*** hereby submitted by me, has not previously been submitted for a degree at this or any other institution, and that this is my own work in design and execution and that all reference material contained therein have been duly acknowledged.

Neluheni J (11554291)



Signature: Date: 2021.10.31

DEDICATION

I would like to dedicate this study to my son Murendeni Neluheni as my blessing from the Almighty God. You should always remember that education is key to unlock potentials and break the walls of ignorance. May God be with you.

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ABSTRACT

Background: Although Tuberculosis can be prevented and treated, it is infecting millions of people around the world. Tuberculosis is an infection caused by *Mycobacterium tuberculosis* which attacks the lungs as well as other parts of the body. It can be dormant and active.

Purpose: The purpose of this study is to evaluate the knowledge of tertiary institution students about pulmonary tuberculosis.

Methodology: The study adopted a quantitative approach and a descriptive design of the cross-sectional survey. A simple random sampling method was used to select respondents. The on-campus' respondents' total population was 8197. The data was analysed using version 26.0 of the Statistical Package for Social Sciences (SPSS). Pulmonary Tuberculosis (PTB) knowledge was assessed and analysed using a self-administered questionnaire. A Spearman's rank-order correlation was run to determine the relationship between the education and the knowledge of TB among the respondents.

Results: The results of this study revealed that students have basic knowledge regarding PTB in one hand, while at the other hand there is insufficient knowledge regarding the causes of PTB among students at the selected tertiary institution. Further, the findings also revealed that there is moderate positive correlation between education and knowledge of PTB among students.

Conclusion: Univen should develop more effective PTB control strategies for better implementation of the Global STOP TB strategy and the NSP to achieve the fight against TB to the large extent by 2030 as stated also in the NDP and SDGs.

Recommendations: Need for future studies on PTB that will assess the relationship between the ages, gender and level of year of students. Univen should increase the level of knowledge of TB treatment, risk factors, spitting techniques to avoid the spread of PTB and tests to diagnose PTB, through educational programmes based on the findings of this study.

Keywords: Knowledge, Students, Tertiary institution, Tuberculosis.

LIST OF ACRONYMS AND ABBREVIATIONS

A	:	Agree
AFB	:	Acid Fast Bacilli
AFMC	:	Association of Faculties of Medicine in Canada
AIDS	:	Acquired Immune Deficiency Syndrome
BC	:	Before Christ
BCG	:	Bacilli Calmette Guerin
BMI	:	Body Mass Index
CDC	:	Centre for Disease Control and Prevention
COVID-19	:	Coronavirus disease 2019
CPHA	:	Canadian Public Health Association
D	:	Disagree
DHM	:	District Health Barometer24
DoH	:	Department of Health
DOT	:	Directly Observed Therapy
DOTS	:	Directly Observed Therapy Short Course
EPTB	:	Extra-Pulmonary –Tuberculosis
ESR	:	Electrolytes Sedimentary rate
ETR	:	Electronic Tuberculosis Register
HCT	:	HIV Counselling and Testing
HIV	:	Human Immune Virus
HMS	:	Harvard Medical School
ICN	:	International Council of Nurses
LP	:	Limpopo Province
LPA	:	Line Probe Assay
MA	:	Mycobacterium africanum
MB	:	Mycobacterium bovis
MDG	:	Millennium Developmental Goal
MDR-TB	:	Multi Drug Resistant Tuberculosis
MERS-CoV	:	Middle East Respiratory Syndrome Coronavirus
MM	:	Mycobacterium microti
MTB	:	Mycobacterium tuberculosis
N	:	Neutral

NSP	:	National Strategic Plan on HIV, TB and STIs
NTCP	:	National Tuberculosis Control Program
OECD	:	Organisation for Economic Co-operation and Development
PH	:	Public Health
PHE	:	Public Health Education
PHEF	:	Public Health Education Framework
PTB	:	Pulmonary Tuberculosis
SA	:	South Africa
SA	:	Strongly Agree
SARS-CoV	:	Severe Acute Respiratory Syndrome Coronavirus
SD	:	Strongly Disagree
SDGs	:	Sustainable Development Goals
SLT	:	Social Learning Theory
SPSS	:	Statistical Package for Social Sciences
Stats SA	:	Statistics South Africa
STIs	:	Sexually Transmitted Infections
TB	:	Tuberculosis
TI	:	Tertiary Institution
UNIVEN	:	University of Venda
USA	:	United States of America
US	:	United States
VDM	:	Vhembe District Municipality
WHO	:	World Health Organisation

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CHAPTER 1

OVERVIEW OF THE STUDY

1.1 Introduction

Tuberculosis (TB) is a major public health problem in the world. The International Council of Nurses (ICN, 2015) states that tuberculosis is an infectious disease caused by *Mycobacterium Tuberculosis*, also known as *tuberculosis bacilli*. TB can be transmitted from one person to another through infectious nuclei droplets which are released when an infected person coughs, sneezes, speaks, or sings. World Health Organisation (WHO, 2020) indicated that nevertheless the availability for over 50 years of the treatment, TB remains a major health threat globally. After the advent of anti-tuberculosis drugs, opined that TB was to be under control globally while the World Health Organisation (WHO) pointed out that it was considered virtually eradicated in high-income countries (WHO, 2020).

Yet, over half a century later TB was declared a global emergency (WHO, 2018; Rukasha, 2019), Furthermore, the necessity to curb the epidemic was followed by the development and global implementation of a TB control programme called Directly Observed Therapy (Short Course) (DOTS) which is now referred to as the most internationally recommended strategy for the control of TB (WHO, 2018). So, according to WHO (2018), when DOTS was implemented initially in 1994, it was estimated that 1.9 million people had died from TB in 1990 and increasing numbers of people were dying annually.

However, TB can remain dormant for a few years without any symptoms. It is preventable and curable. The researcher was interested in Pulmonary Tuberculosis (PTB). Studies conducted by (Zumla *et al*., 2018; WHO, 2019), identified the main clinical signs and symptoms of such persistent, productive diseases lasting more than two weeks such as fever, chest pains, shortness of breath, night sweats, weight loss, loss of appetite. According to the Centre for Disease Control and Prevention (CDC, 2018), PTB is an airborne infection which can be transmitted from cough and sneezing of infected person to another and early identification of the person with active PTB and treatment. The cough etiquette consists of covering the mouth and nose with the elbow when coughing and sneezing.

Due to poverty and other economic and social constraints, TB has again declared an emergency in Africa in 2005 (WHO, 2018). In 2009, over a decade after implementing the DOTS strategy and some years after the transition to the Stop TB strategy, there were an estimated 9.4 million incident cases of TB, most of which were in Asia and Africa (WHO, 2010; 2020). Internationally, approximately 1.6 million people in total, including 1.3 million HIV-negative people and 0.38 million HIV-positive people, died from TB in 2008. Incidence rates

of all forms of TB in some countries, such as South Africa, are over 900 cases per 100 000 residents (WHO, 2010). The contribution of TB to morbidity and mortality is therefore large; TB was estimated to be the seventh leading cause of death and the 11th leading cause of disability worldwide in 2004 (WHO, 2018). The global burden of TB is still considered today, even if the global incidence of the disease has been decreasing slightly since 2004 (Stop TB Partnership, 2010; WHO, 2019).

The ICN (2015) indicated that the diagnosis of people with TB should be immediately addressed through medical examination and an evaluation of the patient. The laboratory tests involved in the diagnosis of tuberculosis are sediment level electrolyte (ESR) blood tests and sputum smear examined microscopically for acid-fast bacilli (AFB). The test is performed by injecting a purified protein subcutaneously into the intradermal of the inner face of the forearm. The test results for Monteux can be ready 48 to 72 hours after the test. Further research on the diagnosis of tuberculosis involves X-rays showing a cavity on the lung parenchyma or pleural effusion. Sources of tuberculosis vary; some come from human bovis and are infected with domestic and wild animals.

The goal of standard treatment regimens is to prevent active TB deaths, prevent drug resistance and heal without relapse (WHO, 2019). Antituberculosis treatment regimens recommend doses based on the weight of the patient. Treatment regimens are effective when taken daily for six to eight months. A treatment administration to patients is the daily dosage, which, for example, is 30-39 kg, 40-54 kg, 55-70 kg, or 70 kg. The use of this drug is described in the Standard Treatment Guidelines and Essential Medicines List (2014), which includes an initial combination of four drugs, namely rifampicin, isoniazid, pyrazinamide and ethambutol, administered daily for one year, (intensive phase for 2 months). The drugs in the continuation phase are rifampicin and isoniazid, given for four months. Multidrug-resistant tuberculosis can occur in patients with tuberculosis whose treatment encourages the patient to abandon treatment.

Risk factors that easily promote TB among susceptible individuals include persons with chronic renal failure. Individuals with diabetes mellitus have greater risks for developing active TB especially among insulin-dependent or poorly controlled diabetes. Furthermore, people with carcinoma, people living with Human Immune Virus (HIV), children and elderly people are susceptible to TB. These are people with compromised immune systems. Other risk factors are the drug users, especially those who share needles, people who live in areas where TB infection is common, and health care workers serving these high-risk clients, TB Management guideline in a new era of diagnostics (DoH, 2016).

1.2 Background of the study

In a study conducted in the United States of America by Garcon (2020), white Americans had higher knowledge about TB as compared to their black counterparts. Over 80% of participants knew that there is latent TB, the mode of spread, transmission, and western medicines that can cure TB. Center for Disease Control and Prevention (CDC, 2018) report that 128 white deaths are due to TB. The study found that Afro-Americans had less knowledge about TB as compared to white citizens. A factor that contributed to less knowledge by Afro-Americans, was that whites are more educated than blacks. Other factors include the fact that less formal education is associated with a poor understanding of TB. This lack of adequate knowledge yields to the transmission of TB and development of MDR-TB. Furthermore, the World Health Organisation (2018) declared TB as a global health emergency and supported national and international strategies to improve the care and control of the disease through Directly Observed Treatment, Short course, (DOTS), and the stop TB strategy.

Montagna *et al*., (2014) conducted a study on 15 Italian medical university students. The study focused on knowledge about TB among undergraduate health care students in 15 Italian universities. There was a knowledge deficit about TB identified among Italian nursing university students as compared to medical students. Areas that had insufficient results relating to knowledge were TB transmission, therapy, clinical signs and symptoms, and causes of TB. There was an estimate of 8.6 million new cases of TB and 1.3 million TB death in 2012. The global population's knowledge of TB was crucial to facilitate the seeking of early medical treatment care and avoidance of further Mycobacterium tuberculosis transmission. Knowledge deficit regarding TB delays diagnosis, treatment and increases the risk of the spread of TB, resulting in Multi-Drug-Resistance TB (MDR-TB) across the world.

In China, a study was conducted about knowledge and determinants regarding tuberculosis among medical students. Poor knowledge regarding TB among medical students was observed. Factors that contributed to insufficient knowledge were among others, not knowing TB information such as symptoms, prevention, diagnosis and treatment of TB. However, older medical students had greater knowledge than younger medical students. The study showed that TB diagnosis delays was related to health facility staff factors, such as the inability to do smear test for suspected TB cases and failure to refer suspected TB cases to the hospital approved for TB management (Shrestha *et al.*, 2017).

According to WHO, the global TB Report (2018), 1.6 million people died from TB in 2016, and the disease ranked as the leading cause of death. India, China and Indonesia accounted for 45% of global cases in 2016 and China had a burden even though the country had achieved

the Millennium Development Goals (MDGs) to reduce the prevalence of smear-positive TB by 50% in 2010. Several studies found that in China, medical students had inadequate knowledge regarding TB.

According to Rana *et al.*, (2015), the cross-sectional study conducted in Bangladesh in 2015 shows that non-medical university students had insufficient knowledge about TB. That poor knowledge was identified from students who were coming from joint families and urban areas. Students who were smokers, coming from single families, rural areas, whose fathers were service holders and educated parents' sons and daughters had more knowledge about TB. In Bangladesh, 1 to 3 million people die each year from tuberculosis. In South Korea, TB remains the leading cause of adult mortality and morbidity as the incidence and corresponding mortalities are at a dangerous level (Im & Kim, 2021). Yusuf *et al*., (2021) emphasized that students have a high risk of contracting TB due to lack of knowledge and negative attitudes toward TB, which create immense challenges in the prevention, controlling, and curing of TB disease among university students. TB also claimed the lives of over 200 million people for a long time M Each year, 40,000 people develop active tuberculosis; among them, 20,000 people have pulmonary tuberculosis (Rana *et al*., 2015).

Sah *et al.,* (2016) conducted a study about knowledge of tuberculosis among students in higher secondary school. The findings showed that schooling students from developing countries do not have knowledge of TB. They lack knowledge about TB in areas such as DOTS therapy, tests for diagnosing, treatment availability and duration, and Mountex-test. These results in the development of TB among community members. Another study conducted by Chinenye (2015) in Rwanda about the knowledge, attitude and practices of TB diagnosed patients in Rwanda towards TB infection. Knowledge about TB in Rwanda was poor; however, some people lack knowledge regarding TB symptoms, diagnosis and risk of TB infection. Factors that prevailed this knowledge deficit were based on practices on health promotion and TB preventions.

According to Hassan *et al*., (2017), young people between the ages of 16 to 29 years in Nigeria had higher knowledge of TB because they had access to information on TB as compared to older people. Esmael *et al.,* (2013) conducted a study on assessment of patients' knowledge, attitude and practice regarding PTB in Eastern Amhara Regional State : Ethiopia. Poor knowledge affects the health of many people. According to Alene *et al.,* (2019), in 2016, there were an estimated 490,000 new cases of MDR-TB and about 200 000 deaths due to MDR-TB in Ethiopia. Ethiopia is one of 30 leading counties of MDR-TB and caused 240.000 deaths from MDR-TB in the world.

South Africa is one of the countries with the highest TB burden. About 0.8% of the 54 million people develop active TB each year. Out of a total of 454,00 incidents reported by WHO, the number of SA cases in 2015 was estimated to be around 57% (258,000) by HIV. WHO (2015) reports that TB continues to be the leading cause of death in South Africa. The World Health Organisation estimates that there are 25,000 deaths from TB and co-infection with HIV and TB. TB remains the leading killer in South Africa followed by HIV/AIDS. Despite the decline in mortality in South Africa, tuberculosis remains the leading cause of death, especially among black men. Of the 45,662 deaths recorded in 2016, the majority were men, at 541.17%, a ratio of 112 deaths per 100 deaths (Kgosana, 2018). Tuberculosis remains a public health problem, despite the availability of TB guidelines.

Ramaliba *et al*., (2017) report that the Limpopo Province is one of the most affected by tuberculosis and ranked number seven among all nine provinces. Regarded as the first priority of the Department of Health strategy plan, TB is one of the major problems in the province (Ramaliba *et al*., 2017). The rate of spread of TB is high in Limpopo Province, due to the high prevalence of HIV / AIDS, compounded by poor TB treatment outcomes. About 55% of TB patients in the province were HIV-positive. Pulmonary tuberculosis resulted in 7.7% of treatment outcomes due to non-compliance with tuberculosis management guidelines (2012). It is necessary to take effective care of tuberculosis patients. A study conducted by Tshitangano (2013) found that of the seven hospitals that admitted TB patients in Vhembe District, only one hospital provides services to TB patients. Those who need TB screening must pay for screening and patients with infectious TB were not isolated from others. Standard national and international TB guidelines were not adhered to either.

The Electronic Tuberculosis Registry in Vhembe District (ETR.net) (DoH, 2018) showed that 2342 new TB cases were reported, extra-pulmonary TB was 701, the mortality rate was 159 and there were 159 cases of patients who had relapsed. In the selected tertiary institution, statistics from 2014 to 2018 indicated 14 cases. Tuberculosis remains a public health problem even though the government provides guidelines for the detection, prevention and management of tuberculosis. Matakanye *et al*., (2019) indicated that although being a curable illness, TB still posing a grave danger to many people including nurses.

1.3 Problem statement

Although TB is preventable and curable, it remains a world health problem. TB is a serious health challenge that affects most people, especially in higher institutions. Some of the factors which contribute to the transmission of PTB include overcrowding, sharing rooms, and close contact with the infected person. Overcrowding in classrooms and sharing of rooms in the

residences by the students put their health at risk of infectious diseases such as TB. The researcher as a professional nurse has observed with great concern that ventilation in the residences has not been adhered to; windows and doors are not open for ventilation. The stated factors above may put students, lecturers and the UNIVEN community at large risk of contracting TB. The lack of knowledge greatly contributes to the spread of TB. There have been 14 recorded TB cases on campus (UNIVEN) from 2014 to 2018. Therefore, the researcher's interest is to assess the knowledge of students regarding PTB at a selected tertiary institution in Vhembe District, Limpopo Province, which is also supported by the National Department of Health TB Management guideline (2017). Further, the researcher found that many studies on students' knowledge of pulmonary TB have been conducted in various countries, but in the Vhembe District, there is no evidence of literature on the topic.

1.4 Significance of the study

This study will not only contribute to the existing body of knowledge on the knowledge of students regarding PTB at a selected tertiary institution in general, but will also bring new knowledge specifically for Univen, a rural based higher institution of learning in Vhembe District. Adding to this, the relationship between the University, Campus Health and the government will also be improved. The results of the study may help with the reduction of PTB infections among the stakeholders such as students and lecturers from being affected with PTB. Furthermore, hostel allocation should be done as per the number required in the residences, by following the policy during room allocation. Residence monitoring should continue to avoid overcrowding and squatting. The budgetary allocation from the government may be used cost-effectively and this would reduce the burden for management of PTB cases. No money would be spent on PTB medications because of fewer TB cases. The absenteeism rate due to sickness may be lower, hence the pass rate may improve. The outcome of this study may improve students' knowledge regarding PTB and benefit their health. Students may be free from PTB infection, as they will be knowledgeable about the prevention, causes, clinical manifestations, management and its complications.

1.5 Study Purpose

The purpose of this study is to determine the knowledge of students regarding PTB at a selected tertiary institution in Vhembe district of Limpopo.

1.6 Research Objectives

Objectives for the study were:

- To assess and analyse the knowledge of students regarding PTB and its causes.
- To describe the knowledge of students regarding PTB at a selected tertiary institution.
- To determine the relationship between education and knowledge of PTB.

1.7 Research question

The research questions of this study will be:

- What knowledge do students have regarding PTB and its causes?
- What describes students' knowledge regarding PTB at a selected tertiary institution?
- What is the relationship between educational level and their knowledge of PTB?

1.8 Theoretical Framework

1.8.1 The Epidemiological Triangle Framework

The epidemiologists use a tool to help understand infectious disease known as the epidemiologic triangle. Poor sanitation, basic knowledge of the disease, low levels of immunity, various model of transmission and the environmental conditions contribute to the diseases that affect the entire population. Yet, epidemiology is a recent discipline which has evolved with the changes taking place in society and the emergence of new diseases. This evolution has allowed epidemiology to remain a useful and relevant tool in bringing to light and understanding diseases and health events (Frérot *et al*., 2018). However, the interrelatedness of three epidemiologic factors often results to the diseases. The epidemiologic triangle (ET) is a model for explaining the organism causing the disease and the conditions that allow it to reproduce and spread (CDC, 2012). This study adopts this model because influences the researcher to investigate how Pulmonary tuberculosis disease spreads from one person to another. The ET can be a significant tool for this study. Hence, to investigate the health challenges such as environmental factors and behavioral problem. In this study, students from a selected tertiary institution in Vhembe District of Limpopo will understand pulmonary tuberculosis and how it spreads from one person to another. Further, it is a model that scientists have developed for studying health problems and can help students and health practitioners understand infectious diseases and how they spread. The ET is made up of three parts corners known as vertices namely:

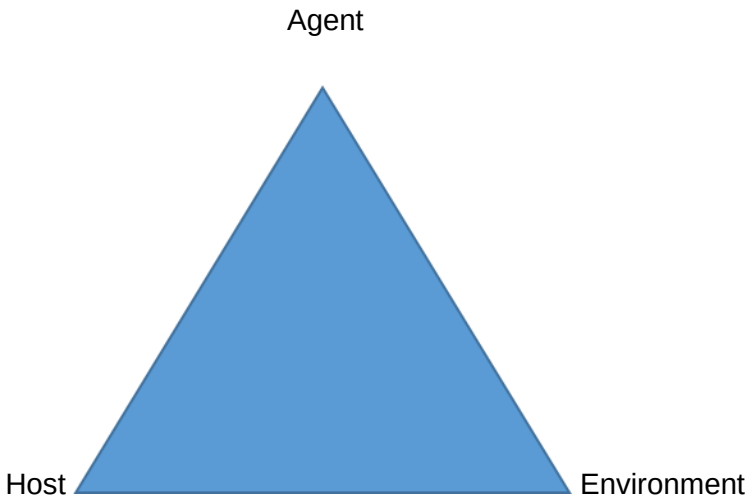

Figure 1: The Epidemiological Triangle

1.9 Definition of terms

Knowledge is the understanding that one has gained through experience or learning (Girard & Girard, 2015). In this study, knowledge is the idea that the respondents will use to answer the questionnaire during the assessment of knowledge of students concerning PTB at a selected tertiary institution in Vhembe district.

Pulmonary Tuberculosis (PTB) is an infectious disease caused by Mycobacterium tuberculosis. This microorganism not only infects the lung but also other organs such as brain, kidneys and lymph nodes. Students from higher institution of learning are exposed to this epidemic due to crowded residences, classrooms as well as other environments.

Students is a person who is studying at a university or other place of higher education (Hornby, 2015). In this study, students are persons studying at a selected tertiary institution and residing in-Campus residence respondents whom data collection will be from and sharing rooms on the Campus.

Tertiary Institution is the educational level following the completion of a school providing a secondary education (Gradidge & Cohen, 2018). In this study, Tertiary Institution refers to any public or private institution, school, or centre of Higher Education other than a University, one of the objects of which is to provide post-secondary education offering courses of study leading to the award of certificates or diplomas and conducting research and publish empirical papers.

So, after completing secondary education, students may enroll in a tertiary institution or acquire a vocational education.

1.10 Chapter Layout

Chapter 1: Overview of the study

This chapter covers the background and significance of the study. It also provides a brief overview of the research questions and objectives, research methods and design, definition of terms, and the theoretical framework.

Chapter 2: Literature review

This chapter reviews the literature on general historic information of TB and PTB, types of TB and Its transmission mode, PTB, Signs and symptoms of PTB, PTB Morbidity related factors, Epidemiology of PTB, Link between TB and COVID-19, Characteristics of SARS CoV-2, Diagnosis of TB, TB Management, The Epidemiological Link between TB and HIV Epidemics, Global impact of TB, Global burden of Tuberculosis, Challenges to Managing TB, Community Awareness on PTB, Tuberculosis at Universities, Prevalence of PTB at Universities Worldwide

Chapter *3*: Research design and methodology

This chapter comprises of study design, study setting, population, sampling frame, approach and technique, sampling method, sampling size, data collection method, data processing, and analysis, ethical considerations as well the dissemination plan of the results.

Chapter *4*: Data analysis and presentation of results

This chapter presented data analysis and presentation of results. The collected data was captured in Microsoft excel before it was subjected to analysis using SPSS version 26. Primary data was obtained from the self-administered questionnaire. A total of 199 questionnaires were distributed and the response rate was 100%. It consists of data analysis, interpretation, and discussion of the results to research questions of the respondents' knowledge regarding pulmonary tuberculosis at a tertiary institution with emphasis at the University of Venda.

Chapter 5: Discussions of Results

This chapter discusses the results of the study by addressing each objective. The study established that there were three groups of students in relationship to the knowledge of PTB, that is, those who have sufficient knowledge regarding the disease, those who do not, and those who do not have sound knowledge. Students from health-related study programs could

be the ones with sufficient knowledge concerning the disease. Under the university setup, every student has access to the disease's information but due to ignorance among other things, students have little or no knowledge on the subject that could directly infect them. Through this study, it was observed that there is a moderate relationship between the level of education and the knowledge of PTB. Universities could introduce educational campaigns on common diseases responsible for mortality and morbidity in the communities.

Chapter 6: Conclusions, recommendations, and limitations.

This chapter provides the summary, conclusions, limitations, and recommendations based on the results of the study.

Summary

This chapter covered the background and significance for the study. A brief overview of the research questions and objectives, research methods and design, definition of terms and the theoretical framework of the study were discussed. Lastly, the layout of all chapters was provided.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents the review of the literature regarding the study objectives. Polit and Beck (2017) defined a literature review as a written summary of the state of evidence on a research problem. The literature review describes the findings of the different sources. A good research study requires a well-structured literature review with empirical evidence from previous and current researchers with enough expertise in the field. Knowledge of students regarding pulmonary Tuberculosis at a selected tertiary institution in Vhembe District of Limpopo Province.

2.2 Purpose of literature review

A literature review according to Polit and Beck (2017) is an organised written presentation of what has been published on a research topic by scholars. The review summarises the findings of previous studies on a topic. It also bridges the gap between previous and existing studies which a study aims to fill.

In this study, the researcher reviewed the literature on general historic information of TB and PTB, students' knowledge of pulmonary TB by focusing on students from tertiary institutions, students from higher secondary schools, health care workers as well as management of TB at health institutions in Vhembe District, Limpopo Province. The researcher found that many studies on students' knowledge of pulmonary TB have been conducted in various countries, but in the Vhembe District, there is no evidence of literature on the topic. The literature in Vhembe District were that of seven hospitals, which admit TB patients. Detailed information regarding the sources of information used in this study is found in the scope of the reviewed literature below.

2.3 Scope of the Literature Review

According to (Mudavanhu, 2017) primary and secondary sources are consulted while reviewing the literature. So, in this study, the most used literature was of primary sources. An internet search was also done, and it provided a lot of general information on the knowledge of TB and PTB worldwide. The knowledge, attitude and practices of TB patients regarding TB-HIV and related STIs co-infection; especially on the knowledge of tertiary institutions' students regarding PTB, information about the types of TB, its global burden and impact, challenges to

managing the disease, community awareness, and PTB at universities. Also, the researcher discusses the public health framework as a guiding framework of this study.

2.4 General Historic Information of TB and PTB

2.4.1 Definition

Tuberculosis is an airborne bacterial and chronic infectious disease caused by bacilli belonging to the genus *Mycobacterium* Ephrem, Mengiste, Mesfin, and Godana (2015) continued by articulating that these micro-organisms have a characteristic of retaining aniline dye (e.g., carbol fuschin) even after decolourisation with acid and alcohol, the reason being, within their inner cell walls, they possess some wax and fat, thus classified as Acid-Fast Bacilli (AFB). It is transmitted between humans through the respiratory route and most commonly affects the lungs, but can damage any tissue (WHO, 2016).

Senkoro (2016) highlights that the *Mycobacterium tuberculosis* (MTB) is the primary bacterium responsible for causing tuberculosis disease while at the same time other bacilli such as *Mycobacterium africanum* (MA) which sometimes appears in West Africa and *Mycobacterium bovis* (MB) which causes tuberculosis in domestic or wild cattle but also causes tuberculosis in humans sporadically. Davies (2015) indicated that another bacillus namely *Mycobacterium microti* (MM) which is a causal agent for tuberculosis in rodents has been recently identified in humans. This is mainly in immunosuppressed subjects, which is *Mycobacterium microti*, a causal agent for tuberculosis in rodents. These four microorganisms, *Mycobacterium tuberculosis*, *Mycobacterium africanum*, *Mycobacterium bovis* and *Mycobacterium microti*, comprises of the so-called *M. tuberculosis* complex (Davies, 2015). This summative definition of TB and PTB will lead us to the next section focusing on the historic highlights of the disease.

2.4.2 Historic highlights of tuberculosis

While Kala et al. (2016) purported that even though the causative organism was discovered some 100 years back and the availability of highly effective drugs for its treatment; TB remains a major public health problem everywhere. The ICN (2015) reiterates that the MTB is as old as the human species as some definite pathological signs of tubercular decay dating from 2400 BC were seen in the fragments from the spinal column of Egyptian mummies. However, Tuberculosis has the dubious distinction of being the most persistent scourge of humankind (Kala *et al*., 2016).

At around 460 BC, Hippocrates described it as the most widespread illness of its time. As appeared initially in Greek literature, TB was nicknamed “white plague” and also called

consumption or phthisis. Then the 17th Century showed some earliest references to the infectious nature of TB appearing in Italian medical literature with some exact an etiological and pathological descriptions of the disease. Yet, there was no sign of a cure but that led to some progress to be made towards prevention. The first hope for a TB cure came later with the introduction of the sanatorium. These special centres were located in areas with a healthier climate, where patients were continuously exposed to fresh air. Improving social and sanitary conditions and ensuring adequate nutrition was all that could be done to strengthen the body's defense against the disease. But many people died at home due to TB because they could not afford to go to a sanatorium to access the available services (ICN, 2015).

A demonstration showing that TB could pass from humans to cattle and from cattle to rabbits was done by Jean-Antoine Villemin who was a French military doctor in 1865. A few years later in 1882, the real fight against the disease began following the discovery of the MTB under the microscope by Robert Koch, a German scientist. Another milestone paved the way in the year 1895 when the discovery of radiation was done by Wilhelm Konrad von Roentgen. Later on, Albert Calmette, a French biologist worked together with Camille Guérin to develop a vaccine against TB. They managed to develop a bacillus harmless to man, so far with the ability to stimulate the production of antibodies by 1921. Then the practice to vaccinate newborns was practiced using the Bacille Calmette Guérin commonly known as (BCG) from 1924 till nowadays (ICN, 2015). Furthermore, another discovery of an antibiotic that could kill TB bacteria called streptomycin happened during the Second World War in 1943 by Selman A. Waksman, an American scientist. Then in the following years, there was the appearance of a rapid succession of anti-TB drugs. Finally following streptomycin, there was the introduction of the following anti-TB agents: isoniazid in 1952, pyrazinamide in 1954, ethambutol in 1962 and rifampicin in 1963 respectively (ICN, 2015). To conclude this section, it is important to note that the above-mentioned anti-TB drugs are still used today in the fight against the disease. The next section will be dealing with types of TB.

2.4.3 Types of Tuberculosis and Its Transmission Mode

Senkoro (2016), categorises TB by how contagious it is and hence there are two forms of tuberculosis: (a) pulmonary tuberculosis, which accounts for 80% of all cases of tuberculosis as it typically affects the lungs and (b) less common, non-infectious, extra-pulmonary tuberculosis which can affect any part of the body other than the lungs, e.g., lymph nodes, spine, pericardium, pleura, joints, genital urinary tract and abdomen (Ait-Khalid *et al*., (2010).

Ato & Sis (2019) stated that pulmonary tuberculosis is the infectious form of the disease. Pulmonary tuberculosis is further classified as either sputum smear-positive or sputum smear-

negative. A patient with both pulmonary and extra-pulmonary tuberculosis should be classified as a case of pulmonary tuberculosis because it is infectious (Senkoro, 2016; Ait-Khalid *et al*., 2010; WHO, 2010).

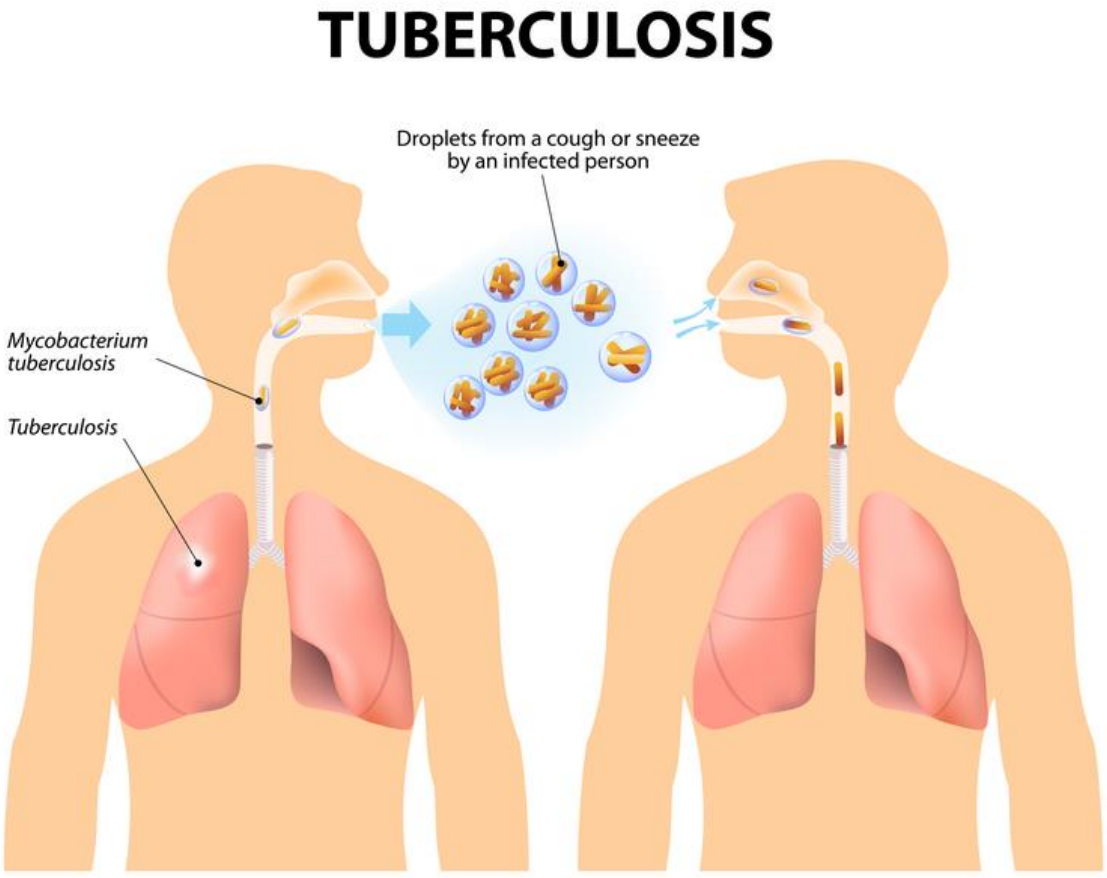

Figure 2: Pictorial view of TB transmission from Harvard Medical School (2019)
https://www.health.harvard.edu/a_to_z/tuberculosis-a-to-z

Study conducted by Senkoro (2016) indicated that the predominant mode of transmission of the bacilli is by aerosol; hence an individual with tuberculosis of the lungs expelling micro-organisms into the air in tiny droplets when talking, coughing, laughing, or sneezing is the most important source of contamination. They continue by asserting that the most communicable cases are patients with pulmonary tuberculosis as the main reservoir of MTB. Only in a small proportion of cases, is the bacillus (*Mycobacterium bovis*) transmitted to humans from infected cows through drinking non-sterilised milk. The existing control of tuberculosis in livestock and widespread pasteurisation of milk has made this second mode of transmission rare in industrialised countries but remains an important problem in developing countries (Alelign *et al*., 2019).

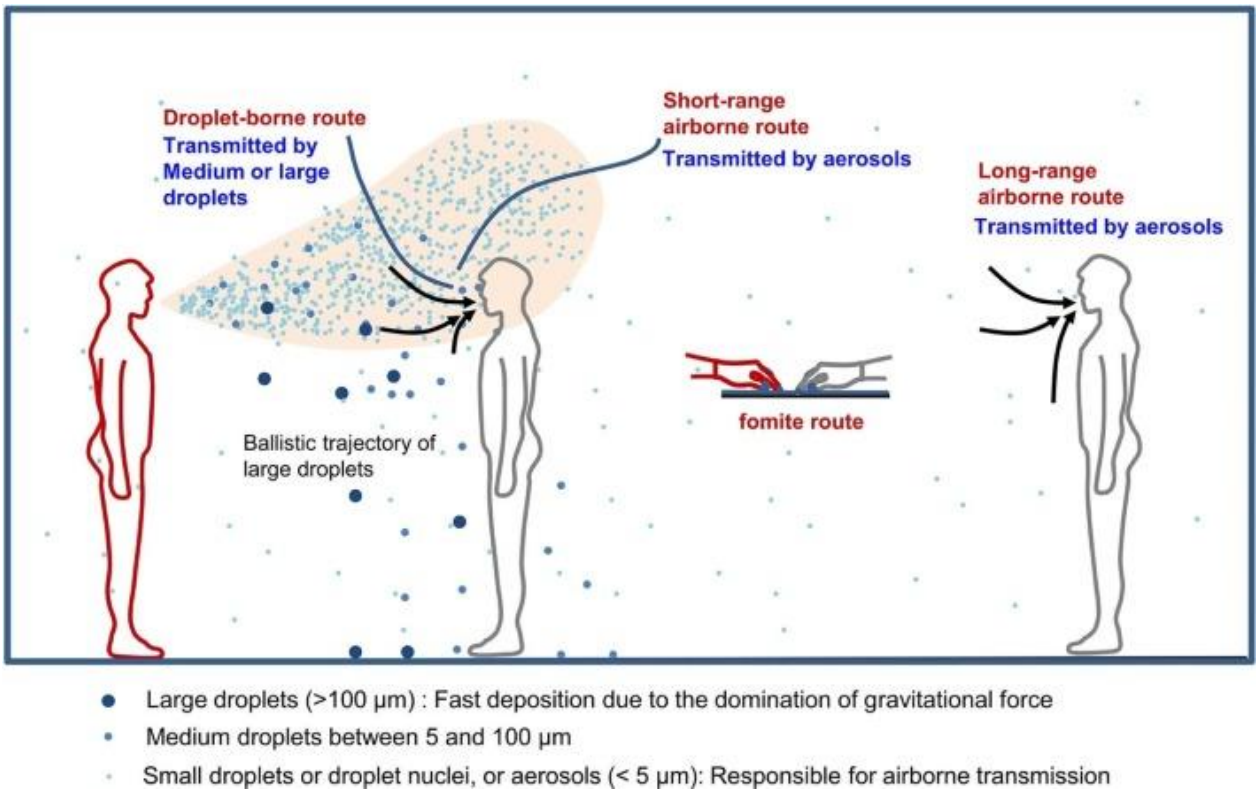

Figure 3: Airborne spread of infectious agents in the environment adapted and modified from Wei & Li (2016).

TB as an airborne infection spreads faster from person to person by droplet nuclei that are produced when a person with PTB or laryngeal TB coughs/sneezes and by aerosol – producing investigations such as bronchoscopy and sputum induction (Wei & Li, 2016; DoH, 2015). Ato and Sis (2019) add that even while people are singing or talking, the transmission happens quicker. A single cough may bring out up to 4.000 droplets. Most infections do not have symptoms, known as latent TB (Ato & Sis, 2019). Adding to this, Ato and Sis (2019) highlight that if left untreated for years by approximately 10% of those infected then the disease could develop into active TB in their lifetime causing up to 50% of the fatality.

So, TB spreads from one person to another by droplet nuclei that are produced when a person with pulmonary tuberculosis or Laryngeal tuberculosis cough, sneezes, and talks. People with active tuberculosis generate droplets of different sizes. The larger droplets which contain a higher number of bacilli do not remain airborne for long periods (Ato & Sis, 2019).

2.4.3.1 Pulmonary Tuberculosis (PTB)

Pulmonary tuberculosis (PTB) continues to be a major public health problem and accounts for over 80% of all cases (Khalil *et al*., 2011). In a study on Pulmonary tuberculosis prevention behaviour improvement and structured-health education in Bogor regency, Indonesia; Astuti, Nursasi and Sukihananto (2019) opine that PTB is easily spread through sputum splashes as it remains a common infectious disease in the world. Hence, it encourages the development of interventions in order to control the transmission of TB, such as structured health education (Astuti *et al*., 2019). Below are the signs and symptoms of PTB in Table 1.

2.4.4 Signs and symptoms of PTB

Table 1.1: Signs and Symptoms of PTB

Pulmonary Tuberculosis (PTB)	
SIGNS	**SYMPTOMS**
Cough – Chronic or more than 2 weeks	Anorexia
Chest Pain	Chest Pain
Dyspnea	Dizzyness
Haemoptysis	Fatigue or Tiredness
Sweating at night	Fever
Weight loss (unintentional) and anorexia	Headache
	Malaise and unusual tiredness
	Pyrexia of unknown origin

2.4.5 PTB Morbidity related factors

TB is the most common cause of communicable disease-related morbidity and mortality worldwide (Chowdhury *et al*., 2015). Other studies have also alluded to the fact that PTB is

one of the leading causes of adult mortality worldwide (WHO, 2016; Pramanik & Ghosh, 2015). In South Africa, TB remains one of the leading causes of death (Stats SA, 2013). An estimation of about 1.8 million people die due to PTB and 95% of deaths occurred in developing countries. There were approximately 10.4 million people affected with PTB globally by the end of the year 2015 (WHO, 2016).

2.4.6 Epidemiology of Pulmonary tuberculosis

Caused by *Mycobacterium tuberculosis* and transmitted from one person to another through nuclei droplets, its causal agent is the tubercle bacillus (ICN, 2015; Ephrem *et al*., 2015). TB remains the most important infectious disease worldwide despite efforts made in the past decade to bring it under control. Although curable and preventable, it has not yet been eliminated in many countries. Recognised as the endemic disease of the poor in the 19th and early 20th centuries, TB remains a great causal pandemic of public concern (ICN, 2015). However, in the 1950s the general opinion, particularly in developed countries, was that the disease no longer poses a threat to public health Ravigilone, (2017) following the development of effective TB treatment.

Regardless of multiple efforts made to control the disease years ago, Musasa (2011) reports that TB remains the most infectious disease at a global level because it's still the main public health challenge on the planet (ICN, 2015). The eradication of the disease never took place in many industrialised or developed countries even if the illness is curable and controllable. A study conducted in Ethiopia by Ephrem *et al*., (2015) on the determinants of active pulmonary tuberculosis in Ambo Hospital, stipulates that it is an airborne bacterial. Bacilli belonging to the genus *Mycobacterium.*, TB is a chronic communicable illness.

Subsequently, WHO global TB report 2013 says that India and South Africa alone account for about one-third of deaths that occur globally. TB is an infectious disease so one non-diagnosed TB patient can infect 10 to 15 persons per year, making the early diagnosis indispensable (Sudha, 2016; World Health Organisation, 2013). Adding to this, the disease has been declared by WHO (2004) that without the availability of treatment, 50% of patients with active TB will be dead after 5 years, while 25% will continue to be ill with constantly infectious TB, and only the remaining 25% will be healthy through self-curing by a strong immunity.

2.4.7 Link between TB and COVID-19

The novel coronavirus came as surprise globally. In the last two decades, three major coronavirus epidemics have been reported worldwide. Those epidemics were caused by

different agents: severe acute respiratory syndrome coronavirus (SARS-CoV) in 2002, Middle East respiratory syndrome coronavirus (MERS-CoV) in 2012, and the current SARS-CoV-2 outbreak, known as COVID-19 (Soriano & Barreiro, 2020). The biological interactions between tuberculosis, HIV, and COVID-19, as well as health system factors, contribute to the impact of COVID-19 on vulnerable populations (Keene *et al*., 2020). Yet, in 2019 alone, an estimated 301 000 people developed TB, nearly 60% of whom were also HIV-infected in SA (Boffa *et al*., 2020). Consequently. Additionally, another danger to this combination is the inadvertent de-prioritisation of TB care if the health system becomes inundated with people experiencing severe acute respiratory syndrome from infection with SARS-CoV-2 (Boffa *et al*., 2020; WHO, 2020).

Hence the health impact of COVID-19 is likely to be far more substantial and long-lasting in countries with high incidences of tuberculosis and HIV than in those with low incidences. Tuberculosis and HIV each have more than double the mortality rate of COVID-19, as shown in the Western Cape, South Africa. (Drain & Garrett, 2020; Keene *et al*., 2020). Tamuzi *et al*., (2020) confirms that the triple burden of COVID-19, tuberculosis and human immunodeficiency virus is one of the major global health challenges of the twenty-first century. Keene *et al*., (2020) points out that the COVID-19 pandemic has exposed systemic weaknesses, such as reduced medication supply and staff shortages, which will require dedicated health system strengthening and substantial investments to correct. However, several gaps remain in the knowledge of the burden of COVID-19 on patients with TB and HIV (Tamuzi *et al*., 2020). Furthermore, HIV, TB and newly Emerging Infectious Diseases such as Coronavirus epidemics are expected to overlap in high HIV and TB burdened countries. The intersecting coronavirus, HIV and TB epidemics in countries with a high burden of HIV and TB infections pose several public health challenges. Therefore, the researcher believes that South Africa as one of the highest countries with the TB burden will be negatively affected due to COVID-19. Below is the *Figure F.4* illustrating the difference between the distance travelled between droplet and airborne after aerosol generation through coughing or sneezing.

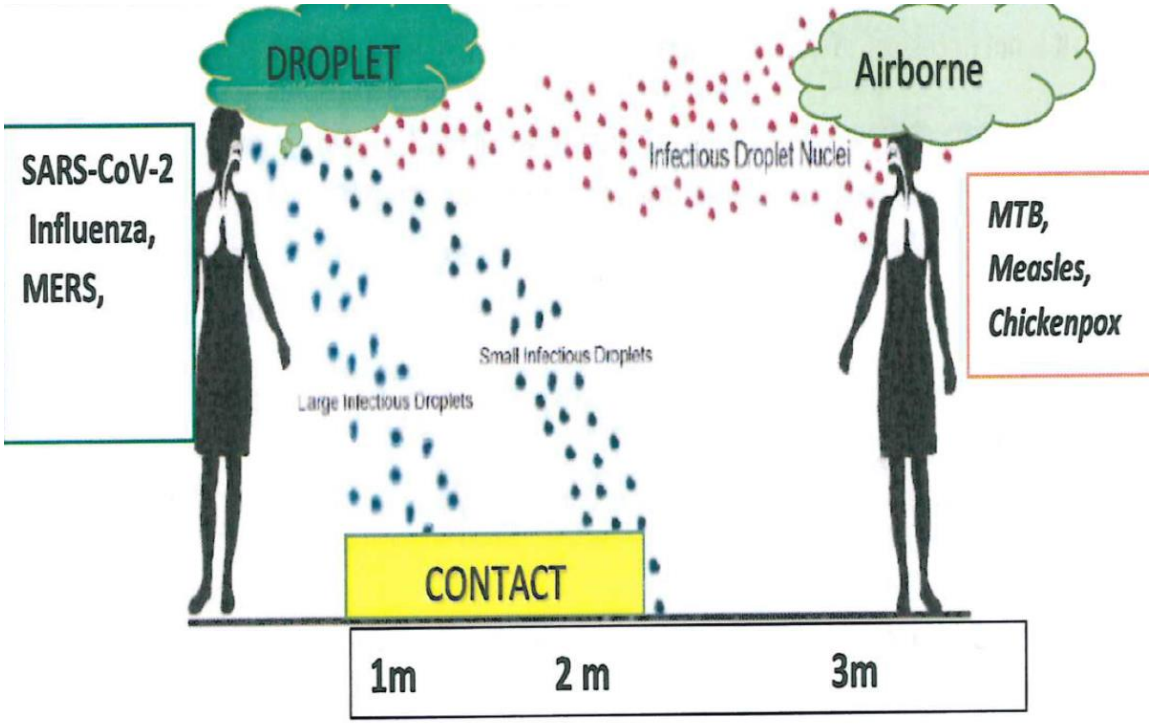

Figure 4: Adapted in (DoH, 2020:4) Illustrating the difference between the distance travelled between droplet and airborne after aerosol generation through coughing or sneezing

Both airborne infections have almost similar routes of transmission. WHO (2020) indicated that there are only two known routes of transmission (WHO recommendations) especially for the COVID-19 which are:

I. Through respiratory droplets produced via sneezing, coughing which is directly inhaled person to person
II. Through respiratory droplets landing on environmental surfaces surrounding the infected person (also known as the patient zone and the health zone) to which are then transferred by the contact route via contaminated hands to a person's face and mucous membranes.

2.4.8 Diagnosis of TB

Diagnosis refers to detecting a disease or medical condition. To understand tuberculosis (TB) diagnosis is a critical phenomenon to why the world is currently failing to end TB disease.

Different methods for diagnosing TB are described below:

Table 1.2: TB Diagnosing Methods

TB DIAGNOSING METHODS	
DIAGNOSING METHOD	**DIAGNOSING TECHNIQUES**
Screening for TB	TB Symptom Screening Tool
Physical examination of the client	Pale, wasted, any clubbing of nail beds, The chest has any abnormalities like enlargement, cavitation, crepitation (DoH, 2020:4), and wheezing sounds.
Chest X-ray	X-ray of the lungs
Mantoux or Tuberculin skin test (TST)	Injecting a small amount of fluid with purified protein derivative (PPD) named tuberculin into the skin in the lower part of the arm.
Sputum / Smear Microscopy	Microscopic or laboratory testing
Acid-Fast Bacilli (AFB) Smear	Microscopic Test of sputum
GeneXpert	Molecular techniques to test sputum in the GeneXpert machine
Line Probe Assay (LPA)	Microscopic test

2.4.8.1 Acid-Fast Bacilli (AFB) Smear

AFB can be done within a very short period. The AFB also identifies a number of bacilli transmitted to another person, and the TAT (Turnaround Time) is 24-48 hours. AFB is an instrument for treatment monitoring accessible to most patients. The limitations are, it cannot differentiate between dead and live bacilli, does not detect drug resistance and 5000 or more AFB/ml sputum specimen is required during collection (ICN, 2015).

Table 1.3: Smear classification results

ACID-FAST BACILLI (AFB) SMEAR		
SMEAR RESULT (NUMBER OF AFB OBSERVED AT 1000 X MAGNIFICATION)	SMEAR INTERPRETATION	INFECTIOUSNESS OF PATIENT
4+(>9/field)	Strongly positive	Very infectious
3+(1-9/ field)	Strongly positive	Very infectious
2+(1-9/10 fields)	Moderate positive	Infectious
1+(1-9/100 fields)	Moderate positive	Infectious
+/-(1-2/300 fields) *	Weakly positive	Infectious
No acid-fast bacilli seen	Negative	Not infectious

2.4.9 TB Management

Phases and duration

There are two phases of TB treatment: initial or intensive and continuation. Treatment of TB usually takes 6-8 months depending on whether the patient is newly diagnosed or a previously treated case. Newly diagnosed cases are treated for six months while previously treated cases are treated for eight months.

Direct Observed Treatment (DOT)

WHO (2013), Direct observation treatment (DOT), is the TB strategy recommended by WHO to all countries with the burden of TB, aiming to end TB by 2035? This means the patient is supervised during swallowing of the TB drugs at the health facility by health care professionals or at their respective homes by a relative, guardian or friend. DOT is essential because it reduces the risk of treatment defaulters and retreatment or relapse. The treatment alsoensures that a TB patient takes the right drugs, in the right doses, at the right intervals to enable a patient to finish treatment within the required duration. Treatment of TB uses standardised regimen (Regimen 1 and Regimen 2); this means that all patients in a defined group receive the same treatment regimen.

Table 1.4: TB Treatment Regimen 1 for newly diagnosed TB patients

PRE-TREATMENT BODY WEIGHT	INITIAL PHASE: Treatment given seven days a week for two months	CONTINUATION PHASE: Treatment given seven days a week for four months	
	R,H,Z,E 150, 75,400, 75	**R,H** 150, 75	**R,H** 300,150
30 - 37 kg	2 Tabs	2 Tabs	
38 - 54 kg	3 Tabs	3 Tabs	
55 - 70 kg	4 Tabs		2 Tabs
71 kg and above	5 Tabs		2 Tabs

R= Rifampicin**; H** = Isoniazid; **Z** = Pyrazinamide; **E** = Ethambutol

The newly diagnosed adult Pulmonary Tuberculosis (PTB) patient should receive a six-month regimen containing rifampicin, Isoniazid (H), Pyrazinamide (Z) and Ethambutol (E). The treatment should be taken daily under observation by a health care worker or treatment supporter (guardian) throughout the six months Standard Treatment Guidelines and Essential Drugs List (2016). Table 3 below indicates the reoccurring TB Treatment Regimen 2.

Table 1.5: Reoccurring TB Treatment Regimen 2

PRE-TREATMENT BODY WEIGHT	INTENSIVE PHASE: 7 DAYS PER WEEK FOR 2 MONTHS		7 DAYS PER WEEK FOR THE 3rd MONTH	CONTINUATION PHASE: 7 DAYS PER WEEK FOR 5 MONTHS			
	R,H,Z,E 150, 75,400,75	STREPTOMYCIN Tablet	R,H,Z,E 150, 75,400,75	R,H 150,75	E 400	R,H 300,150	E 400
30 - 37 kg	2 Tabs	0.5 Tab	2 Tabs	2 Tabs	2 Tabs		
38 - 54 kg	3 Tabs	0.75 Tab	3 Tabs	3 Tabs	2 Tabs		
55 - 70 kg	4 Tabs	1 Tab	4 Tabs			2 Tabs	3 Tabs
71 kg and above	5 Tabs	1 Tab	5 Tabs			2 Tabs	3 Tabs

Rifampicin(**R**), Isoniazid (**H**), Ethambutol (**E**), Streptomycin Tablet (**S**)

Regimen 2 is TB treatment meant for an adult TB case with a history of treatment failure, relapse, treatment interruption, cure and treatment completion (DoH, 2014) as mentioned in Table 3 above with recommendations from the National Department of Health of South Africa. Additionally, when a patient is receiving any TB treatment, there are always side effects related to that particular regimen.

Side-effects of TB treatments

Although TB patients are taking more than one drug, some complete their course without developing side-effects. However, there are measures in place to treat side-effects. Every day the health care professional should monitor for side-effects, or the TB patient should report any side-effects experienced. TB patients do decide to default treatment because of some side-effects. DoH (2016) stipulates the management of TB in a new era of diagnostics. Table 4 below provides some information regarding TB Treatment, its side-effects, and its management.

Table 1.6: TB Treatment, Side effects and Management of side effects.

TB TREATMENT	SIDE EFFECTS	MANAGEMENT OF SIDE EFFECTS
Pyrazinamide (Z)	Joint pains Nausea and Vomiting	Provide pain medication. Consider the diet intake that might cause the problem.
Rifampicin (R)	Anorexia, Nausea, Abdominal pains, Orange coloured urine.	Warn patient of these possible side-effects before commencing treatment. Exclude other causes. Treat symptomatically. Take rifampicin at least 30 minutes before meals. Take Anti-Acids 2 hours before taking treatment.
Isoniazid (H)	Burning sensation in feet	Pyridoxine 25mg oral daily, the dose increased as the side -effects increases to 100mg.
Streptomycin (S)	Hearing loss, Skin rash.	Stop Streptomycin immediately.
Ethambutol (E)	Visual impairment/loss.	Stop ethambutol immediately and never reintroduce it.

2.4.10 The Epidemiological Link between TB and HIV Epidemics

As mentioned earlier, TB, according to Rukasha, (2019) is a bacterial infection caused by *Mycobacterium TB* and is spread from person to person through droplets. Occasionally TB is caused by *Mycobacterium bovis* and *Mycobacterium Africanus*. TB is caused by bacilli belonging to the genus *Mycobacterium.* TB is a chronic communicable illness. Ephrem *et al*., (2015) in a study conducted in Ethiopia, on the determinants of active pulmonary tuberculosis in Ambo Hospital, stipulates that it is an airborne bacterial. Consequently, it has been declared by WHO (2004, 2017) that without the availability of treatment, 50% of patients with active TB will be dead after 5 years, while 25% will continue to be ill with constantly infectious TB, and only the remaining 25% will be healthy through self-curing by a strong immunity.

WHO global TB report in 2013 said that India and South Africa alone account for about one-third of deaths that occur. TB is an infectious disease so one non-diagnosed TB patient can infect 10 to 15 persons per year, making the early diagnosis indispensable (Sudha, 2016; Central TB Division, 2014; WHO, 2013).

The eradication of the disease never took place in many industrialised or developed countries even if the illness is curable and controllable. Yet, regardless of multiple efforts made to control the disease years ago, TB remains the most infectious disease in the twenty first century with other infectious diseases (Bloom & Cadarette, 2019). From the above mentioned, the researcher deducts that as students living in overcrowded residences where there is no proper ventilation, they are vulnerable to contracting the disease especially if their immune system is weak with a nutritionally poor diet.

2.4.10.1 HIV Transmission

HIV is present in the blood, semen and other body fluids such as breast milk and saliva. Exposure to infected fluids leads to a risk of contracting the infection. Major modes of HIV spread are all forms of sexual activity (the most common), parenteral (blood or blood product recipients, injection drug users and occupational injury), and vertical transmission e.g., mother to child transmission. In the early 1980s, HIV infection was regarded exclusively as a disease of homosexuals. Then bisexual males started getting infected and currently, we have HIV infections in the heterosexual population throughout the world Wikins, (2020).

2.4.10.2 TB-HIV Co-Infection and Integration of Services

It has been proven that in regions with a high HIV infection occurrence, the difficulty to control TB is greater (Osei *et al*., 2017). This infection with *Mycobacterium tuberculosis* is the leading cause of death amongst individuals living with HIV (Wong *et al*., 2020). Gounden, Perumal and Magula (2018) acknowledges that South Africa has the highest burden of TB/HIV co-infection in the world, with the province of KwaZulu-Natal representing the global epicentre of TB/HIV. Both infections are interconnected and to describe their close relationship the following terms “co-epidemic” or “dual epidemic’’ are often used (Osei *et al*., 2017).

2.5 The Burden of TB and HIV Infection

Despite 90 years of vaccination and 60 years of chemotherapy, tuberculosis (TB) remains the world’s leading cause of death from an infectious agent, exceeding human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) for the first time (WHO, 2015; 2016).

Globally in 2013, nine million people developed TB, with 1.5 million tuberculosis-related deaths reported in the same period. In the same year, there were 328 826 cases of TB reported in South Africa, 37 709 cases of which were extrapulmonary TB (EPTB) (WHO, 2014). Up to

date, Tuberculosis is still the most common HIV-associated disease and represents the leading cause of death in these patients globally (Gounden *et al.*, 2018 & WHO, 2016). Stats SA (2013) confirms that in South Africa, one of the leading causes of death is TB.

The presentation of the disease may be related to the level of immunosuppression of the patient. Extrapulmonary involvement in particular has been associated with advanced HIV infection (Sunnetcioglu *et al.*, 2015). Generally, pulmonary TB is more common than EPTB in people living with HIV. After more than a decade of rolling out the largest antiretroviral programme in the world, more than 2.4 million people now have access to ART in South Africa.

2.5.1 The Impact of TB Infection on HIV Prevention and Care.

2.5.1.1 Knowledge, attitude and practices of TB patients regarding TB-HIV and related STIs co-infection

In the pursuit of knowledge, the researcher finds it relevant to also discuss the knowledge, attitude, and practices of TB patients regarding TB-HIV and related STIs co-infection. This is to inform readers, students, and recommend to policymakers. The level of awareness of TB, HIV, and STIs to students is of high importance as the prevention of TB is also the prevention of HIV including other STIs because some students living in university residences engage in early relationships leading to risky sexual intercourses. So, a student with TB and STIs can easily infect another student while in an intimate relationship.

A study conducted in Indonesia by Falah *et al*., (2019) on TB Knowledge among University Students revealed that students' lack of knowledge about TB is one factor that causes the high incidence of TB in Indonesia with particular attention on lack of knowledge about the cause, prevention, transmission, and symptoms of TB result in poor behavior seeking treatment (Falah *et al*., 2019). With regards to the knowledge concerning TB risk in HIV patients; Kala *et al*., (2016) revealed limited knowledge with respect to the management domain and TB risk in HIV patients, patients care and discrimination towards TB patients. Another study conducted in India found that a quarter of the patients (25%) could not identify even a single symptom of the disease.

2.6 Global impact of TB

Falah *et al*., (2019) elucidate that internationally the rising incidence of TB has become one of the main health issues. Furthermore, it is confirmed by WHO (2020) that globally the highest incidence rate of Tuberculosis is found in developing countries, yet TB is still distributed unequally worldwide. Thus, this high prevalence of tuberculosis impacts society, the economy and the environment (Falah *et al*., 2019). The largest number of new TB cases occurred in the

WHO South-East Asian region with 44% of new cases, followed by the WHO African region with 25% of new cases and the WHO Western Pacific with 18% in the year 2019 (WHO, 2020). Its occurrence has reached epidemic proportions globally with nearly one and a half million people dying every year from a disease that is curable and preventable (ICN, 2015). Furthermore, Luba *et al*., (2019) in agreement with WHO (2015) reiterate that the most affected continent by TB is Africa because from the estimated 1.2 million new HIV-positive TB cases that occurred globally in 2014, as almost three-quarters were in the African region.

2.7 Global burden of Tuberculosis

In its 2015 global report, the WHO (2015) stipulates that TB remains a major cause of morbidity and mortality, ranking alongside HIV as a leading cause of death worldwide. With about 2 billion people being infected, TB has declared a global public health emergency in 1993, and infection with TB occurs by inhalation of *Mycobacterium tuberculosis* in respiratory droplets from an infectious case of pulmonary TB (WHO, 2017). The WHO (2020) indicated that in 2019 alone, a total of 1.4 million people died from TB (including 208 000 people with HIV) globally; and also, an estimated 10 million people fell ill with TB whereby 5.6 million were men, 3.2 million were women and 1.2 million were children. Nearly 95% of the new cases and 98% of deaths due to TB occur annually in emerging countries. Asia and Africa account for 55% and 32% of cases globally, respectively because TB remains a disease of poverty. Adding to this, the African and South-East Asia Regions account for roughly 80% of tuberculosis deaths among HIV-negative people (WHO, 2015). It has also been documented by the WHO that the burden of TB infection has been amplified since the occurrence of HIV infection. TB and HIV co-infection are increasing worldwide, with a special mention in developing countries.

Moreover, multidrug-resistant TB (MDR-TB) remains a public health crisis and a health security threat worldwide (WHO, 2020). In addition to this, about 5% of infected individuals develop the active disease within 5 years of primary infection while 95% develop a latent infection that can later progress to disease depending on the immune system status (WHO, 2018). Yet, stigma remains one of the many factors in the prevention and control of TB (Cremers *et al*., 2015). Although preventable and curable, TB remains a global public health threat with eight countries accounting for two-thirds of the total TB burden namely India, Indonesia, China, Philippines, Pakistan, Nigeria, Bangladesh and South Africa. The statistics revealed that about 0.72 million new TB cases worldwide were attributed to alcohol use disorder and 0.70 million were attributed to smoking in 2019 (WHO, 2020).

Despite lasting efforts and interventions over decades, TB remains the second most common cause of death due to an infectious disease, and precedence in the global public health

agenda. Suggested trends also reveal that it will remain a major killer and among the top leading causes of global disease burden over the next decades (WHO, 2020). As a result, global progress on major advances in TB prevention and care will depend effectively on these leading countries (Vijayakrishnan, Bobba and Venugopal (2017) with a high TB burden.

Therefore, Senkoro (2016) and WHO (2015) indicated that an assessment of the burden of disease caused by tuberculosis, can be done using the following three indicators:

- Prevalence (defined as the number of cases of tuberculosis at a given point in time)
- Incidence (defined as the number of cases of tuberculosis arising during a given period, usually one year), and
- Mortality (defined as the number of deaths caused by tuberculosis in a given period, usually a year).

2.8 Challenges to Managing TB

As indicated earlier, the management of TB faces several problems. Purport that although a global, structured plan to manage TB epidemics has been constructed, TB treatment programmes need to be tailored to local settings., WHO, (2019) state that implementers need to pay attention to key epidemiological characteristics and resources available, as well as to local values, beliefs and preferences regarding taking treatment. Active TB is not only the result of infection with the TB bacillus – the socio-economic characteristics of the setting influence whether a patient develops active TB or not. TB epidemics have complex relationships to socioeconomic factors, and the disease continues to affect the poor and marginalised (WHO, 2019).

This combined with challenges within health systems (WHO, 2018), such as poor access to treatment make managing TB a complex and challenging task. By definition, managing TB also means the improvement of the public health environment, which aims to provide the maximum benefit for the largest number of people (WHO, 2015). So, as TB remains the leading cause of death in the country (NSP, 2017), the following researchers WHO (2018) emphasisies in their respective studies that major challenges such as available resources, improved health systems for adequate access of services are still prevalent. Additionally, Churchyard *et al*., (2014) posit that the central pillars of TB control include finding, treating and preventing TB in order to avoid TB deaths and reduce transmission. However, the prevention of TB has been a neglected aspect of TB control because TB prevention strategies include treatment of latent TB infection among high-risk persons; case finding to detect and treat infectious TB earlier, reducing the duration of infectiousness and transmission.

Consequently, well-managed TB programmes countrywide are key for implementing public health approaches to address health threats related to TB, and especially to reduce the burden of the disease at rural tertiary institutions of learning. So, it is relevant for the community to be aware of this deadly pandemic in order to prevent it and eliminate all forms of stigma related to it.

2.9 Community Awareness on PTB

South Africa and India rank among the top 10 high TB burden countries with the highest absolute burden of TB, and the second-highest rate of TB incidence, respectively (Padayatchi *et al*., 2019) as well as the second-highest number of diagnosed multidrug-resistant TB cases, and the largest number of HIV-associated TB cases (Churchyard, *et al*., 2014). Therefore, the Millennium Development Goal number 6, target 8, was to 'Halt and begin to reverse the incidence of TB by 2015'. In order to achieve this goal, the World Health Organisation (WHO) launched the Stop TB program; one of the important strategies of which was education and empowerment of communities (WHO, 2014). This goal was not reached as planned as the shift is now on the Sustainable Development Goals (SDGs) that will also expire in 2030. Yet, communities are still experiencing a significant level of stigma due to TB contraction (Bensalah *et al*., 2017).

However, recent years in the Sub-Saharan Africa region have witnessed a dramatic increase in the number of TB cases and a disproportionately high number of people living with TB (World Health Organisation, 2016). Watermeyer and Penn (2019) revealed that South Africa has the highest incidence of TB worldwide; in 2005, extremely drug-resistant TB was first detected in Tugela Ferry and since then there has been a countrywide surge in the number of cases of drug-resistant TB, exacerbated by the HIV burden (Saidi *et al*., 2017; Sah *et al*., (2017). Besides limited resources and infrastructure, social and economic difficulties have made the identification, treatment and cure of TB a challenging task in this context. It is emphasised that TB is mainly an airborne transmitted infection, but sometimes spreads to humans from infected cows through drinking non-sterilised milk in very few cases (WHO, 2018; Saidi *et al*., 2017

Community members are experts of their own lifeworld's - their everyday experiences, lives, and problems and their beliefs about illness and treatment may have a significant impact on adherence to prevention or treatment (Watermeyer & Penn, 2019). Yet, household contact with a sputum positive adult has been found to increase the risk of TB infection.

In a study conducted in India by Kala *et al*., (2016), the researchers mentioned that community awareness on Tuberculosis in the general population is of foremost importance in combating tuberculosis in India. That is why Tolossa *et al*., (2014) indicated that developing interventions that can increase knowledge to improve health behaviour and suppress disease transmission is a necessity because community knowledge about PTB has an effect on the risk of disease transmission to society. Hence, factors like educational status, marital status, and caste were significantly associated with inadequate knowledge of TB among the rural population of Mamandur in Tamilnadu in India (Kala *et al*., 2016); while a low level of knowledge leads to poor health behaviour and encourages the rapid spread of the illness in Eastern Ethiopia (Tolossa *et al*., 2014).

2.10 Tuberculosis at Universities

Universities are places where also the burden of TB is found. Despite studies undertaken on TB at universities, there is a lack of data and empirical studies on students' knowledge of tuberculosis and very little is available in Limpopo especially at the University of Venda. A study conducted by Mekonnen & Petros (2016) confirms that at universities, TB might be significantly prevalent. According to the WHO (2020), even though all age groups are at risk of being affected with TB, it affects mostly adults in their most productive years. Also, alcohol use disorder and tobacco smoking increase the risk of the TB disease by a factor of 3.3 and 1.6 respectively. In Indonesia, Falah *et al*., (2019) mentioned that one causing factor of the high incidence of TB is the lack of students' knowledge about TB with a particular mention on the lack of knowledge due to the cause, prevention, transmission, and symptoms of TB resulting in poor behavior seeking treatment.

Consequently, Falah *et al.,* (2019) affirm that students' knowledge and opinion about tuberculosis (TB) are very important for recognising early symptoms and signs of disease, prevention of late in diagnosis of TB and influence on prevention and outcome of the disease. The researcher estimates that universities are highly compacted settings where the majority of students attending their higher education are at their productive years and most of them abuse substance abuse while at higher education institutions, especially in South Africa. This could continue to affect students especially those from key remote areas with regards to this deadly disease.

2.11 Prevalence of PTB at Universities Worldwide

Watermeyer & Penn (2019) state that with 1.4 million estimated deaths in 2015 tuberculosis ranks as the second leading cause of death from infectious disease worldwide and remains a major public health challenge globally. It is a well-known cause of ill-health among millions of

people each year despite several efforts to improve case identification and treatment compliance (Shimeles *et al*., 2019). Most of the international studies conducted by many researchers are relevant to this study. Hibstu & Bago (2016) conducted a study concerning the knowledge, attitudes and practices about TB in students from a Peruvian University. The study revealed that knowledge deficiency among the students was crucial because the score of 74.9% indicated that the students were unaware of latent Tuberculosis.

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2.12 Knowledge of PTB at the University of Venda

The University of Venda (UNIVEN) is classified as one of the public tertiary institutions of higher learning in South Africa. Understanding that the safety of students is paramount to the core business of the University, this study came as a response related to the healthy state of students. As highlighted by Gounden *et al*., (2018), South Africa has made considerable progress to improve the diagnosis of pulmonary tuberculosis and extrapulmonary TB (EPTB).

As the first survey on knowledge of students about PTB at a selected tertiary institution ever to be done in Vhembe District; this reflects the level of knowledge of the disease but there is a need for more studies to assess the prevalence of PTB among students as well. The figure below depicts the summative sampling and knowledge framework of PTB among students at a selected tertiary institution where this was conducted. It gives a picture of the study findings

of how students at the UNIVEN know about PTB. Also, the findings of this study will have a positive impact on the implementation of innovative public health to address the threat posed by PTB at tertiary institutions as some students who are sick with PTB at the tertiary institution might expel bacteria to others. Furthermore, the findings of this study produced useful information for policymakers to evaluate and shape the TB control programmes and plan socioeconomic and public health measures to increase TB knowledge and further enhance the TB control programmes (Gelaw, 2016).

Therefore, future studies could build their foundations from this summative framework of knowledge of PTB among students in the Vhembe District. However, this is not the framework that guided this study, but the researcher used the Public Health Framework to be the guiding framework of this study because there is a need for more public health education programmes at tertiary institutions in order to reduce and control the transmission of TB (Astuti *et al*., 2019). Looking at the findings of this study the researcher indicates that the health education interventions and programmes will play a significant role in the fight against the disease.

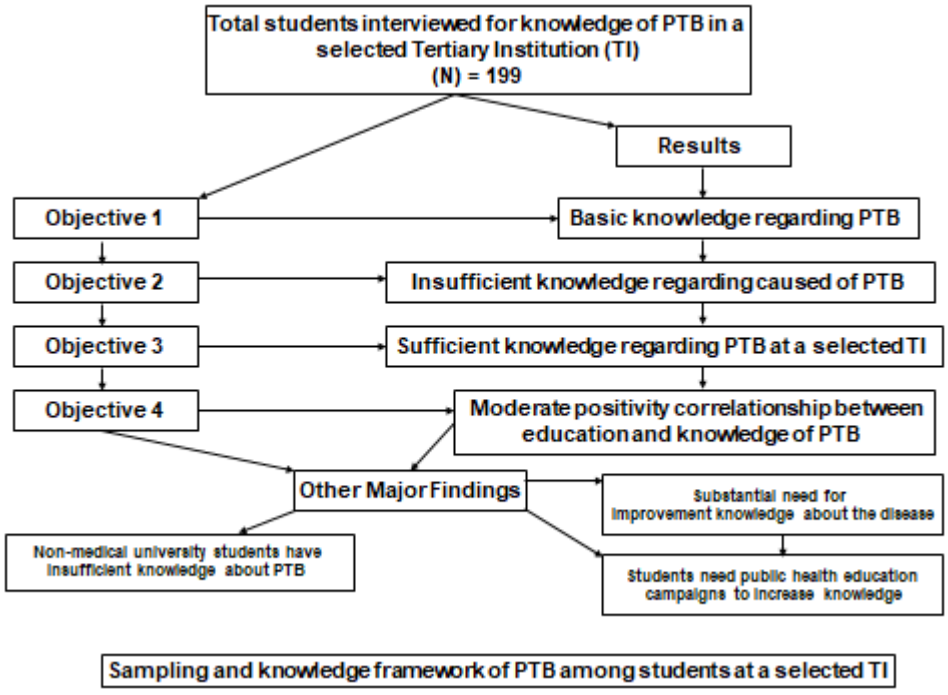


Figure 5: Sampling and knowledge framework of PTB among students at a selected TI Source: Author (The researcher).

2.13 Students' knowledge about PTB from other countries

In Italy, a cross-sectional study was conducted between October 2012 and June 2013 by Montagna *et al*., (2014), data was collected from the participants through a questionnaire.

Fifteen (15) universities enrolled in the voluntary study and were asked to complete an anonymous questionnaire. The questionnaire was investigating both general knowledge (causes, clinical manifestations, treatment of tuberculosis and screening methods), personal experience and practices related to tuberculosis prevention. The findings indicated that medical students had higher knowledge of tuberculosis than nursing students. Factors that contributed to insufficient knowledge of nursing students included misconceptions among health professionals concerning TB transmission and therapy (Montagna *et al*., 2014).

A similar cross-sectional study was conducted in Hunan, China from March to June 2016. A structured questionnaire was used to collect data from the final year undergraduate medical university students were 1088 respondents were interviewed. The study focused on the attitudes, experiences, knowledge, epidemiology, prevention, diagnosis and treatments of tuberculosis. The findings indicated poor knowledge regarding TB among medical students. The contributory factor was their practice and delay to seek medical advice about TB.

In a cross-sectional study conducted in Bangladesh by Rana *et al*., (2015) where a semi-structured questionnaire was used to assess knowledge regarding tuberculosis among non-medical university students; they were asked about what TB is, mode of spread, causes, vaccination, signs and symptoms, as well as curable and DOTS. The study found that non-medical students had insufficient knowledge regarding TB. Factors that resulted in knowledge deficit were students from rural areas had more knowledge than students from urban areas, students from single families had more knowledge that some students had the wrong perception of TB, those whose parents were highly educated were more knowledgeable, smokers had more knowledge and religion also contributed to high knowledge, whereby Hindu's had more knowledge regarding TB.

Samal (2017) focused on perceptions and knowledge of TB and its services among Slim Dwellers in Chhattarai, India. A structured questionnaire was used to collect data from the participants. The findings showed that Slum-dwellers had poor knowledge about the mode of spread and its prevention. Due to poor knowledge, more than in India, TB continues to be a devastating health crisis with more than 300,000 deaths, 2.2 million new cases each year were reported. Because of a lack of knowledge regarding TB, people were contracting TB.

Behnaz *et al*., (2015), conducted a cross-sectional study in 2012, concerning the assessment of knowledge, attitudes and practices regarding tuberculosis among final year students in Yazd, Central Iran. The final medical students participated in the study and showed high knowledge on the cause of TB, the contagious nature of the disease, symptoms, treatment regimens, and attitudes. However, they need to improve on the knowledge of TB transmission, the role of sputum smear in diagnosis and BCG vaccination, where they showed the gaps of

TB knowledge. The above examples showed the relevance of this study was based in a rural setting in the Limpopo Province.

Another study conducted by Teixeira *et al*., (2018) indicated that medical students in Rio de Janeiro State had poor knowledge about TB transmission, hence engaged in risky behaviour when dealing with exposure to *Mycobacterium Tuberculosis* infection during their studies. Two-thirds of medical students did not use masks when examining pulmonary Tuberculosis patients. However, even in their late clinical years, almost half of the students did not use masks (Teixeira *et al*., 2018).

2.14 Students' knowledge about TB at higher secondary school

Sah, Sah, Shah and Amite (2016) conducted a descriptive study to assess the knowledge of TB among students at higher secondary school in Nepal. Data was collected through a self-administered questionnaire. The findings indicated that schooling students of developing countries do not have adequate knowledge of TB. A structured teaching programme is an effective tool to improve the knowledge of students on the prevention and control of tuberculosis (Sah *et al*., 2016).

There is a need for health teaching which focuses on teaching and learning about TB to school students. Knowledge should be raised through media, various awareness programmes and inclusion of the topics in the syllabus of college students through involvement of parents, teachers and health personnel. Proper knowledge about TB helps to prevent the spread of TB and management of TB through proper treatment (Sah *et al*., 2016).

2.15 Healthcare workers' knowledge, attitudes and practices on TB

Shrestha *et al*., (2017) showed that a descriptive cross-sectional survey was carried out where healthcare workers were assessed through a structured questionnaire. Participants were asked about specific components of TB. The findings indicated that non-medical staff and lower-level staff had poor knowledge about TB. Factors that contributed to poor knowledge were educational level, job category and TB training or orientation received by the health care workers. Regular skills training and orientation on TB information for all healthcare workers can improve practices in health facilities and reduce the spread of TB.

In Ethiopia, Alene *et al*., (2019) also conducted a cross-sectional study in 2018 whereby the aim was to assess the knowledge and practice of health workers about Multidrug-resistant Tuberculosis prevention and control. About 377 respondents participated in the study. They were nurses and medical doctors. The structured questionnaire was used to collect data. The

findings revealed poor knowledge and practice of health workers about MDR-TB prevention and control in Amhara region referral hospitals. The leading factor to poor knowledge was insufficient knowledge about MDR-TB.

2.16 Knowledge and attitudes about TB in U.S.A and Nigeria

A study conducted by Howley *et al*., (2016) in 2015 in the U.S.A investigated knowledge and attitudes of TB among USA-born whites and blacks. A structured questionnaire was used to collect data. The study aimed to assess determinants of early diagnosis, prevention and treatment of TB between black and white citizens. The study results indicate that U.S.A blacks had less knowledge and misconception about TB than whites did. Factors that contributed to poor knowledge was that whites were more educated as compared to blacks. Another factor was less formal education associated with a poor understanding of TB.

Another similar descriptive cross-sectional study was undertaken to obtain quantitative and qualitative data by Anochie *et al*., (2013). The purpose of the study was to determine the level of knowledge, attitude and behavioural practice of people towards TB in rural Nigerian communities. About 1086 male and female respondents were assessed. Structured questionnaires and focus group discussions were employed. The findings showed that the Nigerian community was not conversant with etiology, proper preventive measures against TB, symptoms and mode of transmission. Factors that contributed to this knowledge deficit was ignorance and poor knowledge regarding TB.

2.17 Knowledge and practices of TB among medical students in China

Although TB health education in schools in China was emphasised, the researchers found that TB knowledge and practices among medical students were inadequate. World Health Organisation Global TB Report (2017) indicated that HIV and AIDS co-infections remained the contributory factor of TB infections worldwide. Similar evidence showed in South Africa, wherein TB co-infections increased (Zhao *et al.,* 2013).

2.18 TB in South Africa

The global TB burden is comprised of the following countries: India, Indonesia, China, Philippines, Pakistan, Nigeria, Bangladesh and South Africa. The statistics revealed that about 0.72 million new TB cases worldwide were attributed to alcohol use disorder and 0.70 million were attributed to smoking in 2019 (WHO, 2020).

In its National Strategic Plan on HIV, TB and STIs (NSP) 2017-2022 (NSP, 2017), the plan outlines the strategic framework for a multi-sectoral partnership to further accelerate progress

in reducing the morbidity (illness) and mortality (death) associated with HIV, TB and STIs in South Africa. Provinces will develop context-specific Provincial Implement Plans (PIP) to operationalise in greater detail the broad strategic directions and approaches planned (NSP, 2017). In South Africa, it is evident that TB programmes follow the approach recommended in the international DOTS policy. As most TB patients take treatment for 6 months, this is placing strain on an already overburdened public health system. (Keene *et al*., 2020; Kgosana, 2018; NSP, 2017).

However, being one of the world's worst TB epidemics driven by HIV, with the highest incidence and prevalence of TB; including the largest number of HIV-associated TB cases and the second-largest number of diagnosed multi-drug resistant (MDR)-TB cases after India (Churchyard, *et al*., 2014). South Africa needs to strengthen its TB programmes as they follow the recommended approach in the international DOTS policy. As most TB patients take treatment for 6 months, this is placing strain on an already overburdened public health system.

However, Churchyard, *et al*., (2014) asserts that the central pillars of TB control include finding, treating and preventing TB in order to avoid TB deaths and reduce transmissions. SA has made notable progress in improving TB control, but the burden of TB remains enormous. Ensuring high, sustained coverage of effective interventions for TB and HIV, including in children and special populations, will substantially reduce the burden of TB and result in the NSP targets being met. New drugs, diagnostics and vaccines are required to accelerate progress towards TB elimination.

To reduce the TB and MDR-TB epidemics in South Africa, rapid diagnosis and effective treatment are necessary to reduce the spread of these infectious diseases. Thus, the management of TB in populations at risk, such as correctional service inmates and miners, must be optimised and aligned with the NTP (Loveday *et al*., 2014). Although less detailed epidemiological information is available on STIs, the evidence underscores the seriousness as a public health problem and as a risk factor for continuous HIV/TB infection (NSP, 2017). This means at rural tertiary institutions, students are still at risk of being infected with TB especially while residing on campus because according to the researcher these diseases are interconnected (TB, HIV and STIs) and one can easily led to the other.

Lewin *et al*., (2010) posit that treatment is observed at primary health care clinics by lay health workers in the community, or by a work supervisor at the patient's workplace. However, the clinics at which treatment is provided are often overcrowded and have scarce resources Lewin *et al*., (2010). In addition, the health care professionals responsible for running the clinics and providing TB treatment have been described as overworked and stressed Lewin *et al*., (2010).

Despite implementing DOTS, national TB treatment success rates were 76% in 2008 (WHO, 2010). While this represents an increase in treatment outcomes over time, it does not reach the internationally recommended target of 85% (WHO, 2010).

2.19 The practices of TB management in Vhembe District

Managing TB is all about controlling the disease (Tshitangano *et al*., 2013). Unfortunately, is not effectively controlled in the Vhembe District as observed by the researcher, who is a professional nurse. This always puts many people at risk of being contaminated by the disease. The above observation has been confirmed by Tshitangano (2013) who finds that non-TB patients, staff, or visitors were exposed to the infection especially at TB wards. This is the true evidence of the lack of prevention of the disease. This is in accordance with Churchyard *et al*., (2014) who ratified that the prevention of TB has been a neglected aspect of TB control because TB prevention strategies include: treatment of latent TB infection among high-risk persons; case finding to detect and treat infectious TB earlier, reducing the duration of infectiousness and transmission. Tshitangano (2013) conducted a descriptive cross-sectional qualitative design in seven hospitals. Of the seven hospitals, only one tried to follow precautions for managing infectious diseases. The findings indicated that TB cubicles were not reserved for patients with TB, TB patients were not isolated, and patients, staff, or visitors did not use masks consistently. TB patient movements were not restricted. Moreover, this may contribute to the risk of contracting TB in Vhembe District hospitals. And it is in opposition to the central pillars of TB control (Churchyard *et al*., 2014) and global measures for TB control (ICN, 2015).

Global measures for tuberculosis control must follow the TB strategy (ICN, 2015). The Global Plan to Stop TB 2006 - 2015 adopted the WHO-recommended Stop TB Strategy which consists of the following elements:

- Involve all care providers, public, non-governmental and private, by scaling up approaches based on a public-private mix, to ensure adherence to the International Standards for TB Care (TB CARE I, 2014).
- Enable and promote research for the development of new drugs, diagnosis and vaccines. The research will also be needed to improve the successful treatment of patients.

The research confirms that in the Vhembe District Municipality (VDM), the practices of TB management does not align with the global Stop TB strategy of the WHO (2019) that aims at dramatically reducing the global burden of TB, as well as the NSP (2017) of South Africa to

end HIV, TB and STIs by 2030. Looking at the aim of this study, there is a clear indication that this study is also about the improvement of public health practices improvement at tertiary institutions.

2.20 Summary

The studied literature discovered that various studies were conducted on knowledge of students regarding tuberculosis at tertiary institutions. Most of the studies revealed that respondents had either low or inadequate knowledge of TB. This was so among healthcare workers and nursing students. However, some students showed good knowledge in some aspects of TB, especially on transmission, etiology, management and signs and symptoms. Besides, literature was reviewed to get more insight and understanding on knowledge of students on TB at tertiary institutions and to identify the gap in the literature to support the selection of the research topic. Different sources were accessed to get the literature, and these are the internet and UNIVEN library. Most of the studies were conducted from a wide range of places on students. Although some of the studies conducted were on healthcare workers and the general population, they were relevant to TB knowledge. Most of the studies focused on TB and not PTB. There were no studies conducted in Limpopo Province and Vhembe district about knowledge of students regarding PTB at a selected tertiary institution.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This section comprises of the study design, study setting, population, sampling frame, approach and technique, sampling method, sampling size, data collection method, data processing, and analysis. Grove *et al*., (2019) refers to research methodology as the process or plan for conducting specific steps of a study.

3.2 Research Design

The study was guided by a quantitative approach. According to Polit and Beck (2017), the quantitative approach is the investigation of phenomena that lend themselves to precise measurement and quantification, often involving a rigorous and controlled design. A descriptive cross-sectional design will be adopted to give a detailed description of the respondents' knowledge regarding PTB. The descriptive cross-sectional design is a research strategy used by various respondent groups at different stages of a process to manage the time (Grove *et al*., 2019). Descriptive cross-sectional design is concerned only with the present moment, so it was adopted to understand the perceptions of students who reside on the campus of a tertiary institution during the 2019 academic year. Structured questionnaires and a checklist were used to collect data. However, screening tool was helpful to understand how TB diagnosis is done. In this study, the researcher assessed the students' knowledge of PTB at UNIVEN.

3.3 Study Setting

The research setting is referred to the physical location and conditions in which data collection takes place in a study by Polit and Beck (2017). The study was conducted at the University of Venda Campus to assess students' knowledge about PTB. UNIVEN is located in Thohoyandou town under the Thulamela Municipality which falls under the Vhembe District Municipality in the Limpopo Province. It lies on the northern side of Phunda Maria Road. UNIVEN has 17 096 students who registered in the 2019 academic year. There are 8197 rooms occupied by more than 8197 students of all eleven campus residences. The UNIVEN community access most of their health needs and services from the UNIVEN Campus Health Clinic. The study setting was considered because of TB statistics which shows 14 cases of TB recorded in the period of five years. There is a shortage of living space in the students' residences as many students are overcrowded in one room and that puts them at a higher risk of contracting the disease.

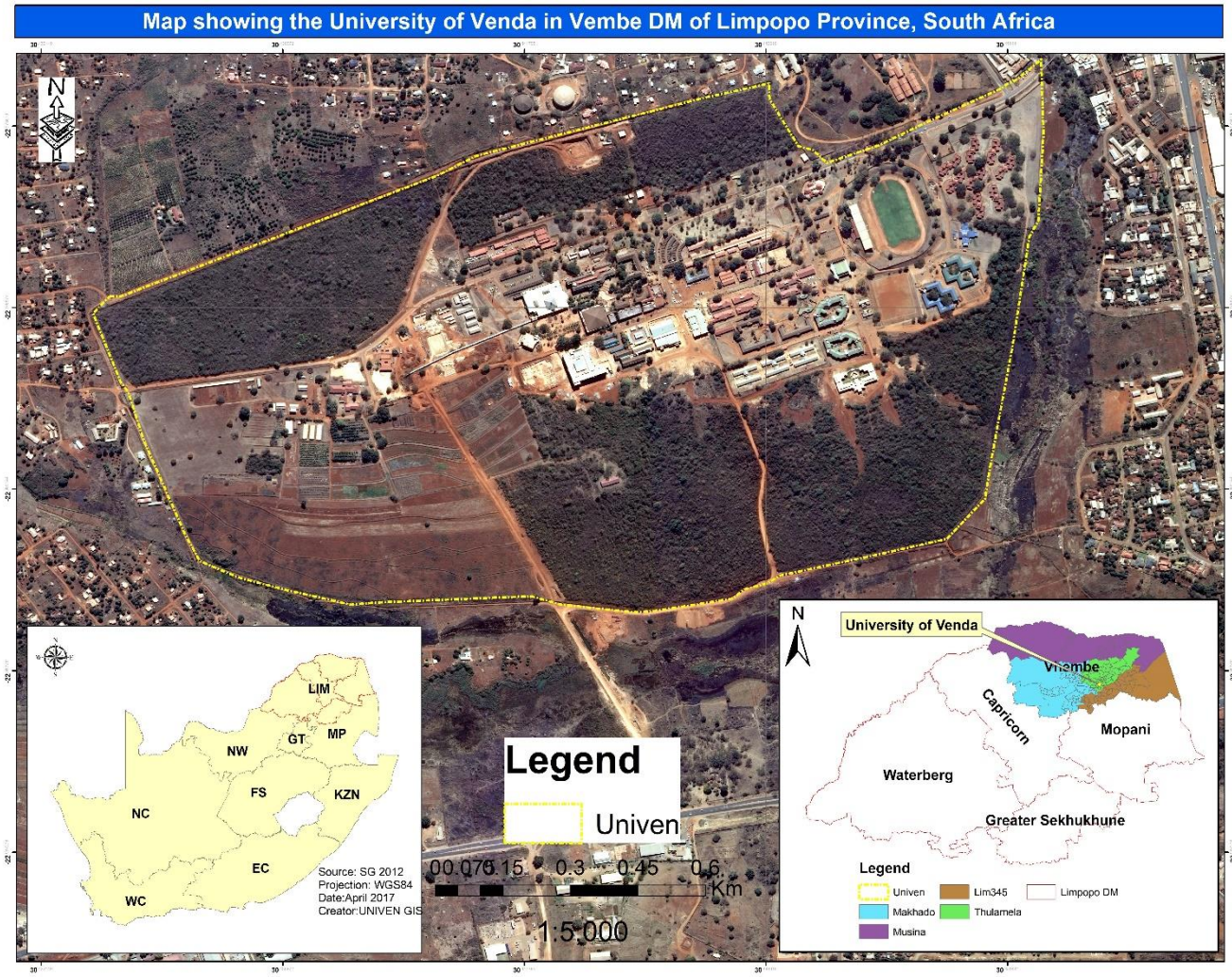


Figure 6: View of the University of Venda under Thulamela Municipality

3.4 Study population and Sampling

3.4.1 Population

Brink *et al*., (2018) defines a population as a complete set of persons or objects that possess the common characteristic that is of interest to the researcher. In this study, the population was registered male and female students who resided on campus in 2019.

3.4.2 Target Population

According to Polit and Beck (2017), a target population is a group of individuals who meet the sampling characteristics of the study. In this study, the researcher's target population was all 8197 students who reside on-campus.

3.4.3 Sampling

Burns *et al*., (2013) define a sample as a subset of the population selected for a study. In this study, the selected respondents were students from overcrowded residences. Polit and Beck (2017) define sampling as the process of selecting a portion of the population to represent the entire population. Hence, Brink *et al*., (2018) indicated that probability sampling is a sample wherein each respondent in the population has an equal chance of being selected to take part in the study. The researcher used a simple random sampling method to select the respondents. The simple random sampling method was the most suitable sampling method for selecting a sample among the population for a wide range of areas and every respondent was accessible. In this study, simple random sampling was appropriate because the sampling size was 200 and it is also best to work with a large sampling size to validate the results of the study. The selected tertiary institution had a total population of 17 096 students.

3.4.4 Sample size

The sample size of this study was calculated using the following Slovin's formula: n = N / (1+Ne^2), where n = number of samples, N = Total number of population and e = margin error of 0.05%. The confidence level will be 95%. The target population of this study is 8197 respondents.

$$n = \frac{\mathrm{N}}{(1+\mathrm{Ne}^2)}$$

= 8197/1+8197(0.05x0.05)

= 8197/1+8197x0.0025

= 8197/1+40

= 8197/41

=199

The sample size is 199.

3.4.5 Sampling frame

According to Brink, van der Walt and Van Rensburg (2018), a sampling frame is defined as a comprehensive list of the sampling elements in the target population.

Table 1.7: Names of On-Campus residences and the total number of occupants

NAME OF RESIDENCE	NO. OF STUDENTS (2019)
F1 residence	231
F3 residence	409
F4 residence	620
F5 residence	215
Lost City residences	360
Mango Groove residence	234
Bernard Ncube residence	118
New male residence	154
Riverside residence	360
GRAND TOTAL	8197

Source:

3.4.5.1 Inclusion criteria

Grove and Gray (2019) reported that inclusion criterion are the characteristics that the study respondents possess to be part of the target population. The study focused only on respondents who are residing on campus. Hence, the students were enrolled in the survey if they were registered students, had resided on campus before and during the survey, and also provided informed consent.

3.4.5.2 Exclusion criteria

Students that were excluded from the survey included those who were not registered at the time the study was conducted and those who were residing at residences located outside the campus.

3.5 Measurement instrument

A questionnaire according to Creswell (2014) is the most common instrument for data collection, while Polit and Beck (2017) posit that a questionnaire is a document used to gather self-reported data via self-administration of questions. In this study, the researcher collected data through a self-administered questionnaire. The researcher developed a questionnaire to provide answers to the research questions and to achieve the aim of the study. The questionnaire was administered in English. A questionnaire was used because it is more effective as it enables respondents to answer more questions compared to an interview (Polit *et al*., 2014). The research instrument consisted of two sections: Section (A), respondent's demographic information, and Section (B), Knowledge of respondents about PTB.

3.5.1 Variables measured by the instrument

The dependent variables measured are all about knowledge related to TB. The independent variables include demographic characteristics such as age, gender, level of study, place of origin (province) and name of the residence.

3.5.2 The Composite Evaluation and Measures of Knowledge of TB

In this study, data was collected through a self-administered questionnaire by the researcher who designed the questionnaire in order to provide empirical answers to the research questions and to achieve the aim of the study of evaluating the knowledge of tertiary institution students about pulmonary tuberculosis with the emphasis at the University of Venda where this study was conducted.

A total of 8 questions on knowledge were initially included in the questionnaire and had the following key answer options of "Strongly Disagree", "Disagree", "Neutral", Agree" and "Strongly Agree". While the answering options were on a scale of 1 to 5, the affirmative answers were scored 4 or 5 marks, the neutral answer was scored 3 marks; followed by the disagreement or negative answers scored 1 or 2 marks.

However, to facilitate analysis, data reduction was done, and knowledge was divided into eight dimensions namely, knowledge on the causal factor of TB, knowledge on the transmission process of TB, knowledge on the signs and symptoms of TB, knowledge on the curability of TB, knowledge on the risk factors for TB, knowledge on the best tests to diagnose TB, knowledge on the duration of the ordinary time for TB treatment, and knowledge on the preventive measures to preempt the spread of TB. Thus, as mentioned by Brink *et al*., (2018), this process as the grouping of data collected into meaningful form; enabled me as the

researcher to reduce, summarise, organise, manipulate, evaluate, interpret and communicate the result from the quantitative data obtained from the respondents.

In this study, the researcher collected data through a self-administered questionnaire. The researcher developed a questionnaire to provide answers to the research questions and to achieve the aim of the study. The questionnaire was administered in English. A questionnaire was used because it is more effective as it enables respondents to answer more questions compared to an interview (Polit & Beck, 2017). The research instrument consisted of two sections: Section (A), respondent's demographic information, and Section (B), Knowledge of respondents about PTB.

So, in the second section (B) that was focusing on the respondent's knowledge regarding Pulmonary Tuberculosis, it was the respondent's duty to answer the question by ticking the appropriate box on the questionnaire by using the following key from the scale of 1 to 5: Strongly Disagree (SD), Disagree (D), Neutral (N), Agree (A) and Strongly Agree (SA).

3.6 Pre-test

LoBiondo-Wood and Haber (2014) assert that a pre-test should be done before the study commences. Pre-testing ensures that the research instrument is understandable and clear to everyone and helps to identify mistakes that respondents may have when completing the questionnaire. The purpose of a pre-test is to determine the feasibility of the study. The researcher conducted the pre-test with a few respondents, at least 10% (39 respondents) who were not part of the main study. Pretesting helped in determining the time spent to complete the questionnaire. The researcher assessed students' knowledge regarding PTB by collecting data. Data was collected at UNIVEN Campus. Structured questionnaires were distributed to the respondents. All this was done before the main study was conducted.

3.7 Validity and Reliability

3.7.1 Validity

Validity is the degree to which the instrument measures what it is supposed to measure LoBiondo-Wood and Haber (2014) and De Vos *et al*., (2013) states that it is an instrument that measures truth and accuracy. To ensure the validity of the instrument, the researcher pre-tested the questionnaire to the respondents to validate the aim and objectives of the study. Besides, the researcher enhanced the validity of the instrument by developing a simple questionnaire written in simple English to ensure that all the respondents understand all the questions. Whenever the respondents did not understand, the researcher was able to explain in the local language.

3.7.2 Reliability

Polit and Beck (2017) defined reliability as the consistency with which an instrument measures the attribute. It is concerned with the correct measurement. The instrument is reliable only if it measures maximum true scores and minimises the error components and that if the instrument is offered to the same group of respondents in a similar setting, an instrument will yield the same results. In this study, the researcher ensured reliability by making sure that the questionnaire was short. The questionnaire was pre-tested before the study by using 10% of the respondents to ensure the reliability of data collection instrument. The researcher assisted all respondents who required assistance. In this study, reliability was assured by using a questionnaire that had been tested for reliability prior to the commencement of study.

3.8 Plan for data collection

Data collection is the process in which the researcher collects actual information from the respondents using the instrument that has been developed and tested in the pre-test (Brink *et al*., 2018). The researcher obtained permission from the UNIVEN management. Data collection was done on campus precisely at the campus health clinic and the cafeteria where respondents were in groups. The researcher collected signed consent forms from the respondents that indicated their willingness to participate in the study. The researcher asked the respondents to sign consent forms that indicated adherence to ethics required in a scientific study. The consent forms assured respondents of confidentiality and that they had the right to withdraw from the study at any time. The questionnaires were distributed to the target population. The researcher organised and met with the respondents on an agreed date, time, and place. Data was collected by the researcher. English was the main language used during the study (Grove and Gray, 2019). Self-administered and reporting data collection took 30 - 45 minutes per respondent, where participants provided information about themselves without any interference from the researcher.

3.9 Plan for data management and Analysis.

Polit and Beck (2017) indicated that data analysis is the systemic organisation and synthesis of research data. This is the grouping of data collected into a meaningful form. This process enables the researcher to reduce, summarise, organise, manipulate, evaluate, interpret and communicate quantitative data (Brink *et al*., 2018). There are different procedures of data analysis in quantitative research, however, the SPSS version 26.0 software package was used to analyse data. Data findings were presented on tables and graphs. Data analysis was done with the help of a statistician.

3.9.1 Data Analysis

Before data analysis, data editing was performed to identify errors and strange values and to compare them to the questionnaire for correction. Then the data was captured in Microsoft Excel and analysed using the Statistical Package for Social Sciences (IBM SPSS) software version 26.0. The eight questions in the self-administered questionnaire were grouped into indices evaluating and determining the composite score of knowledge for data analysis. Descriptive statistics, a Spearman's rank-order correlation was used, and results were presented using graphs and tables to determine knowledge of students regarding PTB at a selected tertiary institution in Vhembe district of Limpopo.

3.10 Ethical Considerations

Ethics is a system of moral values concerned with the degree to which research procedures adhere to professional, legal, and social obligations to the study respondents (Polit & Beck, 2017). The study adhered to the following ethical considerations: Permission to conduct the study, right to privacy, informed consent, principle of beneficence, principles of anonymity and confidentiality, and non-maleficence. The researcher received the Ethical Clearance Certificate with the Ethical clearance number: **SHS/20/PDC/33/0508**.

3.10.1 Permission to conduct the study

The researcher requested permission to conduct the study from the UNIVEN Management, Department of Student Affairs. Participation was voluntary and informed consent was obtained from the respondents before participating in the study. The proposal was presented to the Department of Advanced Nursing Science and School of Health Sciences Higher Degrees Committee to ensure quality of the study. Approval was in the form of an ethical clearance from the UNIVEN Ethics Committee**.**

3.10.2 Right to privacy

Every respondent has the right to privacy, and it is his or her right to decide when, where, to whom and to what extent his or her attitudes, beliefs and behaviour could be revealed. Respondents should be informed of all possible limits (De Vos *et al*., 2013). In this study, the respondents were informed about any potential risks and benefits of the study. A respondent had the right to expect that any data he or she provides is kept strictly in confidence. The study was conducted in a safe environment to ensure respondents' safety.

3.10.3 Informed consent

According to Polit and Beck (2017), informed consent is an ethical principle that requires researchers to obtain voluntary participation from respondents after informing them of possible risks and benefits of participating in the study. Before conducting a study, the researcher must get permission from the respondents. The researcher has explained all the procedures to enable the respondent to decide whether to participate in the study or withdraw. The information explained to the respondents included the purpose of the research, methods used, the outcome of the research, as well as risks and benefits respondents may face. The researcher used the respondents' language to facilitate the understanding of questions. The researcher was not in hurry because respondents were signing consent forms to show understanding and agreement. So, the researcher also did not force respondents to sign the consent forms (Creswell, 2014).

3.10.4 Principle of Beneficence

Polit and Beck (2017) state that beneficence is a fundamental principle that seeks to maximise benefits for study respondents and prevent harm. The researcher needs to secure the well-being of the respondent who has the right to protection from discomfort and harm, be it physical, psychological, emotional, spiritual, economic or social. In this study, the researcher maintained all forms of beneficence by helping to prevent harm and promoting good to respondents all the time. The researcher was honest at all times to the respondents (Brink *et al*., 2018).

3.10.5 Principles of anonymity and confidentiality

3.10.5.1 Anonymity

Bless, Higson-Smith and Sithole (2013) aver that the principle of anonymity is linked with confidentiality. A respondent's data must never be associated with his or her name or any other identifier. The researcher ensured that the information from the respondents is not associated or linked with a respondent. The researcher will assign numbers to respondents' data to ensure that the data remain anonymous.

3.10.5.2 Confidentiality

Respondents' information, particularly sensitive and personal information was protected and held in confidence. Data from respondents was under secure condition always, even during its analysis, or during the publication process. Respondents will only be willing to volunteer information; especially private or sensitive information if the researcher agrees to hold such

information in confidence. However, permission was sought before such confidential information is disclosed (Bless *et al*., 2013).

3.10.6 NSon-maleficence

Non-maleficence refers to the principle of doing no harm to research respondents Bless *et al*., (2013). The researcher explained fully and honestly what is going to occur. Privacy was maintained.

3.11 Plan for dissemination and implementation of results

The results of this study were disseminated in the form of a research report. One copy of the study will be submitted to the University of Venda Library. The respondents were informed about the findings of a study in the form of feedback. The findings from this study will be published in peer-review journals and presented during conference proceedings.

3.12 Summary

This chapter discussed the methodology applied in this study. The researcher highlighted information on the study design, study setting, population, sampling frame, approach and technique, sampling method, sampling size, data collection method, data processing, and analysis as well as the plan for the dissemination of the results. A quantitative approach was used to investigate the PTB phenomena among selected tertiary institution students. In addition, a descriptive cross-sectional design was adopted to give a detailed description of the respondents' knowledge regarding PTB and to understand the perceptions of students who reside on the campus of a tertiary institution during the 2019 academic year. Ethical considerations were adhered to throughout this study. Structured questionnaires and a checklist were used to collect data. Data was captured in Microsoft Excel and analysed using the Statistical Package for Social Sciences (SPSS) software version 26.0. Data findings were presented on tables and graphs. The eight questions in the self-administered questionnaire were grouped into indices evaluating and determining the composite score of knowledge for data analysis. Descriptive statistics, a Spearman's rank-order correlation was used, and results were presented using graphs and tables to determine knowledge of students regarding PTB at a selected tertiary institution in Vhembe district of Limpopo. Plan for dissemination and implementation of results were discussed as well.

CHAPTER 4

DATA ANALYSIS AND PRESENTATION OF RESULTS

4.1 Introduction

This chapter presents data analysis and presentation of results. The collected data was captured in Microsoft Excel before it was subjected to analysis using IBM SPSS v 26.0. Primary data was obtained from the self-administered questionnaire. A total of 199 questionnaires were distributed and the response rate was 100%. It consists of data analysis, interpretation, and discussion of the results to research questions of the respondents' knowledge regarding pulmonary tuberculosis at a tertiary institution with emphasis at the University of Venda. The findings are reported based on the objectives of this research. The purpose of this study was to determine knowledge of students regarding PTB at a selected tertiary institution in Vhembe district of Limpopo.

The objectives of the study were to:

- To assess and analyse the knowledge of students regarding PTB and its causes.
- To analyse knowledge of students regarding the causes of PTB.
- To describe the knowledge of students regarding PTB at a selected tertiary institution.
- To determine the relationship between education and knowledge of PTB.

4.2 Demographic information

To gather demographic information, respondents were expected to respond to questions such as the causes of TB, the knowledge on signs and symptoms of TB, the risk factors of TB, if TB is curable, knowledge on the best test to diagnose TB, knowledge on the treatment of an ordinary TB and their knowledge on measures to prevent TB. Below is tabular presentation of results with all variables. Discussion of results will follow on each sub-section with detailed explanation.

Table 4.1: Descriptive Statistics for demographic characteristics

Age	Mean (SD)	21.66 (2.7)
	Minimum - Maximum	17 – 35

Variables		**Frequency (percent)**
Gender	Male	51 (25.6%)
	Female	148 (74.4%)
Level of Study	First-year	27 (13.6%)
	Second-year	40 (20.1%)
	Third year	79 (39.7%)
	Fourth	51 (25.6%)
	Masters	1 (0.5%)
	PhD	1 (0.5%)
Name of residence	Lost City	34 (17.1%)
	F4	45 (22.6%)
	New Resident	58 (29.1%)
	F3	18 (9%)
	Mango groove	17 (8.5%)
	F5	12 (6%)
	Carousel	7 (3.5%)
	Riverside	3 (1.5%)
	Bernard	4 (2%)
	River Estate	1 (0.5%)
Place of origin	Limpopo	139 (69.8%)
	Mpumalanga	47 (23.6%)
	Zimbabwe	6 (3%)
	Eastern Cape	1 (0.5%)
	KZN	1 (0.5%)
	Gauteng	4 (2%)
	Northwest	1 (0.5%)

N=199

4.2.1 Age of respondents

Table 4.2: Age group of respondents

Age group of respondents	Frequency	Percentage
17 - 20	99	49.7
21 - 25	65	32.7
26 - 30	30	15.0
31 - 35	5	2.6

N=199

From a total of 199 respondents, 99 (49.7%) were falling between the age of 1- 20 years, 65 (32.7%) of them were between the age of 21-25 years, 30 (15.0%) of them were between the age of 26-30 years, 5 (2.6%) of them were between the age of 31-35 years and mostly postgraduates. Table 4.2 shows that respondents' minimum age was 17 and the maximum was 35 years, with an average age of 22 and standard deviation of 2.7. This indicates that the opinions of students with university experience and those with less experience were considered, hence, reducing biasedness. The age also contributes to the trustworthiness of the data collected.

The 2019 report on Education at a Glance, the Organisation for Economic Co-operation and Development (OECD) (2019) reported that tertiary attainment in South Africa is the lowest across all OECD and partner countries, with most of the population having an upper secondary or post-secondary non-tertiary qualification as their highest level of education. Further, while tertiary education is not widespread in South Africa, the country spends a larger share of its wealth on the public funding of primary, secondary and post-secondary non-tertiary education than most OECD and partner countries (OECD, 2019). More adults are attaining and upper secondary education, but tertiary attainment is the lowest among G20 countries. Educational attainment is still low in South Africa. In 2018, over half (59%) of 25 - 64-year-old in South Africa had attained an upper secondary education as the highest level achieved, well above the G20 average of 32% and the OECD average of 38%, while 26% had not attained upper secondary education. However, attainment has been increasing, particularly since the implementation of the free education. In a recent study conducted by Essop (2020) on the Changing Size and Shape of the Higher Education System in South Africa, 2005-2017; it has been indicated that there is an increased between 2005 and 2017 of students in the 18-25 age group. The researcher is of the view that the majority of students at the tertiary institution of higher learning are those of the age group 18-25 years.

4.2.2 Gender of the respondents

Table 4.1 above revealed that from these 199 respondents, 68 (25.6%) were male and 148 (74.4%) were female. One could speculate that females are more open to participation in research and surveys than males, additionally, more females are enrolling in higher institutions compared to males. Hence, Sevil, García-González, Abós, Generelo and Aibar, (2019) articulate those women represent 53% of bachelor's and master's graduates globally. This shows that the issue of gender differences in research participation have been documented in both quantitative and qualitative studies. The researcher believes that females were significantly more likely to participate comparing to their male counterparts because females are significantly more likely to report a decision influenced by general altruistic considerations. However, the results of a similar study undertaken on Tuberculosis knowledge and attitude among non-health science university students needs attention: a cross-sectional study in three Ethiopian universities by Mekonnen et al., (2018) reported that the majority of the participants were male and rural residents. This study of Mekonnen et al., (2018) contradict our findings which is a normal issue in research.

4.2.3 Level of study

Concerning the level of study of respondents, approximately 14% of the respondents were in the first years, about 20% were in the second year, around 40% were in the third year, nearly 26% were in the fourth year, and almost 1% was at the masters' level and close to 1% of the respondents was at PhD level. The findings show that it is much easier to access undergraduates than postgraduates when conducting such a study. Also, the education, training and innovation are central to South Africa's long-term development (NDP, 2012). So, the researcher observed that the majority of students on campus are undergraduates as supported also by previous studies (Matsolo *et al*., 2016; Mphekgwana *et al*., 2020).

4.2.4 Name of residency

Residences inhabited were on-campus accommodation. Close to 17% reported staying at Lost City, 23% at F4, 29% at the New resident, 9% living at F3, 9% stay at Mango groove, 6% at F5, 4% at Carousel, 2% at Riverside and 1% at River estate. Since there were more females than males, it was expected to realise that majority of respondents were coming from residences such as F4, a female residence. Xulu-Gama (2019) opined that while student housing used to be understood only as a space to accommodate students who primarily come from out of town, now universities have started using student housing strategically to advance

the success of the students. Student housing is now used to build sustainable living and learning student environments in the interests of promotion of student access and success.

4.2.5 Origin of respondents

Regarding the place of origin of respondents, about 70% were from Limpopo, almost 24% were Mpumalanga, approximately 3% were from Zimbabwe, approximately 1% from Eastern Cape, 1% from KZN, almost 2% from Gauteng and nearly 1% from North-West. The results show that majority of the participants were from Limpopo and this outcome was expected since the study was conducted in Limpopo. According to the Council on Higher Education (CHE), the number of previously disadvantaged students registering at universities has increased drastically in post-apartheid South Africa (CHE, 2016). Yet, the role of university student housing in the lives of undergraduate students has changed because it was understood previously only as a space to accommodate students who primarily come from out of town (Xulu-Gama, 2019). So, far the University of Venda welcomes often students from Limpopo, Mpumalanga, Zimbabwe, Eastern Cape, Kwa-Zulu Natal, Gauteng and Northwest.

4.3 Respondent's knowledge regarding pulmonary Tuberculosis

This section provides findings on the respondents' knowledge concerning pulmonary tuberculosis, four issues were examined, and results are displayed in Table 4.2.

Table 4.2 indicates that 41% agree and 38% strongly agree that TB is caused by Mycobacteria, 14% were neutral, 2% disagreed while 6% strongly disagreed. The respondents had a decent knowledge of the agent that causes TB.

In terms of transmission, the majority (87.4%) agreed that it is transmitted from one person to another, while 5% were neutral and 8% disagreed. This means that respondents had appropriate knowledge and understanding of TB transmission dynamics.

Furthermore, 87% of the respondents affirmed that "Coughing for more than three weeks, night sweating, losing weight and chest pains are the signs and symptoms of TB", however, 13% disagreed. The majority understand the signs and symptoms of TB, which implies that respondents have adequate knowledge of the subject. This could be due to educational programmes from public healthcare.

The result also indicated that TB is curable according to 27% who agreed, 54% strongly agreed, 14% were neutral whereas 4% strongly disagreed and 1% disagreed. The results show that respondents had a sound knowledge about the cure of TB. One can speculate that the subject is now common to almost everyone.

***Table 4.3*: Knowledge about Tuberculosis, its signs, and symptoms (N=199)**

Variable	S D	D	N	A	S A
TB is caused by Mycobacterium Tuberculosis	11(5.5%)	4(2.0%)	28(14.1%)	81(40.7)	75(37.7%)
TB is transmitted from one person to another through coughing and sneezing.	12(6%)	3(1.5%)	10(5%)	56(28.1%)	118(59.3%)
Coughing for more than three weeks, night sweating, losing weight, and chest pains are the signs and symptoms of TB	4(2%)	1(0.5%)	20(10.1%)	60(30.2%)	114(57.3%)
TB is curable	7(3.5%)	2(1%)	28(14.1%)	54(27.1%)	108(54.3%)

Keywords: SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, and SA=Strongly Agree.

4.4 The risk factors of Tuberculosis

The knowledge of the risk factors of tuberculosis was studied among the respondents and the findings are displayed in Table 4.3

Table 4.3 shows that majority (36.7%) of the respondents strongly agreed that “squatting and overcrowding” is a risk factor for TB, followed by 28% of the respondents who agreed, followed by 20% who were neutral, 9% disagreed and 7% strongly disagreed. The study indicates that

respondents have sound knowledge that poor living conditions such as squatting and overcrowding increase TB risk.

Concerning “Smoking” approximately half of the respondents (47%) strongly agreed, followed by 32% who just agreed, followed by 11% who were neutral, followed by 6% who strongly disagreed, and 4% who disagreed. Most of the respondents understand that smoking increases the risk of contracting TB, this could be due to educational programmes delivered by public healthcare players.

Among the respondents, 34% strongly agreed, 22% agreed, 15% were neutral, 12% disagreed and 16% strongly disagree that HIV positive is a risk factor. Surprisingly, approximately half of the respondents were not aware that HIV positive individuals are at a higher risk of conducting TB. Hence, respondents have no decent knowledge of HIV as a risk factor for TB.

The majority of the respondents, 29%, agreed, followed by 24% who were neutral, followed by 17% who strongly agreed, followed by 16% who strongly disagreed, and 12% who disagreed that diabetes mellitus increases the risk of TB. This implies that respondents do not have sufficient awareness regarding diabetes mellitus.

Considering kissing as a risk factor, 16% strongly disagreed, likewise, 18% disagreed, 26% were neutral about the subject, 21% agreed and 19% strongly agreed. More than of the respondents have no sound acquaintance that TB is not spread through kissing, which implies that they are not aware that the TB bacteria are spread through the air from one person to another.

***Table 4.4*: Knowledge about risk factors of TB (N=199)**

Variable	SD	D	N	A	SA
Squatting and overcrowding	14(7%)	17(8.5%)	39(19.6%)	55(27.6%)	73(36.7%)
Smoking	12(6%)	7(3.5%)	21(10.6%)	63(31.7%)	94(47.2%)
HIV Positive people	31(15.6%)	24(12.1%)	30(15.1%)	44(22.1%)	67(33.7%)
Diabetes Mellitus	33(16.6%)	24(12.1%)	48(24.1%)	58(29.1%)	34(17.1%)
Kissing	31(15.6%)	35(17.6%)	51(25.6%)	41(20.6%)	38(19.1%)

4.5 Knowledge about Tuberculosis treatment

The knowledge of TB treatment was tested among the respondents and the results are displayed in Table 4.4. Three options were presented, that is, six to seven months, five months, and ten months.

As illustrated in Table 4.4, the majority (56.8%) indicated that tuberculosis treatment duration lasts for six to seven months, while 35% were neutral and 8.5% disagree. This indicates that nearly half of the respondents were aware of the TB treatment duration, hence, there is a need to increase the level of knowledge of TB treatment through educational programmes.

It was observed that 5.5% strongly disagreed and 7% disagreed while more than half (70%) of the respondents were neutral, however, 12% agreed and 6% strongly agreed that TB treatment takes five months. It is observed that the majority of the participants do not have solid knowledge regarding TB treatment regimens.

Likewise, the majority, 85%, were neutral while 1.5% strongly agreed and 1 % agreed while 4% disagree and 8% strongly disagreed that the treatment takes ten months. This outcome implies that the knowledge of respondents concerning TB treatment is not solid.

***Table 4.5*: Knowledge about Tuberculosis treatment (N=199)**

Variable	SD	D	N	A	SA
Six to seven months	13(6.5%)	4(2%)	69(34.7%)	33(16.6%)	80(40.2%)
Five months	11(5.5%)	14(7%)	139(69.8%)	23(11.7%)	12(6%)
Ten months	16(8%)	8(4%)	170(85.4%)	2(1%)	3(1.6%)

4.6 Knowledge about Tuberculosis prevention

Table 4.5 shows techniques to prevent the spread of TB. The majority, 52% strongly agreed and 31% agreed that proper coughing techniques can prevent TB transmission, while 7% were neutral, 5% disagreed and 6% strongly disagreed on the matter. Most of the respondents have solid knowledge concerning proper coughing as a prevention technique.

Among the techniques, 46% strongly agreed, 32% agreed and 11% were neutral, however, 5% disagreed and 7% strongly disagreed that avoiding overcrowding prevents the transmission of TB. Similarly, majority have a sound awareness of the technique of avoiding overcrowding.

In as far as spitting is concerned, 44% strongly agreed, 28% agreed and 17% were neutral. However, 4% disagreed and 7% strongly disagreed that proper spitting prevents the spread of TB. More than half (54%) of the respondents. Nearly 70% of the respondents understand that spitting can promote the spread of the disease, which implies that 3 out of 10 people are not aware of the effect of spitting.

The respondents were asked to indicate their views on “Early diagnosis and treatment”, majority, 54% strongly agreed, 31% agreed, 7% were neutral, 2% disagreed and 6% strongly disagreed. This implies that respondents have good knowledge of the subject.

In addition, the majority of the respondents, 42%, followed by 35% mentioned that eating a balanced diet, while 13% were neutral, 5% disagreed and 5% strongly disagreed. Ultimately, the study reveals that participants have good knowledge concerning a balanced diet and the prevention of TB.

***Table 4.6*: Knowledge about TB prevention (N=199)**

Variable	SD	D	N	A	SA
Proper coughing techniques	11(5.5%)	9(4.5%)	13(6.5%)	62(31.2%)	104(52.3%)
Avoiding overcrowding	14(7%)	9(4.5%)	21(10.6%)	63(31.7%)	92(46.2%)
Proper spitting technique	14(7%)	8(4%)	34(17.1%)	55(27.7%)	88(44.2%)
Early diagnosis and treatment	11(5.5%)	4(2%)	14(7%)	61(30.8%)	108(54.3%)
Eating a balanced diet	10(5%)	9(4.5%)	26(13.1%)	70(35.2%)	84(42.2%)

4.7 Knowledge on the best test to diagnose TB

The majority of the respondents, nearly, 42% strongly agreed, followed by 35% who were neutral, followed by 16% who agreed, followed by 4% who strongly disagreed and 3.5% who disagreed that Sputum and Saliva are sufficient for tuberculosis testing. Furthermore, the majority were close to 61% were neutral, followed by 18% who strongly agreed, followed by 15% who agreed, followed by 3.5% who strongly disagreed, and 2.5% who disagreed on the

subject “Blood test is the best test to diagnose TB”. X-Ray checkup was also considered; however, majority of the respondents were neutral about the matter, followed by 13% who strongly agreed, 3.5% strongly disagreed and 1.5% disagreed. The majority of the respondents approximately 74% were neutral, 13% strongly agreed, 4% agreed, 7% disagreed and 5% strongly disagreed that a urine test is the best test to diagnose TB.

Table 4.7: Knowledge on the best test to diagnose TB (N=199)

Variable	SD	D	N	A	SA
Sputum and Saliva	8(4%)	7(3.5%)	69(34.7%)	32(16.1%)	83(41.7%)
Blood test	7(3.5%)	5(2.5%)	122(61.3%)	29(14.6%)	36(18.1%)
X-Ray check-up?	7(3.5%)	3(1.5%)	147(73.9%)	17(8.5%)	25(12.6%)
Urine Test	10(5%)	14(7%)	159(79.9%)	7(3.5%)	9(4.5%)

4.8 Impact of education on the knowledge of TB

To understand the relationship between education and knowledge of TB, the Spearman’s correlation, its significance value, and the sample size were computed.

***Table 4.8*: Correlation table for education and knowledge of TB (N=199)**

			Level of study	Knowledge of TB
Spearman's rho	Level of Study	Correlation Coefficient	1.000	.669
		Sig. (2-tailed)	.	.035
		N	199	199
	Knowledge of TB	Correlation Coefficient	.669	1.000
		Sig. (2-tailed)	.035	.
		N	199	199

A Spearman’s rank-order correlation was run to determine the relationship between the education and the knowledge of TB among the respondents. There was a positive correlation

between education and the knowledge of TB, which was statistically significant (Spearman's rho = 0.669, p=0.035).

Keywords: SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree and SA=Strongly Agree.

4.9 Summary

This chapter delivered the findings of the study obtained through statistical analysis of data collected using questionnaires. The results indicated a high number of female respondents and the average age of the respondents was 21. Majority of the respondents were residing in the new resident and were from Limpopo, and this was not a surprise since the study was conducted in the same province. It was clear that majority of the respondents were on the third level of their studies.

It was noted from the findings that majority of the respondents appreciate what TB is and its transmission routes and symptoms, which means participants had a fair knowledge of the disease. Furthermore, the risk factors identified by the study were familiar to the respondents. However, majority were not sure about whether diabetes mellitus is a risk factor.

Although majority correctly selected the treatment for TB, they were not sure if it could be five or ten months. Majority indicated that they were not sure about the five months duration and the ten-month one.

The succeeding chapter presents a discussion of the findings as means to provide an insight that can be trusted for recommendations and policies in the institutions of higher learning, to raise the level of understanding among students.

CHAPTER 5

Discussions of Results

5.1 Introduction

This chapter presents an account of the previous chapters. The present study was conducted to determine the knowledge of students regarding PTB at a selected tertiary institution in Vhembe district of Limpopo. Conclusions and Recommendations and limitations of the study are presented in chapter 6. Data was collected from respondents through self-administered questionnaires, all of which were then checked for completeness and appropriate cleaning performed.

5.2 Knowledge of students regarding PTB and its causes

The discussion in this section was centered around students' knowledge regarding PTB, which was indicated in Table 4.2 and the results thereof fulfill objective 1, that was, to assess knowledge of students regarding PTB.

As illustrated in chapter 4, Table 4.2, the results of the study indicated that majority of the respondents were knowledgeable that TB is caused by *Mycobacteria Tuberculosis*. From the findings in the same table, we noted that similarly, majority of the respondents were aware that TB is transmitted from one person to another through coughing. Furthermore, more than half of the respondents indicated that coughing for more than three weeks, night sweating, losing weight, and chest pains are the signs and symptoms of PTB.

The study established that an average person in a tertiary environment has basic knowledge regarding PTB. Similarly, more than half of the respondents were aware that TB is curable. On the contrary, nearly 14% were not sure that *mycobacterium tuberculosis* causes TB, while 5% were not sure that TB is transmitted from one person to another through coughing and sneezing. Again, nearly 10% of the respondents indicated that coughing for more than three weeks, night sweating, losing weight and chest pains are the signs and symptoms of PTB.

Knowledge constitutes one key factor integral to changing a person's behaviours. So, increasing understanding about latent TB infection (LTBI) and TB disease has been associated with healthy behaviours and more favourable outcomes for patients, including greater adherence to and completion of treatment for LTBI or TB (Howley *et al*., 2015).

The findings imply that there are groups of students who have insufficient knowledge regarding PTB and the other group with sufficient knowledge, because of the student's field of study. Hence, a student in the healthcare-related field could be contributing to high levels of knowledge. Therefore, from the findings of this study, students will learn from observing the actions and resulting consequences of others as indicated from the SLT of Bandura (1986) in order to prevent PTB on campus. Students should learn from others through observation and imitation because TB remains a public health issue globally as well as in South Africa.

5.3 Knowledge of students regarding the causes of PTB

Table 4.3 in the previous chapter shows the analysis of respondents' knowledge regarding risk factors of TB. The discussion in this section is centered on the findings from Table 4.3; More than half of the respondents (64%) were aware that squatting and overcrowding are risk factors of PTB. More than 70% of the students believed that smoking is a risk factor for PTB. However, almost half of the students do not know that HIV positive is a risk factor for PTB. Only 46% of the students believed diabetes mellitus can be a risk factor for TB. Whereas, about 39.7% of the students had no sound knowledge that kissing has a role in transmitting.

The results of this study shown in Table 4.3 indicate that student's knowledge is limited to general common knowledge, which implies that students need public health education campaigns to increase their level of disease characteristics such as the causes, transmission modes, treatments, and signs. The study result shows that students had insufficient knowledge about TB causes this could be due to fewer or no public healthcare educational programmes. According to Anochie *et al*., (2013), insufficient knowledge is due to ignorance and poor knowledge regarding PTB.

5.4 Knowledge of students regarding PTB at a selected tertiary institution

A majority more than half of the students had sufficient knowledge about Tuberculosis, its sign, and symptoms. Furthermore, the findings of the study show that the majority of the students were aware and knowledgeable about risk factors of TB. Similarly, as far as knowledge about tuberculosis treatment is concerned, the finding indicated that majority of the students had sufficient knowledge. Furthermore, the results indicate that majority of the students have sufficient knowledge about tuberculosis prevention. The study further establishes that majority of the students had sufficient knowledge on the best testing diagnose of TB. The findings of the study was supported by a similar study conducted in Ethiopia where by the results indicated that the vast majority of the study participants knew that TB is a communicable disease and its mode of transmission is through the air when an infected person coughs or

sneezes (Mekonnen *et al*., 2018). Thus, the results demonstrate that a clear majority of the students had sound knowledge regarding PTB. Even though the findings indicated sufficient knowledge on tuberculosis, this study highlights the substantial need for improvement in knowledge about the disease.

5.5 Relationship between education and knowledge of PTB

A chi-square test was conducted to determine the relationship between education and knowledge of PTB. The result indicated that there is a moderate positivity correlation between education and knowledge of PTB. A correlation close to zero indicates no linear relationship between the variables. The researcher, therefore, argues that students in higher levels of tertiary education such as third year university students, Honours, Masters, and PhD have better knowledge regarding PTB compared to first- and second-year students. This notion is also supported by results displayed on Table 4.6.

The findings indicate that there is a knowledge deficit in the lower levels of tertiary education. One can speculate that general knowledge increases with levels of education in the tertiary environment, which means lower formal education is associated with a poor understanding of PTB. The deficiency in knowledge about PTB transmission modes, therapy, clinical signs and symptoms and causes of PTB could promote the spread of the disease in an environment such as the University of Venda, where there are accommodation arrangements with the potential to accelerate the disease transmission. Sufficient knowledge of TB can allow one to seek medical attention early to avoid disease development due to delays in the administration of treatment.

Relevant studies from literature (Rana *et al.,* 2015) illustrated that non-medical university students have insufficient knowledge about PTB, which is what this study also confirmed. This makes it relevant for students at the University of Venda to begin learning by applying the Epidemiological Triangle Framework (ET).

5.6 Public health use of the findings

This study embraced the Epidemiological Triangle Framework (ET) and is the first survey on the knowledge of students about PTB at a selected tertiary institution ever to be done in VDM. In agreement with Khalil *et al*., (2011), PTB continues to be a major public health problem and accounts for over 80% of all cases globally as well as in South Africa. The results from this

study produced useful information for policymakers to evaluate and shape the TB control programmes and put socioeconomic and public health plans in place as measures to increase TB knowledge and further enhance the TB control programmes Gelaw (2016), as the disease poses a threat to global health (Ato & Sis, 2019). In their respective arguments above, Ato and Sis (2019) and Khalil *et al*., (2011) put emphasis on public health as human health is threatened by the disease throughout the world, and they recommend some key elements for implementing a public health approach to address health threats. Thus, concurring with their arguments, the researcher stresses that the findings of this study will have a positive impact on the implementation of innovative public health to address the threat posed by PTB at tertiary institutions as some students who are sick with PTB at the tertiary institution might expel bacteria to others.

As Gelaw (2016) continues emphasising public health measures, he indicated that that public health measures should thus focus on enhancing health education to address the most affected population group and increase the level of TB knowledge among the general population. Thus, a study like this should also develop public health interventions that could curb the spread of the PTB, especially at a tertiary institution. This is the reason why Astuti *et al*., (2019) stated that studies on PTB prevention are encouraged to develop interventions such as structured health education in order to control the transmission of TB (Astuti *et al*., 2019). However, Gelaw (2016) proposes that educational materials need to be target-oriented and incorporate the basic knowledge gaps such as concepts on TB transmission, TB major symptoms, curability, prevention methods, and the importance of treatment, at the same time of addressing the misconceptions. Increasing the use of multiple mass media sources would help to improve the health education coverage and address the target populations (Gelaw, 2016).

Increasing the regular education coverage to the population and incorporating TB into the school curriculum would especially address the uneducated and the in-school youths. Most importantly, tuberculosis control programmes and intervention prioritisations should consider appropriate strategies for tuberculosis education, promotion, communication, and social mobilisation to address the rural women, the youth, the poor, less educated people, and unskilled workers. Additionally, the depth of the magnitude of the problem needs to be addressed by socioeconomic measures such as empowering rural women to make their own decisions and to get access to information and reformulating poverty reduction strategies to improve the socioeconomic status of the people. Furthermore, a large-scale study is recommended to address the unmeasured confounders and additional TB knowledge questions (Gelaw, 2016).

In a study in Bogor regency in Indonesia on pulmonary tuberculosis prevention, behaviour improvement and structured-health education came through as key initiatives to address the splurge of the disease. Astuti *et al*., (2019) opine that PTB is easily spread through sputum splashes as it remains a common infectious disease in the world. Hence, it encourages development of interventions in order to control the transmission of TB, such as structured health education (Astuti *et al*., 2019). For that reason, the researcher truly believes that if such health education interventions and current strategies are well implemented, there will be more of TB transmission reduction.

5.6 Summary

The study established that there were three groups of students in relationship to the knowledge of PTB, that is, those who have sufficient knowledge regarding the disease, those who do not, and those who do not have sound knowledge pertaining to the disease. Students from health-related study programmes could be the ones with sufficient knowledge concerning the disease. Under the university setup, every student has access to the disease's information but due to ignorance among other things, students have little or no knowledge on the subject that could directly infect them. Through this study, it was observed that there is a moderate relationship between the level of education and the knowledge of PTB. Universities could introduce educational campaigns emphasising on the application of the ET as a model developed for studying health problems and can help students at the University of Venda understand how an infectious diseases such as PTB can spread from one host to another at their residences (CDC, 2012).

CHAPTER 6

CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

6.1 Introduction

The previous chapter outlined the discussions of the results. This chapter provides the summary of study aim and objectives, research methodology and design, and major results, conclusions, limitations, and recommendations based on the results of the study.

6.2 Study Aim and Objectives

This study aimed at determining the knowledge of students regarding PTB at a selected tertiary institution in Vhembe district of Limpopo. Hence, the objectives of the study were as follows:

- To assess and analyse the knowledge of students regarding PTB and its causes.
- To describe the knowledge of students regarding PTB at a selected tertiary institution, and
- To determine the relationship between education and knowledge of PTB.

6.3 Summary of Research Method and Design

The study adopted the ET as it theoretical framework and was guided by a quantitative approach to investigate the PTB phenomena among selected tertiary institution students. In addition, a descriptive cross-sectional design was adopted to give a detailed description of the respondents' knowledge regarding PTB and to understand the perceptions of students who reside on the campus of a tertiary institution during the 2019 academic year. Ethical considerations were adhered to throughout this study.

Structured questionnaires and a checklist were used to collect data. The study was conducted at the University of Venda Campus to assess students' knowledge about PTB. Data was collected through a self-administered questionnaire by the researcher who designed the questionnaire in order to provide empirical answers to the research questions and to achieve the aim of the study of evaluating the knowledge of tertiary institution students about pulmonary tuberculosis with emphasis at the University of Venda where this study was conducted. Data was captured in Microsoft Excel and analysed using the Statistical Package for Social Sciences (SPSS) software version 26.

Data findings were presented on tables and graphs. The eight questions in the self-administered questionnaire were grouped into indices evaluating and determining the

composite score of knowledge for data analysis. Descriptive statistics, a Spearman's rank-order correlation was used, and results were presented using graphs and tables to determine knowledge of students regarding PTB at a selected tertiary institution in Vhembe district of Limpopo. A plan for dissemination and implementation of results was discussed as well.

6.4 Summary of Major Results

The major results of this study revealed that students have basic knowledge regarding PTB in one hand, while at the other hand there is insufficient knowledge regarding the causes of PTB among students at the selected tertiary institution. Also, students need public health education campaigns to increase their knowledge on PTB and non-medical Univen students have insufficient knowledge about PTB. Further, the results also revealed that there is moderate positive correlation between education and knowledge of PTB among students.

6.5 Conclusion

The main objective or purpose of this study was to determine knowledge of students regarding PTB at a selected tertiary institution in Vhembe District of the Limpopo Province. The University of Venda was the selected tertiary institution where the researcher conducted his study. The study has also assessed and described the knowledge of students regarding PTB. Furthermore, the study assessed the knowledge of students regarding PTB, determined their knowledge regarding the causes of PTB, and determined the relationship between education and knowledge of PTB. The findings reveal that the respondents had sufficient knowledge of the agent that causes PTB, TB transmission, signs and symptoms of PTB. But there was inadequate knowledge regarding the risk factors of PTB, TB treatment regimens, spitting technique and the best test to diagnose PTB. There is a need to increase the level of knowledge of TB treatment, risk factors, spitting techniques to avoid the spread of PTB and tests to diagnose PTB, through educational programmes.

Findings from a study conducted by Astuti *et al*., (2019) encourage the development of interventions in order to control the transmission of TB, such as structured health education. Structured health education improves pulmonary TB prevention behaviour of adult age community members. Structured health education provides material explanation in order to make the respondents understand TB material. This happens whilst respondents are undergoing a facilitated session to observe how something is done in order to transfer theory into practical applications by demonstration. This method enables the respondents to practice healthy behaviour that can accelerate a behavioural change process. Structured health

education can be used as an alternative nursing intervention in improving pulmonary TB prevention behaviour in the community. Similar research needs to be done for longer to show more behavioural changes over time. Furthermore, structured health education can also be applied to other health conditions which are related to non-healthy behaviour, such as prevention of hypertension and diabetes including other non-communicable diseases (Astuti *et al*., 2019).

Grounded on the notion that learning occurs through social observation and subsequent imitation of modeled behaviour (Lyons & Berge, 2012), the ET was the suitable theoretical framework of this study as it implies that students (hosts) learn how the agent infects them within their environment. Further, as highlighted by Frérot *et al*. (2018) the ET remain a useful and relevant tool in bringing to light and understanding diseases and health events. Thus, poor sanitation, basic knowledge of the disease, low levels of immunity, various model of transmission and the environmental conditions contribute to the diseases that affect the entire population. In this regard, students from a selected tertiary institution in Vhembe District of Limpopo Province will learn from the actions and resulting consequences of others in order to prevent PTB. Students should learn from others through observation and imitation because TB remains a public health issue globally as well as in South Africa.

Based on the findings the following conclusions are drawn, and recommendations suggested. However, there is a need for further investigation with a larger sample to have a general view of the situation of all tertiary institutions within the Vhembe District and the entire Limpopo Province. Hence, TB control could be significantly improved if more consideration was given to the population's knowledge and attitudes about TB and related healthcare-seeking behaviour, by directing efforts towards making individuals more informed and aware of all aspects of TB (Gelaw, 2016). As a consequence, the community of tertiary institutions (UNIVEN and other institutions) should have knowledge about TB. This is where the researcher will come up with effective public health educational programmes to fight TB and reduce its transmission while applying behaviour change among students. Researchers such as (Giovazolias & Themeli, 2014) stated that "By observing others, people acquire knowledge, rules, skills, strategies, beliefs, and attitudes. Individuals also learn from models the usefulness and appropriateness of behaviors and the consequences of modeled behaviors, and they act in accordance with beliefs about their capabilities and the expected outcomes of their actions". So, students therefore will exercise the capacity to think critically, "reflecting on the possible consequences of certain behaviours and then deciding on the best action".

6.6 Recommendations

Areas of knowledge that should be addressed to UNIVEN students are as follows:

- The agent (Mycobacterium Tuberculosis) that causes PTB.
- The risk factors that contribute to the spread of PTB.
- The TB treatment regimens.
- The best test to diagnose PTB.
- The proper spitting technique of sputum to prevent the spread of PTB.
- To provide an insight that can be trusted for recommendations and policies in higher learning, to raise the level of understanding among students.
- Universities could introduce educational campaigns on common diseases responsible for mortality and morbidity in the communities. Since the government already provides the guidelines for the detection, prevention, and management of tuberculosis, it could be less costly to introduce educational programs to the people mostly infected by the disease.
- To remedy ignorance and poor knowledge among the students by campaign services.
- The burden of TB in the student population especially in rural-based universities should not be underestimated.
- Empower non-medical university students on the knowledge about PTB.
- The campus health clinic should have continuous door-to-door visits at all residences to share more knowledge about PTB and encourage a healthy lifestyle among students.
- Tertiary institutions management in Vhembe District should make sure that all residence rooms are widely ventilated and spacious enough for students.
- The campus health clinic should introduce the teaching of TB at tertiary institutions within the Vhembe District as well as delivery of TB information, education, and communication (IEC) messages among students and staff through workshops, seminars and radio talk shows with particular emphasis on the application of the ET as it posits that people learn from one another, via these three learning processes: observation, imitation and modeling.
- The campus health clinic should embark on an aggressive screening drive of PTB among students at all tertiary institutions in the Vhembe District.
- Develop a knowledge framework of PTB to be used at a tertiary institution in Vhembe District and across the country. Further both Provincial and National Departments of Health should strengthen a collaborative partnership in order to help tertiary institutions to advance the NDP and SDGs and to stop the spread of TB at rural tertiary institutions.

- Need for better implementation of the Global STOP TB strategy and the NSP to achieve the fight against TB to the large extent by 2030 as stated also in the NDP and SDGs.
- The University management should implement a room allocation policy effectively so that students are allocated rooms in time to reduce squatting and overcrowding.
- Future studies on PTB that will assess the relationship between the ages, gender and level of year of students.

6.7 Limitations

In this study, the researcher observed two limitations. Firstly, the findings of this study cannot be generalised because only on-campus students were interviewed whilst excluding off-campus students. Secondly, the newly COVID-19 disease pandemic had affected the study negatively by delayed data collection process.

6.8 Dissemination of Results

The results of this study will be disseminated in the form of a research report. One copy of the study will be submitted to the University of Venda Library. The respondents will be informed about the findings of the study in the form of feedback. The findings from this study will be published in peer-review journals and presented during conference proceedings.

6.9 Final Summary of the Chapter

This chapter provided the summary of the study aim and objectives, research methodology and design, and major results, conclusions, limitations, and recommendations based on the results of the study. Further, it also shares information on how the results of the study will be disseminated. This study was framed on the ET framework to determine the knowledge of students regarding PTB at a selected tertiary institution in Vhembe district of Limpopo.

References

Ait-Khalid N, Alarcon E, Armengol R, Bissell K, Boillot F, Caminero JA, et al. (2010). Management of tuberculosis: a guide to the essentials of good practice. Sixth ed. Paris, France: International Union Against Tuberculosis and Lung Disease.

Alelign, A., Zewude, A., Petros, B., & Ameni, G. (2019). Tuberculosis at farmer-cattle interface in the rural villages of South Gondar Zone of northwest Ethiopia. *Tuberculosis research and treatment*, *2019*.

Alene, K. A., Adane, A. A., Yifiru, S., Bitew, B. D., Adane, A., & Koye, D. N. (2019). Knowledge and practice of health workers about control and prevention of multidrug-resistant tuberculosis in referral hospitals, Ethiopia: a cross-sectional study. *BMJ open*, *9* (2), e022948.

Anochie, P.I., Onyeneke, E.C., Onyeozirila, A.C., Igbolekwu, L.C., Onyeneke, B.C. & Ogu, A.C. (2013). Evaluation of public awareness and attitude to pulmonary tuberculosis in a Nigerian rural community. *GERMS*, 3 (1), 52-62.

Astuti, V.W., Nursasi, A.Y. & Sukihananto. (2019). Pulmonary tuberculosis prevention behavior improvement and structured-health education in Bogor regency. *Enfermeria Global*, 54, 294 – 302.

Ato, M.L. & Sis, M.T. (2019). Assessment of Knowledge, Attitude and Practice of Tuberculosis Transmission and Prevention Among Tuberculosis Patients at Kuyyu Hospital, North Shoa Zone, Oromia Regional State, Ethiopia. *Anatol J. Family Med*., 2 (3), 91 - 97.

Behnaz, F., Mohammadzade, G., Mousavi-Rokhabadi, R. S., & Mohamadzadeh, M. 2015. Assessment of Knowledge, attitudes and practices regarding Tuberculosis among final year students in Yazd, central Iran.

Bensalah, N., Hsairi, M., Snene, H., Bejar, D., Mehiri, N., Fourati, R., Tritar, F., Louzir, B. & Beji, M. (2017). Community knowledge, attitude, and practices towards tuberculosis in Tunisia. *European Respiratory Journal*, 50.

Bless, C., Higson-Smith, C., & Sithole S. L. (2013). Fundamentals of Social Research Methods: An African Perspective. 5th edition, Juta and Company Ltd. Cape Town, South Africa.

Bloom, D.E. & Cadarette, D. (2019). Infectious Disease Threats in the Twenty-First Century: Strengthening the Global Response. *Frontiers Immunology*, 549 (10), 1-12.

Boffa, J., Mahlaba, T., Moyo, S., Sifumba, Z., Pai, A and Daftary. (2020). COVID-19 and Tuberculosis in South Africa: Adangerous Combination, South Africa.

Brink, H. Van der Walt, C., & van Rensburg, G. (2018). *Fundamentals of research methodology for healthcare professionals*, 4th edition, Juta, Cape Town., South Africa.

Burns, N. & Grove, S. (2013). *The practice of Nursing Research Conduct, Critique and Utilization*. Fifth Edition. Philadelphia: Elsevier Saunders.

Canadian Public Health Association (CPHA) (2017). Public Health: A Conceptual Framework. Working Paper, Second Edition, pp.1-14.

Canadian Public Health Association (CPHA) (2010). Enhancing the Public Health Human Resource Infrastructure in Canada. Ottawa: Canada.

Centers for Disease Control and Prevention (CDC) (2018). Introduction to Program Evaluation for Public Health Programs: A self-study guide. Atlanta, GA: United States.

Chinenye, N. M., (2015). Evaluation of Knowledge, Attitude and Practices of TB Diagnosed Patients in Rwanda towards TB Infection.

Chowdhury, M.R.K., Rahman, M.S., Mondal, M.N.I., Sayem, A. & Billah, B. (2015). Social Impact of Stigma regarding Tuberculosis Hindering Adherence to Treatment: A Cross Sectional Study Involving Tuberculosis Patients in Rajshahi City, Bangladesh. *Journal of Infectious Disease*, 68, 461- 466.

Churchyard, G.J., Mametja, L.D., Mvusi, L., Ndjeka, N., Hesseling, A.C., Reid, A., Babatunde, S. & Pillay, Y. (2014). Tuberculosis control in South Africa: Successes, challenges and recommendations. *South African Medical Journal,* 104 (3-1), 244-248.

Creswell, J., W. (2014). Research Design International Student Edition Qualitative, Quantitative, Mixed methods Approaches, 4th edition, Washington DC.

Davies, P.D.O. (2015). Respiratory tuberculosis. Clinical Tuberculosis. Third Ed. London: Arnold, pp. 107-124.

De Vos, A., S., Strydom, H., Fouche,' C.B, & Delport, C., S., L. (2013). Research at Grass Roots, 4th edition, Van Schaik, Cape Town, South Africa.

Department of Health (2020). National Practical Manual for the Implementation of the National IPC Strategic Framework, p. 23.

Department of Health (2020). COVID-19 Disease: Infection Prevention and Control Guidelines version 1 April 2020, Pretoria, South Africa.

Department of Health (2018). TB Report. Vhembe District. Electronic Tuberculosis Register (ETR.Net).

Department of Health (2017). Annual TB Report. Pretoria, South Africa.

Department of Health (2016). National Tuberculosis Management Guidelines. Pretoria, South Africa.

Department of Health (2016). Managing TB in a new era of diagnostics. The Aurum Institute.

Department of Health (2015). National Infection Prevention and Control Guidelines for TB, MDR-TB and XDR-TB. Pretoria, South Africa.

Department of Health (2016). Standard Treatment Guidelines and Essential Medicines List. Essential Drug Programme South Africa. Fifth Edition. Pretoria.

Department of Health (2014). Ethics in Health Research: Principles, Structures and Processes. Pretoria: http://www.doh.gov.za/docs/factsheets/guidelines/ethnics/

Dirlikov, E., Raviglione, M. & Scano, F. (2015). Global tuberculosis control: Toward the 2015 targets and beyond. *Ann Intern Med*., 163 (1), 52 – 58.

Drain, P. & Garrett, N. (2020). SARS-CoV-2 pandemic expanding in sub-Saharan Africa: considerations for Covid -19 in people living with HIV. E Clinical Medicine.

Ephrem, T., Mengiste, B., Mesfin, F. & Godana, W. (2015). Determinants of active pulmonary tuberculosis in Ambo Hospital, West Ethiopia. *African Journal of Primary Health Care Family Medicine*, 7(1), 1-8.

Esmael, A., Ali, I., Agonafir, M., Desale, A., Yaregal, Z. & Desta, K. (2013). Assessment of patients' knowledge, attitude and practice regarding Pulmonary Tuberculosis in Eastern Amhara Regional State, Ethiopia.

Falah, M., Tai, C-Y., Lu, Y-Y., Liu, C-Y. & Lismayanti, L. (2019). Tuberculosis Knowledge among University Students in Indonesia. *South East Asia Nursing Research*, 1 (2), 95-105.

Garcon, I. (2020). Impact of Demographic Characteristics and Therapy on Tuberculosis Incident Cases. Unpublished Doctoral Thesis, College of Health Sciences, Walden University.

Gafar, M., M., Nya zema, N., Z., & Damisya, Y., M. (2013). Factors that influencing treatment outcome in Limpopo Province, South Africa.

Gelaw, S.M. (2016). Socioeconomic Factors Associated with Knowledge on Tuberculosis among Adults in Ethiopia. *Tuberculosis Research and Treatment*, 1-11.

Giovazolias, T. & Themeli, O. (2014). Social Learning Conceptualization for Substance Abuse: Implications for Therapeutic Interventions. *European Journal of Counseling and Psychology*, 3, 69 - 88.

Girard, J. & Girard, J. (2015). Defining knowledge management: Toward an applied compendium. *Online Journal of Applied Knowledge Management*, *3*(1), 1 - 20.

Gounden, S., Perumal, R. & Magula, N.P. (2018). Extrapulmonary tuberculosis in the setting of HIV hyperendemicity at a tertiary hospital in Durban, South Africa. *Southern African Journal of Infectious Diseases*, 33 (3), 57 - 64.

Grove, S., K., & Gray, J., R. (2019). Understanding Nursing Research Building an Evidence-Based Practice, 7th edition,

Hassan A. O., Olukolade, R., Ogbuji, Q. C., Afolabi, S., Okwuonye, L. C., Kusimo O. C., Osho, J. A., Osinowo, K. A., & Ladibo, O. A. (2017). Knowledge about Tuberculosis: A Precursor to Effective TB Control - Findings from a Follow-Up National KAP study on Tuberculosis among Nigerians.

Hibstu, D,. T and Boga, B,. J. 2016. Knowledge, attitude and practice of Tuberculosis and its transmission among high school students in Yirgacheffe Town, Gedeo Zone, Southern Ethiopia.

Hornby, A., S. (2015). Oxford Advanced Learner's Dictionary of current English. Oxford University Press, Oxford.

Http://www.CDC.gov/tb/statistics/reports / (2015) / default.htm

Im, C. & Kim, Y. (2021). Spatial pattern of tuberculosis (TB) and related socio-environmental factors in South Korea, 2008-2016. *PLoS ONE*, 16 (8), 1-14.

International Council of Nurses (ICN). (2015). TB Guidelines for Nurses in the Care and Control of Tuberculosis and Multidrug-Resistant Tuberculosis. 3rd Edition, Geneva.

Kala, M., John, K.R. & Logaraj, M. (2016). A Study on Awareness on Pulmonary Tuberculosis Among Population Covered Under Rural Health Training Centre at Mamandur in Tamilnadu. *Biomedical & Pharmacology Journal*, 9 (2), 651- 657.

Kambale, S. (2012). Assessment of the Knowledge and Perceptions about Tuberculosis Among Primary School Children in Ntcheu District, Malawi. Unpublished mini thesis in Public Health, School of Public Health, University of the Western Cape.

Keene, C., Mohr-Holland, E., Cassidy, T., Scott, V., Nelson, A., Furin, J., Triviño-Duran, L. (2020). How COVID-19 could benefit tuberculosis and HIV services in South Africa. *The Lancet Respiratory Medicine*, 8 (9), 844 – 846.

Kgosana, K. (2018). The First National Tuberculosis Prevalence Survey, South Africa.

Khalil, S., Ahmad, E., Khan, Z. & Perwin, N. (2011). A Study of Knowledge and Awareness Regarding Pulmonary Tuberculosis in Patients under Treatment for Tuberculosis in a Rural Area of Aligarh-Up. *Indian Journal of Community Health*, 23 (2), 93 - 95.

Lewin, S,. Muunambi-Babigumira, S,. Glenton, C,. Daniels, K,. Bosch-Capblanch, X,. Van Wyk, B,. Odgaurd-Jensen, J,. Johansen, M,. Aja,G,. N,. Zwarenstern, M,. and Scheel, I.B. (2010). Lay Health wokers in primary and community health care for maternal and child health and the management of infectious disease.

LoBiondo-Wood, G., & Haber, G. (2014). Nursing research, Methods and Critical Appraisal for Evidence-Based Practice, 8th Edition, China.

Loveday, M., Smith, J. & Day, C. (2014). Knowing our TB Epidemic: Key Challenges Facing the TB Programme in South Africa. South African Medical Research Council and Health Systems Trust.

Matakanye, H., Ramathuba, D.U. & Tugli, A.K. (2019). Caring for Tuberculosis Patients: Understanding the Plight of Nurses at a Regional Hospital in Limpopo Province, South Africa. International Journal of Environmental Research and Public Health, 4977 (16), 1-15.

Mekonnen, A. Collins, J.M., Aseffa, A., Ameni, G. & Petros, B. (2018). Prevalence of pulmonary tuberculosis among students in three eastern Ethiopian universities. *International Journal of Tuberculosis Lung Disease*, 22 (10), 1210 - 1215.

Mekonnen, A. & Petros, B. (2016). Burden of tuberculosis among students in two Ethiopian universities. *Ethiop Med Journal*, 54, 189 - 196.

Mo, M. & Jang, H. (2016). University students' behavior with regard to tuberculosis. *ASEHL*, 8, 52 - 55.

Montagna, M. T., Napoli, C., Tafuri, S., Agodi, A., Auxilia, F., Casini, B., Coscia, M. F., D' Errico, M. M., Ferrante, M., Fortunato, A., Germinario, C., Martinelli, D., Masanotti, G.M., Massenti, M.F., Messina, G., Montuori, P., Mura, I., Orsi, G. B., Quaranta, A., Sotgiu, G., Tardivo, S., Torregrossa, M. V., Tortorano, A. M., Veronesi, L., Zarrilli, R. & Pasquarella, C. (2014). Knowledge about tuberculosis among undergraduate health care students in 15 Italian universities: a cross-sectional study. *BMC public health*, *14* (1), 970.

Mudavanhu, Y. (2017). Quality of literature review and discussion of findings in selected papers on integration of ICT in teaching, role of mentors, and teaching science through science, technology, engineering, and mathematics (STEM). *Educational Research and Reviews*, 12 (4), 189 - 201.

Nabavi, R.T. (2012). 'Bandura's Social Learning Theory & Social Cognitive Learning Theory'. Theories of Developmental Psychology, pp.: 1-24.

Osei, E., Der, J., Owusu, R., Kofie, P. & Axame, W.K. (2017). The burden of HIV on Tuberculosis patients in the Volta region of Ghana from 2012 to 2015: implication for Tuberculosis control. *BMC Infectious Diseases*, 504 (17), 1 - 9.

Padayatchi, N., Daftary, A., Naidu, N., Naidoo, K., & Pai, M. (2019). Tuberculosis: treatment failure, or failure to treat? Lessons from India and South Africa. *BMJ Global Health*, 4, 1 - 6.

Polit, D. F., & Beck, C. T. (2017). *Nursing research: Generating and assessing evidence for nursing practice*. Lippincott Williams & Wilkins.

Prager, K. & Creaney, R. (2017). Achieving on-farm practice change through facilitated group learning: Evaluating the effectiveness of monitor farms and discussion groups. *Journal of Rural Study*, 56, 1 - 11.

Pramanik, D. & Ghosh, J.R. (2015). Knowledge and Awareness of Tuberculosis among Pulmonary Tuberculosis Patients in a Rural Area of West Bengal. *SAARC Journal of Tuberculosis, Lung Diseases & HIV/AIDS*, XII (2), 13 - 19.

Ramaliba, T.M., Tshitangano, T.G., Akinsola, H.A. & Thendele, M. (2017) Tuberculosis risk factors in Lephalale local municipality of Limpopo province, South Africa. *South African Family Practice*, 59 (5), 182 - 187.

Rana, M., Sayem, A., Karim, R., Islam, N., Islam, R., Zaman, T.K. & Hossain, G. (2015). Assessment of Knowledge regarding Tuberculosis among Non-Medical University Students in Bangladesh: A cross-sectional study. *BMC Public Health*, 716 (15), 1 - 7.

Raviglione, M,. C,. and Pio, A,. (2017). Evolution of WHO policies for Tuberculosis control, 1948-2017.

Rodela, R. (2014). Social Learning, Natural Resource Management, and Participatory Activities: A reflection on construct development and testing. NJAS Wagening. *Journal of Life Science*, 69, 15 - 22.

Rukasha, I. (2019). Antimicrobial susceptibility testing and sequencing of Mycobacterium tuberculosis clinical isolates. Unpublished Doctoral dissertation, University of the Free State, South Africa.

Sah, B. K., Sah, J. P., Shah, S. K., & Amita KC, A. (2016). Knowledge on tuberculosis among students of higher secondary school, lalitpur, Nepal. *MOJ Public Health*, *4* (5), 133 - 141.

Saidi, T., Salie, F., & Douglas, T.S. (2017). Towards understanding the drivers of policy change: A case study of infection control policies for multidrug resistant tuberculosis in South Africa. *Health Research Policy and Systems*, *15* (1), 41.

Salisu, A. & Ranson, E. N. (2014). The role of modeling towards impacting quality education; Nigeria.

Samal, J. (2017). Perception and knowledge of tuberculosis and its services among slum dwellers in Chhattisgarh. *Indian Journal of Respiratory Care*, *6* (2), 828.

Senkoro, M. (2016). Burden of Pulmonary Tuberculosis and Its Major Determinants: A National Prevalence Survey in Tanzania. Unpublished Doctoral Thesis, Centre for International Health, University of Bergen.

Sevil, J., García-González, L., Abós, Á., Generelo, E., & Aibar, A. (2019). Can high schools be an effective setting to promote healthy lifestyles? Effects of a multiple behavior change intervention in adolescents. *Journal of Adolescent Health*, *64* (4), 478-486.

Shrestha, A., Bhattarai, D., Thapa, B., Basel, P., & Wagle, R. R. (2017). Health care workers' knowledge, attitudes and practices on tuberculosis infection control, Nepal. *BMC infectious diseases*, *17* (1), 724.

Shimeles, E., Enuqueselassie, F. and Tilahu, M. M. (2019). Risk factors for Multidrug-Resistant Tuberculosis and characteristics of cases: Acase-control study in patients attending ALERT. General Hospital in Addis Ababa, Ethiopia.

Soriano, V. & Barreiro, P. (2020). Impact of new coronavirus epidemics on HIV-infected patients. *AIDS Rev*., 22 (1), 57 – 58.

Sudha, S.2016. Tuberculosis diagnosis- an overview to the conventional diagnostic methodology and need for nandiagnosis, India.

Sunnetcioglu, A., Sunnetcioglu, M., Binici, I., *et al*. (2015). Comparative analysis of pulmonary and extrapulmonary tuberculosis of 411 cases. *Ann Clin Microbiol Antimicrob*., 14, 75.

Statistics South Africa (2016). Mortality and causes of death in South Africa. 2011 Findings from death notification, Pretoria.

Stop TB Partnership (2010). The global plan to stop TB 2011 - 2015: Transforming the fight - towards elimination of tuberculosis. World Health Organisation: Geneva.

Tamuzi, J.L., Ayele, B.T., Shumba, C.S., Adetokunboh, O.O., Uwimana-Nicol, J., Haile, Z.T., Inugu, J. & Nyasulu, P.S. (2020). Implications of COVID-19 in high burden countries for HIV/TB: A systematic review of evidence. *BMC Infectious Diseases*, 20:744, 1-18.

Teixeira, E.G., Menzies, D., Cunha, A.J.L.A., Luiz, R.R., Ruffino-Netto, A., Scartozzoni, M.S., Portela, P., Trajman, A. (2018). Knowledge and Practices of Medical Students to Prevent Tuberculosis Transmission in Rio de Janeiro, Brazil. *Rev Panam Salud Publica / Pan Am Journal of Public Health*, 24 (4), 265 - 270.

The Association of Faculties of Medicine in Canada (AFMC). (2017). Primer on Population Health. Ottawa: Canada.

Treatment Action Campaign (TAC). (2013). Letter from International Health and Human Rights Experts to Mbeki and Zuma on the Need for a Human Rights approach to TB. Available from: http://www.tac.org.za/community/

Tshitangano, T. G. (2013). The management of latent tuberculosis infection in health care workers at hospitals in Vhembe district. *Occupational Health Southern Africa*, *19* (5), 14 - 19.

Tolossa, D., Medhin, G. & Legesse, M. (2014). Community knowledge, attitude, and practices towards tuberculosis in Shinile town, Somali Regional State, Eastern Ethiopia: A cross-sectional study. *BMC Public Health*, 14; 804, 1 – 13.

Vijayakrishnan, G., Bobba, S. & Venugopal, V. (2017). A study on awareness of Tuberculosis amongst patients attending a rural health center in Tamilnadu, India. *International Journal of Community Medicine and Public Health*, 4 (4), 1195 - 1198.

Watermeyer, J. & Penn, C. (2019). Community perspectives on tuberculosis care in rural South Africa. *Health Soc Care Community*, 27, 182 - 190.

Wei, J. & Li, Y. (2016). Airborne spread of infectious agents in the indoor environment. *American Journal of Infection Control*, 44: 102 - 108.

Wikins, T. (2020). HIV1: epidemiology, pathology and transmission.

Wong, K., Nguyen, J., Blair, L., Banjanin, M., Grewal, B., Bowman, S., Boyd, H., Gerstner, G., Cho, H.J., Panfilov, D., Tam, C.K., Aguilar, D. & Venketaraman, V. (2020). Pathogenesis of Human Immunodeficiency Virus - *Mycobacterium tuberculosis* Co-Infection. *Journal of Clinical Medicine*, 9, 1 - 23.

World Health Organisation (2019). Consolidated guidelines on drug-resistant Tuberculosis treatment, Geneva, Switzerland.

World Health Organisation (2019). Guidelines on tuberculosis infection prevention and control, 2019 update, Geneva.

World Health Organisation (2020). Tuberculosis Fact Sheets. www.who.int/news-room/fact-sheets/detail/tuberculosis. Accessed on the 14 October 2020

World Health Organisation (2020). Global Tuberculosis Report, Geneva, Switzerland.

World Health Organisation (2018). Global Tuberculosis Report. Geneva, Switzerland.

World Health Organisation (2016). Global Tuberculosis Report. Geneva, Switzerland.

World Health Organisation (2015). *Guide to Monitoring and Evaluation for Collaborative TB/HIV Activities--2015 Update*. Geneva, Switzerland.

World Health Organisation (2015). Global Tuberculosis Report. Geneva, Switzerland.

World Health Organisation (2014). *Companion handbook to the WHO guidelines for the programmatic management of drug-resistant tuberculosis*. World Health Organisation.

World Health Organisation (2014). Public Health Surveillance. Geneva, Switzerland.

World Health Organisation (2014). Epidemiology. Geneva, Switzerland.

World Health Organisation (2013). What are social determinants of health? Geneva, Switzerland.

World Health Organisation (2013). Global Tuberculosis Report. Geneva, Switzerland.

World Health Organisation (2013). *WHO policy on TB infection control in health-care facilities, congregate settings and households*. Geneva, Switzerland.

World Health Organisation (2012). Global Tuberculosis Report. Geneva, Switzerland.

World Health Organisation (2010). Global tuberculosis control 2010 2010. Geneva, Switzerland.

World Health Organisation (2019). *Global Tuberculosis Control: Epidemiology, Strategy, Financing.* Geneva, Switzerland.

World Health Organisation (2018). The global burden of disease: 2004 update. Geneva, Switzerland.

World Health Organisation (2005). “Who Declares TB an Emergency in Africa.” News release. Geneva, Switzerland.

Yusuf, L., Puspitasari, I.M. & Sinuraya, R.K. (2021). Recent studies on knowledge, attitude, and practice toward tuberculosis among university students. *Journal of Applied Pharmaceutical Science*, 11 (08), 178 – 183.

Zhang, S., Xiaohong, L. I., Zhang, T., Xiangni, W. A. N. G., Weiping, L. I. U., Xuexue, M. A., & Yahui, F. A. N. (2016). Framework for establishment of a comprehensive and standardized administration system for prevention and control of tuberculosis in college student community in China. *Iranian Journal of Public Health*, *45* (10), 1300.

Zhao, Y., Ehiri, J., Li, D., Luo, X. & Li, Y. (2013). A Survey of TB Knowledge among Medical Students in Southwest China: Is the Information reaching the Target? *BMJ Open*, 3, 1 - 10.

Zumla, A., Raviglione, M., Hafner, R. & von Reyn, C. F. (2018). Current concepts. *N Engl J Med*, *368*, 745 - 755.

Annexures

Measurement instrument adapted from Likert Chart

Section A : Respondent's Demographic/ Personal data

Age: _____Sex_____Level of study_____Name of residence_____

Place of origin_____

Section B: Respondent's Knowledge regarding Pulmonary Tuberculosis

The respondent will answer the question by ticking the appropriate box byusing the key below:

1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree

Please respond to the following statements by ticking the appropriate box you agree with	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
1. TB is caused by Mycobacterium Tuberculosis.					
2. TB is transmitted from one person to another through coughing and sneezing.					
3. Coughing for more than three weeks, night sweating, losing weight and chest pains are the signs and symptoms of TB.					
4. TB curable.					
5. The risk factors for TB are: 5.1 Squatting and overcrowding 5.2 Smoking 5.3 HIV Positive people 5.4 Diabetes Mellitus 5.5 Kissing					
6. The following is the best test to diagnose TB. 6.1 Sputum and Saliva sample 6.2 Blood test					

6.3 X-Ray check-up? 6.4 Urine Test					
7.Ordinary TB treatment last for: 7.1 Six to seven months 7.2 Five months 7.2 Ten months					
8.The following measures can help in preventing the spread of TB: 8.1 Proper coughing technique 8.2 Avoiding overcrowding 8.3 Proper spitting technique 8.4 Early diagnosis and treatment 8.5 Eating a balanced diet					

Request Letter to conduct a study

The University of Venda
Private Bag x 5050
Thohoyandou
0950

12 August 2020

The Director
Student Affairs
University of Venda

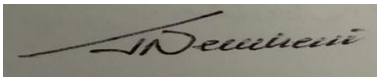
Dear Sir,

REQUEST TO CONDUCT RESEARCH PROJECT

I hereby wish to apply to be granted permission to conduct a research study at University of Venda Campus Health as currently completing my Masters in Nursing under the School of Health Sciences. My student number is 11554291 and the title of my research project is "**Knowledge of the students regarding pulmonary tuberculosis at a selected tertiary institution in Vhembe District of Limpopo Province**". The results of the study may help with the reduction of PTB infections among the stakeholders such as students and lecturers. Furthermore, hostel allocation should be done as per the number required in the residence, by following the policy during room allocation. Residence monitoring should continue to avoid overcrowding and squatting. The outcome of this study may improve students' knowledge regarding PTB and benefit their health. Students may be free from PTB infections as they will be knowledgeable about the prevention, causes, clinical manifestations, management and its complications. All information collected will be confidential. For any enquiry kindly contact my supervision team as follow: Dr. T.R. Luhalima on 015 962 8841 and Dr. T. Malwela on 015 962 8842 including myself Mr. J. Neluheni on 083 960 1885 / 015 962 9153.

Hoping my request is taken into consideration.

Yours faithfully



Neluheni J

Date: 2020.08.12

Permission Letter to conduct the study

University of Venda

Office of the Director Student Affairs
University Road, Thohoyandou, Limpopo
Private Bag X5050, Thohoyandou, 0950
Limpopo, South Africa
Tel: (015) 962 8506/8319
Fax: (015) 962 8379/ 8028
E-mail: Affairs@univen.ac.za

17 August 2020

Mr. Neluheni J.
University of Venda
Private Bag X5050
Thohoyandou
0950

Dear Mr Neluheni

PERMISSION TO CONDUCT RESEARCH PROJECT

This serves to inform you that you have been granted permission to conduct your study among students residing on our campus residences as requested.

Please note that you should adhere to all COVID-19 regulations during your study. Should you face any challenges, do not hesitate to contact me.

Regards,

Mr L.G. Tshikhudo
Director: Student Affairs

UNIVERSITY OF VENDA
DIRECTOR: STUDENT AFFAIRS
17 -08- 2020
APPROVED
Sign:.....

Consent form

Letter of Information

Title of the Research Study**: Knowledge of Students about Pulmonary Tuberculosis at a selected Tertiary Institution in Vhembe District Limpopo**.
Principal Investigator/Researcher: Neluheni Joseph

Co-Investigators/supervisors: Dr. Luhalima T.R (Supervisor) and Dr. Malwela T. (Co-Supervisor)

Brief Introduction and Purpose of the Study

Introduction

I Neluheni Joseph, work at the University of Venda Campus Health Clinic. I am doing research on the knowledge of the students about pulmonary tuberculosis at a selected tertiary institution in Vhembe District of Limpopo. I would ask you to participate in the study. You are not forced to participate in the study. You can ask anyone you feel comfortable with regarding this research. If you come across any unusual words or words that you do not understand, please ask me to stop as we go through the information and I will explain.

Purpose of the study: Is to assess knowledge of the students regarding pulmonary tuberculosis at a selected tertiary institution in Vhembe district of Limpopo.

Outline of the Procedures

Type of intervention: This research will require your participation for at least 30-45 minutes' interview.

Participation selection: You are being invited to take part in this research because I feel that your knowledge as students can contribute much to my understanding and knowledge of pulmonary tuberculosis at a selected tertiary institution.

Voluntary participation: Your participation in this research will be voluntary. It is your choice to participate. If you choose not to participate, you are free to do so.

Procedure: You will participate in an interview with me (Neluheni Joseph). During the interview, I will sit down with you in a comfortable and safe place within the campus. If you do not wish to answer the question, I will move to the next question. The information you provide

will be confidential. My supervisors, Dr Luhalima T and Dr Malwela T and I will be the only people who will have access to the information you provided.

Risks or Discomforts to the Participant

Risk: I will ask you to share with me some very personal and confidential information. You may feel uncomfortable talking about some of the topics. You do not have to answer any question or take part in the interview if you do not wish to do so.

Benefits: No direct benefit to you except the knowledge that will help you, you and your colleagues find knowledge about pulmonary tuberculosis at tertiary institution in Vhembe district.

Reason/s why the Participant May Be Withdrawn from the Study: Participants were informed that they could withdraw from the study at any time.

Remuneration: No money will be paid to you as a way of reward or incentive.

Cost of study: You will not be expected to pay any money for affiliation for participating to the research or interview.

Confidentiality: The researcher will conduct the study in the Campus and being confidential, no one will get access the findings except for the research team. No sharing of information shall occur outside the research team. The information will be kept private. No name will be attached to the information you provided. You are only entitled to have a number. Only the UNIVEN Higher Degrees Committee and my supervisors, Dr Luhalima T and Dr. Malwela T. will have access to the information.

Sharing the results: No information will be shared to anybody outside the research team and nothing will be attributed to you by name. The knowledge that I get from this research will be shared with you before it is available to the public.

Research-related Injury: No injury related to the study

Persons to contact if there are problems: My supervisors (Dr. T. Luhalima and Dr T Malwela) please contact the researcher at the following numbers: 083 960 1885 or 015 962 9153. My supervisor's contact number is 015 962 8841 or University Research Ethics Committee Secretary on 015 962 9058. For complaints, report to the Director: Research and Innovation, Prof GE Ekosse on 015 962 8313.

General: Potential respondents will be assured that participation is voluntary, and the approximate number of respondents will not be disclosed. The researcher will issue a copy of the information letter to respondents. The information letter and consent form will be translated and provided in the primary spoken language of the research population.

Consent

Statement of Agreement to Participate in the Research Study:

• I hereby confirm that the researcher, Neluheni Joseph, has informed me about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Project no: SHS/20/PDC/33/0508

• I have also received, read and understood the above written information (Respondent Letter of Information) regarding the study.

• I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will anonymously be processed into a study report.

• In view of the requirements of research, I agree that the data collected during this study can be processed in a computerized system by the researcher.

• I at any stage, without prejudice, can withdraw my consent and participation from the study.

• I have had enough opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.

• I understand that significant new findings developed during this research, which may relate to my participation will be made available to me.

…….	……	……	……..
Full Name of Participant	Date	Time	Signature

I Neluheni Joseph herewith confirm that the above respondent has been informed fully about the nature, conduct and risks of the above study.

…….	…….	……..
Full Name of Researcher	Date	Signature
…….	…….	……..
Full Name of Witness (If applicable)	Date	Signature
…….	…….	……..
Full Name of Legal Guardian (If applicable)	Date	Signature

TB Symptom Screening Tool for Adult and Children

Patient Details

Surname ---------- First Name ----------

Physical Address ---------- Age ----------

Telephone Number ---------- Patient Folder Number----------

MEDICAL HISTORY

Close contact of a person with infectious TB: (Tick)

Type of index patient:

Diabetic:

HIV Status:

Other: (specify):

TB SYMPTOM SCREEN

1. **ADULTS**

Symptoms	**Tick**	**Yes**	**No**
Cough of two weeks or more or of any duration if HIV positive			
Persistent fever of more than two weeks			
Unexplained weight loss > 1.5 kg in a month			
Drenching night sweats.			

2. **CHILDREN**

SYMPTOMS	**Tick**	**Yes**	**No**
Cough of two weeks or more which is not improving on treatment			
Persistent fever of more than two weeks			
Documented weight loss/ failure to thrive (check road to health card)			

Fatigue (less playful/ always tired)

If yes to one of the above mentioned, consider TB.

If the patient is coughing, collect sputum and send for Xpert testing.

If the patient is not coughing but has other symptoms, assess the patient and refer for further investigation.

Date of last TB test ----------

Patient referred for assessment and investigation

Date of referral ---------- Facility Name----------

Name ---------- Date ----------

Is there any family members, friend and co-workers who are on TB treatment or have TB symptoms? Any medical condition such as diabetes mellitus or HIV/AIDS? Employment history like prison and mine worker? Basic HIV Course for Health Care Professionals NIMART (2018).

Ethical Clearance

ETHICS APPROVAL CERTIFICATE

RESEARCH AND INNOVATION
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:
Mr J Neluheni

STUDENT NO:
11554291

PROJECT TITLE: Knowledge of students with regards to pulmonary tuberculosis at a selected tertiary institution in Vhembe of Limpopo province.

PROJECT NO: SHS/20/PDC/33/0508

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
Dr TR Luhalima	University of Venda	Supervisor
Dr T Malwela	University of Venda	Co - Supervisor
Mr J Neluheni	University of Venda	Investigator – Student

Type: Masters Research
Risk: Straightforward research without ethical problems
Approval Period: August 2020 – August 2022

The Human and Clinical Trails Research Ethics Committee (HCTREC) hereby approves your project as indicated above.

General Conditions
While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, please note the following.

- The project leader (principal investigator) must report in the prescribed format to the REC:
  - Annually (or as otherwise requested) on the progress of the project, and upon completion of the project
  - Within 48hrs in case of any adverse event (or any matter that interrupts sound ethical principles) during the course of the project.
  - Annually a number of projects may be randomly selected for an external audit.
- The approval applies strictly to the protocol as stipulated in the application form. Would any changes to the protocol be deemed necessary during the course of the project, .the project leader must apply for approval of these changes at the REC. Would there be deviated from the project protocol without the necessary approval of such changes, the ethics approval is immediately and automatically forfeited.
- The date of approval indicates the first date that the project may be started. Would the project have to continue after the expiry date; a new application must be made to the REC and new approval received before or on the expiry date.
- In the interest of ethical responsibility, the REC retains the right to:
  - Request access to any information or data at any time during the course or after completion of the project,
  - To ask further questions; Seek additional information; Require further modification or monitor the conduct of your research or the informed consent process.
  - withdraw or postpone approval if:
  - Any unethical principles or practices of the project are revealed or suspected.
  - It becomes apparent that any relevant information was withheld from the REC or that information has been false or misrepresented.
  - The required annual report and reporting of adverse events was not done timely and accurately,
  - New institutional rules, national legislation or international conventions deem it necessary

ISSUED BY:
UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE
Date Considered: July 2020

Name of the HCTREC Chairperson of the Committee:

Signature: MMLapuntle

Director Research and Innovation

UNIVERSITY OF VENDA
OFFICE OF THE DIRECTOR
RESEARCH AND INNOVATION
2020 -08- 06
Private Bag X5050
Thohoyandou 0950

Signature: ..... GIEkosse..... 06 August 2020

University of Venda
PRIVATE BAG X5050, THOHOYANDOU, 0950, LIMPOPO PROVINCE, SOUTH AFRICA
TELEPHONE (015) 962 8501/8313 FAX (015) 962 0060
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Enquiries to: Ms M.N Mashamba
Email: Mudzunga@tppgroup.co.za
Cell: 066 374 1847

STATEMENT OF COMPLETED WORK DONE: RESEARCH DOCUMENT

This confirms that the dissertation submitted for the Master's degree of Mr J. Neluheni on '*Knowledge of the students regarding pulmonary tuberculosis at a selected tertiary institution in Vhembe district of Limpopo Province, South Africa*' was edited and proofread by us.

CLIENT CONTACT DETAILS:
Ms J Neluheni – joseph.neluheni@univen.ac.za
Contact Numbers: 083 960 1885