Predictors of medication adherence in people hospitalised with tuberculosis: utility of the Health Belief Model

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ABSTRACT

The purpose of this study was to explore the utility of the Health Belief Model (HBM) to predict adherence to treatment for tuberculosis. The first aim was to develop an appropriate, and freely available instrument to measure tuberculosis medication-taking behaviour. The final scale consisted of four self-reported questions, and one question based on information obtained from reports made by health care-providers. I named this scale the Tuberculosis Adherence Scale (TB-AS). The Cronbach's alpha calculated for TB-AS was 0.69.

The second aim of this study was to construct a questionnaire based on the HBM specific to adherence to tuberculosis medication. I administered the HBM measure to 205 participants. Following an item analysis and exploratory factor analysis, 41 items were retained, and five subscales were extracted. I named the subscales Perceived Threat, Perceived Benefits, Perceived Barriers, Self-Efficacy and Cues to Action. I named the questionnaire the Tuberculosis Health Belief Scale (TB-HBS). The TB-HBS demonstrated excellent internal consistency and produced a Cronbach's alpha of 0.87. The Cronbach's alpha for each subscale ranged from 0.72 to 0.81.

The final aim of the study was to explore the utility of the HBM and additional variables to predict adherence to tuberculosis treatment. I used a cross sectional design and 175 participants who were hospitalised at two specialised tuberculosis hospitals in the Western Cape, South Africa were recruited. Adherence was measured using the TB-AS, health beliefs using the TB-HBS and beliefs about medicine evaluated by the Beliefs about Medicine Questionnaire, Alcohol use, drug use and depression were assessed using the Alcohol Use Disorders Identification Test, Drug Use Disorder Identification Test and Beck Depression Inventory respectively.

The results obtained from the TB-AS indicated that 33.1% of participants had low adherence, 34.3% had medium adherence and 32.5% of participants had high adherence. The HBM factors did not significantly predict adherence and explained an additional 2% of variance when included in the regression analysis. Older age [$\beta = 0.24$, t (158) = 3.37, $p < 0.01$], full time occupation [$\beta = 0.18$, t (158) = 2.47, p = 0.01], high belief in the general harm of medication [$\beta = 0.20$, t (158) = 2.07, p = 0.04], fewer specific concerns about tuberculosis treatment [$\beta = -0.04$, t (158) = -2.11, p = 0.04], lower alcohol use [$\beta = -0.20$, t (158) = -2.76, p = 0.01], fewer symptoms of depression [$\beta = -0.16$, t (158) = -2.09, p = 0.04] significantly predicted improved adherence to treatment for tuberculosis. The results of the regression analysis indicated that the

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model explained 21% of the variance in adherence (adj R^2 =0.21, F (3, 158) = 5.12, p< 0.01) yielding a moderate effect size (f^2 = 0.27).

The TB-HBS and the TB-AS showed promise as reliable tools to measure health beliefs and adherence to treatment, respectively. The findings suggest that the HBM may not be an appropriate theoretical model to predict adherence to treatment in this context. Further research is recommended to explore the complex and interacting dimensions that affect adherence to tuberculosis treatment.

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OPSOMMING

Die doel van hierdie studie was om die nut van die Gesondheidsoortuigingsmodel (GOM) te ondersoek om die nakoming van behandeling vir tuberkulose te voorspel. Die eerste doelstelling was om 'n toepaslike, en vrylik beskikbare instrument te ontwikkel om tuberkulose medikasie gebruik gedrag te meet. Die finale skaal het bestaan uit vier self-gerapporteerde vrae en een vraag gebaseer op inligting wat verkry is uit gesondheidsorgverskaffers se verslae. Hierdie skaal word voorts genoem die Tuberculosis Adherence Scale (TB-AS). Die Cronbach's alpha, vir die TB-AS was 0.69.

Die tweede doelstelling was om 'n GOM gebaseerder vraelys op te stel, toegespits op tuberkulose medikasie nakoming. Die GOM-meting is op 205 deelnemers toegepas. Na 'n item ontleding en verkennende faktorontleding was 41 items behou en vyf subskale onttrek. Die subskale word voorts genoem Perceived Threat, Perceived Benefits, Perceived Barriers, Self-Efficacy en Cues to Action en die vraelys die Tuberculosis Health Belief Scale (TB-HBS). Die TB-HBS het uitstekende interne konsekwentheid getoon en 'n Cronbach's alpha van 0.87 opgelewer. Die Cronbach's alpha vir elke subskaal het gewissel van 0.72 tot 0.81.

Die finale doel van die studie was om die nut van die GOM en addisionele veranderlikes te ondersoek om die nakoming van tuberkulose-behandeling te voorspel. 'n Deursnee-ontwerp is gebruik en 175 gehospitaliseerde deelnemers, in twee gespesialiseerde tuberkulose-hospitale in die Wes-Kaap, Suid-Afrika was gewerf. Nakoming is gemeet met behulp van die TB-AS, gesondheidsoortuigings met behulp van die TB-HBS en oortuigings oor medisyne met behulp van die BMQ. Alkoholgebruik, dwelmgebruik en depressie was geëvalueer aan die hand van die AUDIT, DUDIT en BDI.

Die TB-AS resultate het gedui op lae nakoming onder 33.1% van die deelnemers, 34.3% medium nakoming en 32.5% hoë nakoming. Die GOM-faktore het nakoming nie beduidend voorspel nie en het 'n bykomende 2% variansie aangedui toe dit in die regressie-analise ingesluit was. Ouer ouderdom [$\beta = 0.24$, t (158) = 3.37, $p < 0.01$], voltydse beroep [$\beta = 0.18$, t (158) = 2.47, p = 0.01], hoë vertroue in algemene skade berokken deur medikasie [$\beta = 0.20$, t (158) = 2.07, p = 0.04], minder spesifieke kommer oor tuberkulose-behandeling [$\beta = -0.04$, t (158) = -2.11, p = 0.04], laer alkoholgebruik [$\beta = -0.20$, t (158) = -2.76, p = 0.01], minder depressie simptome [$\beta = -0.16$, t (158) = -2.09, p = 0.04] het die nakoming van die behandeling vir

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tuberkulose beduidend voorspel. Die resultate van die regressie-analise het aangedui dat die finale model 'n statisties beduidende 21% van die variansie in nakoming uitmaak (adj R^2 =0.21, F (3, 158) = 5.12, p< 0.01) wat 'n groot effekgrootte lewer (f^2 = 0.27).

Die TB-HBS en die TB-AS het belofte getoon as betroubare instrumente om onderskeidelik gesondheidsoortuigings en die nakoming van die behandeling te meet. Die bevindinge dui daarop dat die GOM moontlik nie 'n toepaslike teoretiese model is om die nakoming van behandeling in hierdie konteks te voorspel nie. Verdere navorsing word aanbeveel om die ingewikkelde en interaktiewe dimensies, wat die nakoming van die behandeling van tuberkulose beïnvloed, te ondersoek.

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LIST OF ABBREVIATIONS

AIDS	Acquired immunodeficiency syndrome
AUDIT	Alcohol Use Disorder Identification Test
BDI	Beck Depression Inventory
BMQ	Belief about Medicine Questionnaire
CT scans	Computerized tomography scan
DOT	Directly Observed Therapy
DOTS	Directly Observed Therapy Short Course Strategy
DS-TB	Drug sensitive tuberculosis
DUDIT	Drug Use Disorder Identification Test
EFA	Exploratory factor analysis
EPTB	Extra-pulmonary tuberculosis
GHS	General Household Surveys
HBM	Health Belief Model
HBMAI	Health Belief Model Applied to Influenza
HIV	Human immunodeficiency virus
HIV-ASES	The HIV Treatment Adherence Self-Efficacy Scale
MDR-TB	Multi drug resistant tuberculosis
MEMS	Medication Events Monitoring System
MERM	Medication Event Reminder Monitor System
MMAS-8	Morisky eight item Medication Adherence Scale

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NCD	Non-communicable disease
PMT	The Protection Motivation Theory
Pre-XDR TB	Pre- extensively resistant tuberculosis
PTB	Pulmonary tuberculosis
RR-TB	Rifampicin tuberculosis
SCT	The Social – Cognitive Theory
SDG	Sustainable Development Goals
SPSS	Statistical Package for the Social Science
STI	Sexually transmissible infections
TB	Tuberculosis
TB-AS	Tuberculosis Adherence Scale
TB-HBS	Tuberculosis Health Belief Scale
TBM	Tuberculosis meningitis
TBMAS	Tuberculosis Medication Adherence Scale
TDM	Therapeutic drug monitoring
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
WHO	World Health Organization
XDR-TB	Extensively drug resistant tuberculosis

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Chapter 1: Introduction

Despite the availability of effective treatment, approximately 1.4 million people died, which is nearly 4000 people per day, worldwide due to tuberculosis in 2019 (World Health Organization [WHO], 2020). Prior to COVID 19, tuberculosis was the greatest killer worldwide due to a single infectious agent and ranks above human immunodeficiency virus (HIV) (Sohrabi, et al., 2020; WHO, 2019, 2020). Adherence to treatment by people infected with tuberculosis is essential to effectively manage this disease. The aim of this dissertation was to explore the effectiveness of the Health Belief Model, along with additional factors, to predict medication adherence in people hospitalised with tuberculosis.

The Health Belief Model (HBM) is a one of the psychological theories that has been applied to understanding the reasons for health-related actions such as adherence to treatment (Conner & Norman, 2005; Glanz et al., 2008). The HBM postulates that perceptions and beliefs are the core factors that influence an individual's chosen health related action (Rosenstock et al., 1988). When the HBM is applied to adherence to treatment, it is hypothesized that the belief that the illness is a threat and that the benefit of adherence will outweigh the cost, will predict adherence to treatment (Horne et al., 2013). Reminders to take treatment and the belief of the individual in in his/her capacity to succeed will increase the likelihood that an individual will adhere to treatment. (Horne et., 1999). The HBM has been applied to medication adherence for several conditions including hypertension, diabetes, HIV, and tuberculosis (Azizi et al., 2018; Erkin & Özsoy, 2012; Jahan et al., 2014; Vitalis et al.,2017; Yang et al., 2016;). However, there is a paucity of quantitative studies that have utilized the HBM to predict adherence to treatment for active tuberculosis in South Africa.

1.1 Tuberculosis

Tuberculosis has infected and affected humankind throughout history and is considered one of the oldest human afflictions (Daniel, 2006). Various strains of tuberculosis bacilli were present in East Africa three million years ago, and this suggests that our hominid ancestors may have been infected with tuberculosis (Gutierrez et al., 2005). On 24 March 1882, Robert Koch announced his discovery of the specific tubercle bacillus *Mycobacterium tuberculosis*, as the cause of tuberculosis (Daniel, 2006). It was hoped that Koch's discovery would lead to the

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eradication of the disease that in the 19th century caused the deaths of 25% of the population of Europe (Keshavyee & Farmer, 2012). This hope, however, was not realized.

The World Health Organization (WHO) declared tuberculosis a global health emergency in 1993 following the report of 1.9 million tuberculosis deaths in 1990 (WHO Global Tuberculosis Programme, 1994). Since then, the WHO has embarked on various global strategies to address the spread of tuberculosis (WHO, 2017a). These strategies have met with some success, and it was estimated that by 2016 incidences of new infections had decreased globally by an average of 1.3% since 2000 (WHO, 2017a). Most new cases of active tuberculosis are sensitive to the current standardized treatment regime (WHO, 2017b). This treatment has routinely shown a cure rate of more than 95% in numerous clinical trials (Ginsberg & Spigelman, 2007). However, despite the availability of effective treatment, many people continuously become infected with - and die from tuberculosis every year.

1.1.1 Prevalence of tuberculosis

The global average incidence of tuberculosis is approximately 130 new cases per 100 000 population per year. There were roughly ten million new cases of people infected with tuberculosis worldwide in 2019 (WHO, 2020).

The best estimate of total tuberculosis incidence in South Africa for 2019 was 615 (range 427 – 835) per 100 000 people which accounts for 3.6% of the global total (WHO, 2020). South Africa had the third highest estimated incident rate of tuberculosis among the 20 countries with the highest estimated absolute number of tuberculosis (WHO, 2019, 2020). Approximately 301 000 people became ill, and 58 000 people died from tuberculosis in South Africa in 2019 (WHO, 2020).

Current prevalence of tuberculosis and associated mortality have shown a reduction when compared to the available data from 2000. There was a 31% reduction in tuberculosis related deaths in HIV negative people and a 69% reduction in tuberculosis related deaths among HIV positive people in 2019 as compared to 2000 (WHO, 2020).

According to a 15-year review, it was estimated that 33 million deaths globally and 1.6 million deaths in South Africa were attributed to tuberculosis between 2000 and 2015 (WHO, 2017). The WHO projected that based on the implementation of strategies to address the spread of tuberculosis the number of deaths from tuberculosis for the period 2015-2030 will decrease as

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compared to the previous 15 years, to 28 million globally at a global cost of $983 billion (WHO, 2017a).

While there has been progress made to eradicate tuberculosis, the milestone as part of the End TB Strategy of a 35% reduction of deaths due to tuberculosis between 2015 and 2020 is unlikely to be realized (WHO, 2020). The current global strategies and the sustainable development goals are aimed towards the end of the tuberculosis epidemic by 2035 (WHO, 2017a). The strategy required to achieve this goal involves a holistic, multidimensional approach to the management of tuberculosis (WHO, 2014b, 2015, 2017a). Adherence to treatment for tuberculosis is essential both to achieve good clinical outcomes, improve quality of life, and to decrease the length of time that an infected individual can transmit the disease.

1.1.2 Clinical aspects of tuberculosis

Tuberculosis is usually transmitted from one person to another through the airborne route (Joon et al., 2017). Droplet nuclei are produced when a person with pulmonary or laryngeal tuberculosis coughs, sneezes talks or sings. Less than ten bacilli can result in infection with tuberculosis, and one cough can produce 3000 droplet nuclei containing bacilli and a sneeze up to one million (South African Department of Health, 2014). Not every person who inhales *Mycobacterium tuberculosis* bacilli will become infected with tuberculosis, and the development of active disease is dependent on various factors including the immune system of the exposed individual. The specific clinical manifestation of tuberculosis and the severity and extent of potential harm may differ according to the primary site of infection. The treatment given for tuberculosis depends on the resistant strain of the bacilli as well as the area of the body that is infected (WHO, 2016b, 2017a).

Once the bacillus is inhaled, it is usually deposited in the respiratory bronchioles or alveoli and ingested by alveolar macrophages in the lungs (South African Department of Health, 2014). The immune system of most people who inhale tuberculosis bacilli can contain the disease and the disease will remain dormant. It is estimated that up to one third of people globally are infected with this dormant form of the disease which is known as latent tuberculosis (WHO, 2018). Approximately 5% to 10% of people, usually due to a compromised immune system, will develop active disease (WHO, 2018).

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Pulmonary tuberculosis (PTB) is the most common form of the disease with the infection occurring in the lungs (South African Department of Health, 2014). However, tuberculosis bacilli can spread to various sites in the body including organs other than the lungs, lymph nodes, joints, and bone. The signs and symptoms of tuberculosis can vary according to the area, or areas, that have become infected.

1.1.3 Signs and symptoms of tuberculosis

Tuberculosis can have severe physiological implications which can impact on quality of life, lead to permanent structural lung and organ damage, and cause death (Dheda et al., 2016). There are common systemic symptoms that are evident in most types of tuberculosis: (1) unintentional or unexplained weight loss of more than 1.5kg in a month; (2) fever for more than two weeks; (3) night sweats (South African Department of Health, 2014).

In addition to the three common symptoms listed above, a person with pulmonary tuberculosis (PTB) will usually have a persistent cough, shortness of breath and chest pains. PTB is the most infectious type of tuberculosis and occurs in over 80% of cases (South African Department of Health, 2014). Other symptoms of PTB include lack of appetite as well as metabolic changes that can lead to severe wasting from loss of fat and muscle tissue (Joon et al., 2017). Tuberculosis can affect almost any part of the body and infection occurring outside of the lungs is broadly referred to as extra-pulmonary tuberculosis (EPTB).

Symptoms of EPTB are dependent on the location of the infection. In the case of tuberculosis meningitis, the common systemic features of weight loss, fever and night sweats are experienced with the additional symptoms of headache, confusion, neck-stiffness, decreased consciousness and occasionally vomiting (South African Department of Health, 2014). If tuberculosis occurs in the stomach, significant stomach pain, possible bowel obstruction and abdominal masses are expected. Tuberculosis can affect any bone resulting in pain and decreased mobility in the affected area. The spine is the most commonly affected bone (Joon, et al., 2017). In addition to the common systemic symptoms (weight loss, fever, night sweats) local pain, tenderness and stiffness of the back as well as muscle spasms, cold abscess and spinal deformity may be present with tuberculosis of the spine (South African Department of Health, 2014). Tuberculosis of the spine can result in difficulty with mobilization and permanent disability.

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In approximately 20% of people with EPTB, the disease spreads through the blood or lymph system to more than one area within the body resulting in disseminated tuberculosis (Joon et al., 2017). A person with disseminated tuberculosis will often have significant weight loss with additional symptoms depending on the infection site (South African Department of Health, 2011).

It is essential to promptly screen, correctly diagnosis, and accurately identify the resistant profile of the organism to be able to initiate treatment that is effective (South African Department of Health, 2014; WHO, 2014b) The management of tuberculosis includes a multiple drug medication regime (presented in Table 2) and may require life-style changes to ensure adherence and decrease vulnerability to re- infection.

1.1.4 Management of tuberculosis

The effective management and treatment of tuberculosis requires an accurate diagnosis and the commencement of optimal medication which is used correctly (WHO, 2015). The rapid initiation of effective treatment will both increase the likelihood of a favorable outcome for the infected individual, as well as decrease the period of infectiousness (WHO, 2014b). Optimal management requires the identification of vulnerable people, accurate screening and testing for tuberculosis, and focused intervention to promote adherence to treatment.

1.1.4.1Tuberculosis and vulnerable populations

The risk of exposure to tuberculosis and the development of active disease are higher in certain populations. People who are more likely to be exposed to tuberculosis bacilli for a longer period such as contacts of people with active tuberculosis, health care workers, inmates and people living in an informal settlement are at increased risk of infection (Munro, Lewin, Smith, et al., 2007; Sabaté, 2003; South African Department of Health, 2014).

Tuberculosis is strongly associated with conditions of poverty both in relation to increased vulnerability to infection as well as non-adherence to treatment (Hargreaves, 2011; Lutge et al., 2014; WHO, 2020). People who live in informal settlements are more vulnerable to spread of infections, such as tuberculosis, due to high population density, and lack of access to resources such as clean water, sanitation, and health care (Weimann & Oni, 2019).

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People who develop active tuberculosis are usually immunocompromised and certain disease such as silicosis, diabetes and HIV affect the immune response (South African Department of Health, 2014; WHO, 2018). Infection with HIV or diabetes is associated with an increased risk of the development of active tuberculosis (WHO, 2018). According to the South African National strategic plan 2017-2022, it was estimated that 63% of the 450 000 new tuberculosis cases diagnosed in 2015 in South Africa were among HIV positive people (South African National AIDS Council, 2017). Diabetes increases the risk of development of active tuberculosis by between 2.3% and 4.3%, with approximately 800 000 of the 10.4 million people newly infected with tuberculosis world-wide in 2016 also have comorbid diabetes (WHO, 2017a).

In addition to disease, other demographic or lifestyle factors can increase vulnerability to tuberculosis. People who are pregnant, malnourished, under five years of age, elderly and exposed either actively or passively to tobacco smoke are at a greater risk for developing active tuberculosis (WHO, 2017b). Heavy drinking of alcohol and substance use is associated with both an increased risk of development of tuberculosis, as well as a decreased adherence to treatment (Chaulk & Moonan, 2020; South African Department of Health, 2014; WHO, 2010).

1.1.4.2 Diagnosis of tuberculosis

People are usually tested for tuberculosis when they begin to show signs and symptoms typical of tuberculosis and it is recommended that people who are more vulnerable to infection with tuberculosis are actively screened for any symptoms of tuberculosis infection (WHO, 2013). However, it is estimated that no observable symptoms are experienced by 10-25% of people who are confirmed to have active tuberculosis (WHO, 2011a).

A diagnosis of tuberculosis is usually based on microbiological, molecular, or radiographic investigation (South African Department of Health, 2014; WHO, 2017b). Microbiological testing is done in a laboratory and includes microscopic observation of bacilli in relevant clinical samples (pus, sputum, or tissue) and/or cultures. Molecular testing requires specialised equipment to determine the genetic profile of the *Mycobacterium tuberculosis* present in the clinical sample. Radiographic evaluation can be performed based on X-Rays, CT scans or ultrasound (South African Department of Health, 2014).

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In addition to using tests to diagnose active tuberculosis, it is necessary to determine which treatment will be most effective based on the specific strain of tuberculosis. People who have not been adherent to treatment, or if resistance to treatment is suspected, require specialised tests to determine the drug sensitivity of the bacteria (South African Department of Health, 2014). Accurate testing confirms the presence of active tuberculosis and can indicate the resistant profile of *Mycobacterium tuberculosis* that an individual is infected with.

1.1.5 Types of tuberculosis

Tuberculosis is classified according to the anatomical site where the infection is located and the resistant profile of the organism (South African Department of Health, 2014). Tuberculosis bacteria are capable of change, thus making them resistant to certain medications. Identification of the resistant profile is essential to ensure that treatment to which the bacteria are susceptible is prescribed. As shown in Table 1, tuberculosis is classified as drug sensitive, rifampicin resistant, multi-drug resistant, pre-extensively drug resistant or extensively drug resistant depending on the specific medications to which the bacteria are resistant (WHO, 2017a, 2021).

People who are classified as being infected with drug sensitive tuberculosis are susceptible to, and thus treated with, the standardized first line drugs that are available (South African Department of Health, 2014; WHO, 2017b). *Mycobacterium tuberculosis* that is resistant to rifampicin, which is considered a powerful first line-drug, is defined as rifampicin resistant tuberculosis (RR-TB). If the bacteria are resistant to both the most important first-line tuberculosis drugs (isoniazid and rifampicin) then the disease is classified as multi-drug resistant tuberculosis (MDR-TB). The term extensively drug-resistant tuberculosis (XDR-TB) was introduced in 2006. An outbreak of XDR-TB in the Tugela Ferry region of the province of Kwa-Zulu Natal in South Africa in 2006, where 52 of the 53 people diagnosed with XDR-TB died, highlighted the deadly nature of this strain of tuberculosis (Wise, 2006). XDR-TB is defined as being resistant to all first line drugs as well as any of the fluoroquinolones (Group A drugs in Table 2) and any injectable or any of the core second line (Group C in Table 2) tuberculosis drugs (WHO, 2014d, WHO 2017b). In January 2021, the WHO announced an updated definition of XDR-TB and introduced pre-XDR as a new category of drug resistant tuberculosis (WHO, 2021). The core change in the definition of XDR-TB is the specification of the Group A

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and Group C medication to which resistance has developed, and the drugs levofloxacin, moxifloxacin, bedaquiline and linezolid are included (WHO, 2021). Pre-XDR is a strain of *Mycobacterium tuberculosis* that fulfil the definition of either MDR-TB or RR-TB and is also resistant to any fluoroquinolone (WHO, 2021). Table 1 shows the classification system of tuberculosis based on the resistant profile of the bacilli and the usual treatment duration.

Table 1

Classification of tuberculosis based on resistance.

Classification	Resistant profile	Treatment Duration
Drug -sensitive (DS-TB)	No resistance to rifampicin or isoniazid	6 – 9 months
Rifampicin resistant (RR-TB)	Resistant to rifampicin	9 - 12 months (short course) 24 months (long course)
Multi- drug resistant (MDR-TB)	Resistant to rifampicin and isoniazid	9 - 12 months (short course) 24 months (long course)
Pre extensively drug resistant (Pre-XDR)	Resistant to rifampicin or rifampicin and isoniazid and any fluoroquinolone	24 Months
Extensively drug-resistant (XDR-TB)	Resistant to rifampicin and isoniazid and any of the drugs from the fluoroquinolone class and at least one of levofloxacin, bedaquiline and linezolid	24 months

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Drug resistant tuberculosis requires treatment with more toxic medication for a longer time as compared to DS-TB. The resistant profile of the disease will affect the types of drugs that are used as well as the duration of treatment according to treatment guidelines.

1.1.6 Guidelines for treatment of tuberculosis (adults)

The first medications for treatment of tuberculosis, p-aminosalicylic acid and streptomycin, were introduced in 1944 - more than 60 years after Robert Koch identified the *Mycobacterium tuberculosis* bacilli. The first person declared cured following treatment was in 1947 (Keshavyee & Farmer, 2012). Over the course of the next 20 years eight drugs were introduced with the two most effective drugs being isoniazid (introduced in1951) and Rifampicin (introduced in 1957) (Keshavyee & Farmer, 2012). These two core drugs are still used today in the treatment of drug sensitive tuberculosis (WHO, 2017b).

Drug susceptible tuberculosis in adults is treated in two phases over a period of six to nine months (South African Department of Health, 2014, WHO, 2017b). The first intensive phase lasts for two to three months. Four different types of drugs (isoniazid, rifampicin, pyrazinamide, ethambutol), which have been combined into one tablet, are given for five days per week (usually two tablets). During the continuation phase, the number of drugs used is decreased to two drugs (isoniazid and rifampicin), five days a week for a period of four to five months (usually two tablets). If a person is being treated for DS-TB for the first time, then the entire duration of treatment is six months. If a person is presenting for retreatment either after cure or non-adherence, then medication is required to be used for eight to nine months (South African Department of Health, 2014; WHO, 2017b).

The guidelines for standardized RR-TB and MDR – TB regime consists of at least six months of intensive phase treatment with five drugs and one injectable taken six times per week (South African Department of Health, 2013). The intensive phase is followed by a continuation phase of four drugs taken at least six times per week. The continuation phase lasts for at least eighteen months after culture conversion which is determined by a specialised laboratory test performed on sputum.

The intensive phase for XDR-TB treatment includes seven drugs (12 – 18 tablets plus an injection) taken daily for at least six months, with the duration guided by culture conversion. The intensive phase is followed by a continuation phase for at least eighteen months after culture

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conversion. During the continuation phase six different drugs are taken daily and the injectable is stopped. In some instances, a surgical intervention may be performed including the removal of part of the lung (Dheda et al., 2016).

In May 2016, the WHO organization updated the treatment guidelines for MDR- TB and RR -TB treatment based on a shorter regimen without an injectable that had been successfully used in several countries (WHO, 2016b). Treatment may be given for a shorter duration of nine to twelve months under specific conditions. The treatment regimen consists of seven drugs (14 – 21 tablets) during the intensive phase of four to six months, followed by four drugs (8 – 12 tablets) given for five months in the continuation phase. The South African National Department of Health endorsed the use of the shorter regimen when appropriate and the Western Cape began using this shorter course of treatment in some cases in October 2017 (Cloete, 2017).

In the last decade with increased global funding several new or repurposed drugs are in various stages of development. In South Africa, three new drugs (linezolid, bedaquiline, delamanide) were rolled out since 2015, marking the first new treatment for tuberculosis in nearly 40 years (Directorate DR-TB, 2015). However, if people do not adhere to treatment, then a strain of tuberculosis that is resistant to these new medications will most likely appear. It is essential to ensure that these newly developed medications are protected, and that adherence to treatment is improved if the End TB strategy and associated goals are to be realized.

Treatment for DR-TB usually requires a combination of medication from different groups of available treatment. The medication that is available for the treatment of drug resistant tuberculosis is shown in Table 2.

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Table 2

Second – line drugs available for the treatment of DR-TB

Group and class of drug	Name of medication
Group A	Levofloxacin
Fluoroquinolones	Moxifloxacin
	Gatifloxacin[1]
Group B	
Second line injectables	Amikacin
	Capreomycin
	Kanamycin
	Streptomycin[1]
Group C	
Other core second line drugs	Ethionamide/Prothionamide
	Cyloserine[1] /Terizidone
	Linezolid
	Clofazimine
Group D	
Add on agents	Pyrazinamide
	Ethambutol
	High-dose isoniazid
	Bedaquiline
	Delamanide
	p-aminosalicylic acid
	Imipenem-cilastatin
	Meropenem
	Amoxicillin-clavulanate[1]
	Thiocetazone[1]

Note. [1]These are not routinely used in South Africa

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1.1.7 Global strategies to manage tuberculosis

The WHO declared tuberculosis a global emergency in 1993 following a report that an estimated 1.9 million people had died in 1990 from tuberculosis (WHO Global Tuberculosis Programme, 1994). It was feared that if trends continued unabated the number of tuberculosis deaths might reach four million by the year 2000 (WHO Global Tuberculosis Programme, 1994).

Following the declaration of tuberculosis as a global emergency, several strategies have been implemented in an intensified effort to control tuberculosis. In 1994 the WHO introduced the Directly Observed Treatment, Short-Course (DOTS) strategy aimed at improving global control of tuberculosis (WHO, 1999). This was expanded in 1999 to DOTS-Plus to incorporate the emergence of drug resistant tuberculosis and the high coinfection of HIV and tuberculosis (WHO, 2002). There were five components to this strategy: (1) sustained political commitment to make resources available for the management of tuberculosis; (2) improving the detection of new cases through the availability of quality sputum microbiology; (3) standardized treatment provided for all people with active tuberculosis under direct observed supervision (DOT) with effective case management; (4) sufficient systems to supply appropriate medication; (5) standardized methods to report and record relevant information (WHO, 1999).

The DOTS strategy (1994-2006) reinforced the principle that the treatment of tuberculosis required a comprehensive multi sectoral approach which included methods to improve adherence (WHO, 2006). In 1998 a global partnership, Stop TB, that aimed to link health, social and economic sectors in the fight against tuberculosis was launched (WHO, 2002). This partnership culminated in the signing of The Amsterdam Declaration on 24 March 2000; 118 years after the ground-breaking discovery of Robert Koch was announced (Banta, 2000). The Amsterdam Declaration and the Stop TB Partnership resulted in 148 countries implementing the DOTS strategy (Banta, 2000; WHO, 2002). South Africa was one of the countries to implement DOTS including direct observation of treatment by a responsible treatment supporter (South African Department of Health, 2000). The Stop TB Strategy was published by the WHO in 2006 with the purpose of guiding policy regarding tuberculosis such that the Global Millennium Goals that pertained to tuberculosis could be met (WHO, 2006).

The latest strategy, End TB (2016-2035), was endorsed by the United Nations in 2014 and was included as one of the Global Sustainable Development Goals (2016 – 2030). The goal is to end the tuberculosis epidemic globally by 2035 (WHO, 2014b, 2016a). The South African

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National Strategic Plan for HIV, TB and STIs 2017 -2022 incorporates the 90-90-90 targets as set forth in the Sustainable Development Goals (SDG) and End TB strategy (South African National AIDS council, 2017). The goal is for 90% of people who are diagnosed with active tuberculosis to receive appropriate therapy, 90% of people in vulnerable populations to be screened, and 90% of people diagnosed with tuberculosis to be successfully treated. The End TB strategy is based on three fundamental pillars: (1) integrated patient-centered tuberculosis care and prevention, (2) bold policies and supportive systems, (3) intensified research and innovation (WHO, 2014b).

It seems obvious that medical treatment cannot work if people receiving treatment do not follow medical advice. Based on the pillar of patient-centered care, it is recommended that each person started on treatment for tuberculosis should be evaluated for potential challenges regarding adherence and appropriate interventions implemented (WHO, 2014b). Some of the strategies recommended to improve adherence include patient and staff education, direct support in terms of provision of food or other financial incentives, offering psychological support and implementing reminder systems (WHO, 2017b). The South African Department of Health (2016) published adherence guidelines for HIV, tuberculosis, and non-communicable disease. This publication includes guidelines for testing, retaining people in care through monitoring of adherence and attendance of clinic appointments, early identification of potential barriers to adherence and implementing targeted counselling-based intervention (South African Department of Health, 2016).

1.1.8 Healthcare and tuberculosis in the South African context

Prior to the end of apartheid in 1994, White people were generally privileged over other racial groups (Warren, 1995). Since becoming a democracy, the South African government has implemented strategies to improve access to healthcare for poor and most marginalized people by increasing the number of health care facilities, prioritizing primary health care and abolishing fees for primary health care (Van Rensburg, 2014). However, despite these improvements poor people are more likely to experience challenges with accessibility and availability of health care as compared to non-poor people (Burger & Christian, 2020). Marginalized populations have a higher rate of poverty in South Africa (Stats SA, 2017). Most poorer people access health care from government funded clinics or hospitals, while people with a higher socioeconomic status access private health care usually through medical aid (Burger & Christian, 2020). Most White

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people (72.2%) and Asian people (51.4%) have medical aid coverage, whereas 17% of Coloured people and 9.8% of Black African people are covered by medial aid (Stats SA, 2018).

The estimated prevalence of tuberculosis in South Africa in 2018, according to the First National TB Prevalence Survey (2020) was 737 per 100 000 population (Van der Walt & Moyo, 2021). According to the 2014/2015 National Income dynamics Study (NIDS), people categorized as Black South Africans had the highest prevalence of tuberculosis (1643 per 100 000), followed by Coloured people (1227 per 1000 000) and White people (9 per 100 000) (Bendavid et al., 2017). The association between poverty and tuberculosis is unequivocal (WHO, 2020). Bendavid et al. (2017) determined, based on the 2013 South Africa General Household Survey (GHS) and the 2014/2015 NIDS, that the prevalence of tuberculosis was five times higher in the lowest socioeconomic households relative to the highest.

Treatment for tuberculosis in South Africa is available at no cost. However, tuberculosis can perpetuate poverty through loss of income due to inability to work, increased costs associated with accessing health services and the need for additional care such as help with household duties (Foster et al., 2015). South Africa introduced a decentralized model of care for the management of drug-resistant tuberculosis in 2011 which has met with some success despite some challenges with practical implantation (Vanleeuw et al., 2020). Prior to 2011, people with MDR or RR tuberculosis were hospitalised at a specialised tuberculosis hospital for the duration of treatment. In the Western Cape decentralization allowed people to access treatment as an outpatient at any of the 406 local facilities that offered care as opposed to requiring hospitalization at one of the six available tuberculosis hospitals (Leavitt et al., 2021). The decentralized model has resulted in improved access to care, higher case detection, better outcomes, and lower costs (Cox et al., 2014; Leavitt et al., 2021). Access to treatment, and continuous adherence to effective medication is essential if the goals to eradicate tuberculosis are to be reached.

Numerous studies have been conducted to understand adherence to treatment in various context. The results show that adherence is a complex, multifaceted behaviour with people reporting numerous reasons for non-adherence (Jin et al., 2008; Munro, Lewin, Smith, et al., 2007; WHO, 2003). Health behaviour theories such as the Health Belief Model (HBM) provide a theoretical background from which to explain, understand and predict adherence (Munro, Lewin, Swart, et al., 2007).

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1.2 Health Belief Model

I evaluated the effectiveness of the HBM to predict adherence to tuberculosis treatment in the current study. The HBM was chosen for use in the current study as it is the most widely used model in health psychology and has been applied to many different behaviours including medication adherence (Abraham & Sheeran, 2005; Carpenter, 2010; Munro, Lewin, Swart, et al., 2007; Tarkang & Zotor, 2015). The HBM was originally developed to explain why people were not following medical advice (Rosenstock, 1974). Since then, this model has been used in a variety of studies to explain specific health behaviours. Some studies have focused on behaviour to detect or prevent illness such as preventative mammograms, condom use and more recently to preventative behaviours related to COVID- 19 (Champion, 1998; Jose et al., 2020; Tarkang & Zotor, 2015). Other studies have considered the influence of HBM constructs in sick role behaviours such as participation in cardiac rehabilitation or adherence to treatment (Horwood et al., 2015; Malcolm et al., 2003; Pourghaznein et al., 2013).

The theory of the HBM is that perceived susceptibility, perceived severity, perceived benefits, perceived barriers as well as cues to action and self-efficacy will impact on the health behaviours of an individual (Conner & Norman, 2005). Demographic factors, socioeconomic factors and personality are modifying variables that can influence perceptions. People are thus believed to make rational decisions regarding adherence to treatment. According to the HBM, if people perceive that tuberculosis is serious and that they are likely to become infected then they will feel threatened. Action to mitigate this threat based on weighing up perceived barriers and benefits of adherence to treatment will be taken. If they believe that they are capable of being adherent and they receive either internal or external cues to encourage adherence, then chances of taking the action of adherence to treatment is increased. Thus, greater perception of threat, benefits, self-efficacy, and cues to action with less barriers will result in improved adherence (Conner & Norman, 2005).

Figure 1 provides a graphical representation of the HBM constructs and how these are theorized to influence health related action.

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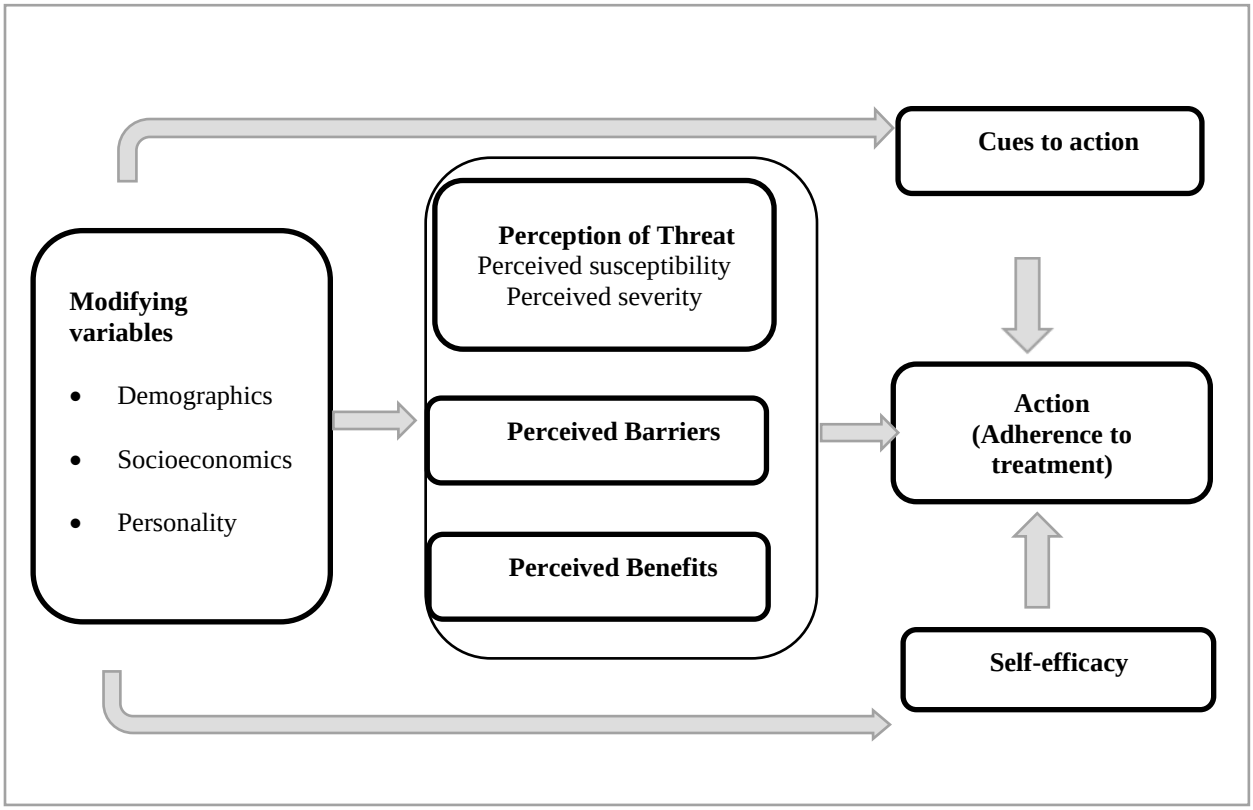

Figure 1 Graphical representation of the Health Belief Model (adapted from Conner & Norman, 2005)

There are no routinely used general questionnaires available to measure the HBM constructs. Researchers have developed tools that have been used for specific conditions, such as adherence to hypertension medication (Kamran et al., 2014). A recent study used a purposively designed questionnaire based on the HBM to determine adherence to tuberculosis treatment in Iran (Azizi et al., 2018). Research indicates that the HBM appears to be a suitable model to predict adherence to treatment for tuberculosis.

1.3 Problem Identification

Prior to the outbreak of coronavirus (COVID-19) in December 2019, tuberculosis was the biggest killer worldwide by a single infectious agent (WHO, 2020). The COVID – 19 outbreak was declared a Public Health Emergency by the WHO on 30 January 2020 (Sohrabi et al., 2020).

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There were 1.9 million deaths worldwide attributed to COVID-19 in 2020 (Worldometer, n.d.). Concerns have been raised that COVID-19 may negatively impact the diagnosis and treatment provided for tuberculosis due to the disruption of essential healthcare services (Khan et al., 2021). It has been suggested that there may be an additional 1.4 million deaths worldwide from tuberculosis between 2020 and 2025 due to health care disruptions caused by COVID-19 (Stop TB Partnership., 2021). It is predicted that the countries with a high burden of tuberculosis will be the most affected by the social and economic effects of COVID-19 which may result in a dramatic increase in the incidence of tuberculosis (Saunders & Evans, 2020).

South Africa has the third highest prevalence of tuberculosis among the 20 high-burden countries in terms of absolute number of cases (WHO, 2020). The target treatment success rate of new active tuberculosis cases in South Africa as set out in the National Strategic Plan on HIV, STIs and TB: 2017-2022 is 90% for drug sensitive tuberculosis and 75% for drug resistant tuberculosis (South African National AIDS Council, 2017). It has been suggested that strategies to improve adherence may have a greater impact on global health than the improvement of medical treatment (Sabaté, 2003). Medication adherence to tuberculosis treatment has not been sufficiently studied in South Africa (O'Donnell et al., 2016; Van Den Boogaard et al., 2011).

There was only one study found in the literature review that specifically used the Health Belief Model as the theoretical paradigm to predict adherence to tuberculosis treatment in South Africa (Peltzer et al., 2002). Consultation of the references and studies included in several meta-analysis and systematic reviews relating to adherence showed limited South African based studies exploring adherence to tuberculosis treatment (Janz & Becker, 1984; Munro, Lewin, Smith, et al., 2007; Munro, Lewin, Swart, et al., 2007; Sabaté, 2003). A systematic review of 20 years of research that used health psychology theories to predict adherence to treatment had no tuberculosis-specific study included in their review (Holmes et al., 2014). The South African Department of Health (2016) published the "Adherence Guidelines for HIV, TB and NCDs: Policy and service delivery guidelines for linkage to care, adherence to treatment and retention in care". In their list of 80 references, there are no studies that focused primarily on adherence to tuberculosis treatment. Dr. Ditiu, Executive Director of the Stop TB Partnership explained that: "Years of chronic neglect have led to an unbearable situation in which TB kills more than 4000 people a day - more than HIV and malaria combined - and still, too few decision makers and stakeholders care about TB" (Stop TB Partnership, 2021). The incoming vice-chair of the Stop

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TB Partnership and Executive Director of Afro Global Alliance Chief Obiefuna stated: “Despite being one of the leading infectious disease killers in the world, TB remains an orphan disease, never a political priority and never high up on funding agendas (Stop TB Partnership, 2021). The relative lack of research pertaining to adherence to treatment for tuberculosis appears to support these viewpoints.

A good understanding of factors that determine adherence to treatment can contribute towards improving treatment outcomes for tuberculosis, limiting the spread of the disease, and decreasing development of drug resistant tuberculosis. Hence the goal of the current study was to explore the utility of the Health Belief Model to predict adherence to treatment of people hospitalised for tuberculosis. The aims outlined below were achieved by using quantitative research with a cohort of 215 participants who had been hospitalised for treatment for tuberculosis.

1.4 Research aims

Aim 1: To develop a tuberculosis medication adherence scale (TB-AS).

Aim 2: To construct a Tuberculosis Health Belief Questionnaire (TB-HBS).

Aim 3: To quantitatively assess the utility of the HBM and the addition of beliefs about medicine, alcohol use, drug use and depression to explain the variance in adherence to treatment in people hospitalised with tuberculosis.

1.5 Impact of the study

Improving the understanding of predictors to non-adherence to tuberculosis medication can assist in implementation of targeted strategies for people at risk for poor adherence. In a high burden country for tuberculosis such as South Africa where resources are limited, optimal interventions for people identified to be at risk for poor adherence is essential to reach the goal of ending tuberculosis. The purposively designed tuberculosis adherence scale (TB-AS) incorporated both health care providers record of adherence and a self-reported adherence. The development of a reliable tuberculosis specific adherence tool that is valid for use in the South African context can provide a standardized method to measure adherence.

The newly developed Tuberculosis Health Belief Scale (TB-HBS) could be used in future research in understanding and improving adherence to treatment for tuberculosis. The results of

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this study may allow for an expanded model that includes depression, alcohol use, drug use and beliefs about medicine to predict adherence to tuberculosis medication and inform strategies to improve adherence.

1.6 Organization of the dissertation

Chapter One. In the first chapter of the dissertation a background to tuberculosis and the HBM are introduced. The identification of the problem followed by the aims and anticipated impact of the study are presented. The organization of the dissertation including a summary of each chapter is provided.

Chapter Two. The review of available literature begins with an explanation of adherence, including how it is defined and measured. The impact of poor adherence and factors that influence adherence to treatment for tuberculosis is explored. Lastly, the theoretical models that have been applied to understanding health related behaviour, with specific emphasis on the HBM are presented.

Chapter Three. The research methodology for this study is presented in Chapter Three.

Chapter Four. The development of a scale to measure adherence to tuberculosis (TB-AS) treatment and the scale to measure the HBM constructs relating to adherence to tuberculosis (TB-HBS) are presented. The results of the reliability analysis and factor analysis pertaining to the identification of subscales within TB-HBS are explained.

Chapter Five. The methodology and the results of the study related to the applicability of the HBM, and the addition of demographic factors, beliefs about medicine, symptoms of depression and substance use to predict adherence to treatment for tuberculosis are presented in Chapter Five.

Chapter Six. A discussion of the results and a conclusion of the study are provided in the final chapter. This includes a presentation of the limitations of the study, implications for practice, as well as recommendations for future research.

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Chapter 2: Literature review

The World Health Organization (WHO) has been recording tuberculosis statistics from participating countries and territories for two decades. The Millennium Development Goals were established by the United Nations in 2000 with targets set for the reduction of the burden of tuberculosis to be achieved by 2015. An evaluation of the results of these goals indicated that by 2015 the tuberculosis mortality rate reduced by 47% and the tuberculosis prevalence decreased by 42% globally since 2000, which translates into 43 million lives being saved (WHO, 2015). This decrease in mortality and prevalence of tuberculosis was not achieved due to any specific medical break-through, but due to system level strategies such as The Stop TB Strategy that aimed at effective diagnosis, access to treatment and improved adherence (WHO, 2015). The latest available figures pertaining to tuberculosis indicates ongoing reduction in prevalence and mortality as compared to previous years (WHO, 2019, 2020). However, despite the comparative success, there were 1.4 million deaths due to tuberculosis in 2019 (WHO, 2020). The current WHO strategy End TB (2016 – 2035) is aimed towards the global end to the tuberculosis epidemic (WHO, 2016). Adherence to treatment is essential if this goal is to be realized.

This chapter explains adherence to treatment including reasons for, and consequences of, non-adherence to tuberculosis treatment. The theoretical framework of the Health Belief Model and how this model can be used to predict adherence to treatment for tuberculosis is explored.

2.1 Definition of Adherence

The terms compliance, concordance and adherence are sometimes used interchangeably and although there are subtle differences in the meanings of these words, they all imply a degree of following rules (Horne et al., 2005) Adherence in a medical context has been defined as “the extent to which patients follow the instructions they are given for prescribed treatments” (Haynes et al., 2002, p.4).. However, there has been a move away from the narrow view that people who are diagnosed with a disease should passively follow the instructions of a medical professional who is considered as being superior. The WHO suggested that adherence to treatment should be defined as “the extent to which a person’s behaviour-taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider” (Sabaté, 2003, p.18). This definition of adherence is person-centered and takes into

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consideration the view that an individual should not only obey instructions, but that treatment should be fully discussed with, and agreed to, by all relevant stakeholders. Monitoring and measuring adherence could assist to identify and address difficulties that people are facing regarding adherence.

There are various definitions of what constitutes optimal adherence. Different thresholds are applied which are often based on the method used to assess adherence (Valencia et al., 2017). Morisky et al. (2008) for example classify a score of above eight in their MMAS-8 self-reported adherence scale as constituting high adherence, a score between six and eight as medium adherence and below six as low adherence. The WHO on the other hand recommended that a patient be considered adherent if their adherence percentage, calculated as proportion of number of pills absent versus number of pills prescribed, is greater than 80% (Brown & Bussell, 2011). Comparisons of adherence across studies and can be challenging as both the definition and measurement of adherence varies.

2.2 Methods to Assess Adherence to Medication

There is no gold standard for the measurement of adherence to treatment. On a population level the difference between adherence and non-adherence is often reported based on the recorded outcome of treatment.

Outcomes are one set of information that is recorded in terms of the WHO tuberculosis data requirements which are collected from participating countries. Outcomes for tuberculosis are based both on clinical outcomes of cure, treatment failure and death; as well as treatment outcomes defined as treatment completed, treatment default and transfer out (WHO, 2010). In 2014 the WHO recommended an updated definitions and reporting framework such that the outcome of “treatment defaulter” be changed to “lost to follow up” as it was less judgmental (WHO, 2014c).

According to the outcome-based method to assess adherence, people with a favourable outcome (cured or treatment complete) after the full course of treatment are defined as adherent, and those with an outcome of default or lost to follow up are classified as non-adherent (Thiam et al., 2007; Zhang et al., 2016). The definitions and explanation of outcomes are presented in Table 3.

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Table 3

Definition of disease outcome for pulmonary tuberculosis

Definition of disease outcome	Explanation of definition
Cure	Patient whose baseline smear (or culture) was positive at the beginning of treatment and is negative in the last month of treatment and on at least one previous occasion at least 30 days prior.
Treatment failure	Patient whose baseline smear (or culture) was positive and remains or becomes positive again at 5 months or later during treatment. This excludes those patients diagnosed with drug resistant TB.
Died	Patient who dies for any reason during the course of TB treatment.
Treatment completed	Patient whose baseline smear (or culture) was positive, and treatment is completed but does not have a negative smear/culture in the last month of treatment or on at least one occasion more than 30 days prior.
Treatment default (renamed lost to follow up)	Patient whose treatment was interrupted for two consecutive months or more during the treatment period.
Transfer out	Patient who was referred to a facility in another district to continue treatment and for whom the treatment outcome is not known.

Note. Based on WHO, 2014c.

Adherence based on the outcome model defines adherence as a binary construct of either adherent or non-adherent. The measurement of adherence on an individual level based on medication taking behaviour allows for adherence to be calculated across a continuum.

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The WHO classifies methods for measuring adherence on an individual level as either direct or indirect methods (Sabatè, 2003). Other studies refer to subjective or objective methods to measure adherence (Lam & Fresco, 2015). Direct methods provide measurable evidence that medication has been taken. However, with indirect methods adherence can only be implied.

Directly observing therapy (DOT) and measuring the drug or its metabolites in the body are examples of direct, objective methods that can be used to measure adherence. Indirect and objective methods include pill-counts, reviewing of prescription or other health care records and using electronic devices such as specialised pill bottles.

Indirect, subjective measures include the evaluation of adherence based on either a self-report, report from a family member or an assessment made by a health care provider.

2.2.1 Directly observed therapy.

Analysis of directly observed therapy (DOT) records is considered by some authors to be one of the most accurate methods to measure adherence to tuberculosis treatment (Osterberg & Blaschke, 2005). DOT formed part of the five component DOTS strategy implemented by the WHO in 1994 (WHO, 1999). In line with this policy a specifically identified individual, preferably a health care worker, should actively observe the person swallowing the tablets. DOT from a clinic is however no longer a routine requirement for all people or for the full duration of treatment.

In the South African context, community- based DOT is sometimes used whereby a family member or community member performs the role of observing treatment and recording this in a treatment card (South African Department of Health, 2014). A study conducted in South Africa indicated that community or family DOT may be as effective a method as DOT by a health care worker (Kaplan et al., 2016). However, concerns have been raised as to the validity of records kept by family members who may distort results to avoid family conflict (Frieden & Sbarbaro, 2006). I did not use analysis of DOT records in this study due to logistical difficulties of accessing these records from the numerous clinics within the referral area of the two research sites.

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2.2.2 Biological markers

Biological markers whereby the drug or metabolites of the drug are detected in samples of blood or urine are a direct and objective way to measure adherence. In terms of tuberculosis treatment some studies have considered discoloration in urine samples to detect presence of the drug rifampicin. However, the practical use of this method is questionable (Zentner et al., 2016). A specialised test designed to measure metabolites of the drug isoniazid in urine was evaluated by Hanifa et al. (2007) for use in South Africa. They concluded that this test could be useful for measuring adherence, although tests conducted more than 24 hours after the last dose are less sensitive. Due to the expense associated with this method of measuring adherence biological markers was not used as a method to measure adherence in this study.

Therapeutic drug monitoring (TDM) involves specialised testing of the blood to determine the level of the specific drug within the body. The use of TDM has shown benefits in clinical work as dosage can be adjusted if drug levels within the individual are not within the desired range to achieve optimal results (Alsultan & Peloquin, 2014). However, the results of the study by Alsultan and Peloquin (2014) indicate that due to complex pharmacological interactions and other confounding factors, TDM may show lower than desirable levels of tuberculosis drugs in the body regardless of adherence. Currently there is no routinely used method to measure adherence to tuberculosis treatment based on blood samples (Valencia et al., 2017).

2.2.3 Electronic monitoring devices

There are several devices that use technology to objectively measure adherence as well as patterns of adherence. Electronic measuring devices utilize specialised equipment such as electronic pill boxes or pill organizers that have sensors that record the opening of the lid. The Medication Events Monitoring System (MEMS) is a popular system that has been used in several studies (Farmer, 1999). A computer chip inside the bottle records the date and time of the opening of the bottle and this information is digitally stored and can be retrieved using a scanner. The opening of the lid and removing medication does not guarantee that medication is swallowed. However, manipulation of results is more difficult as opposed to only discarding unused pills as the container would still need to be opened daily (Lam & Fresco, 2015).

An electronic system, the Medication Event Reminder Monitor System (MERM) that was designed specifically to be compatible for the packaging and format of tuberculosis

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treatment was recently introduced. A study conducted in China concluded that this system was feasible and both providers and users of the MERM reported a positive user experience (Liu et al., 2017). It was announced on 24 March 2017 that the MERM was to be manufactured and available in South Africa (Hlabangane, 2017). A positive overall experience, like the study conducted in China, was reported in a pilot study in South Africa using the MERM (Bionghi et al., 2018). Due to the expense associated with this method, and the budgetary constraints of this study, I did not use an electronic device to measure adherence.

2.2.4 Pill count

Comparing the actual number of unused pills against the expected number of unused pills during visits at a health care facility is an objective and quantifiable way to measure adherence (Osterberg & Blaschke, 2005). Pill counting can be relatively simple to perform and is inexpensive. However, counting errors by health care workers can occur especially if a person is receiving medication for multiple conditions (Valencia et al., 2017). Pill counting can only be performed if people return with unused medication when they attend their health care appointment. Results can be manipulated by discarding unused pills prior to an appointment such that pill count appears to show adherence (Valencia et al., 2017). Due to logistical reasons based on the numerous clinics that participants may have accessed prior to admission at the research sites I did not use records of pill counts in this study.

2.2.5 Pharmacy based records

Adherence can be measured based on the rate of prescription refills. Various equations have been formulated to measure adherence that are calculated according to when a prescription is refilled at a pharmacy as compared to when it should have been filled (Lam & Fresco, 2015). Adherence to treatment can only be assumed however, as refilling a prescription does not guarantee that medication was ingested (Osterberg & Blaschke, 2005).

Measuring adherence based on pharmacy records requires a centralized computer-based system and accurate input of data in this system. Non-adherence may be incorrectly attributed to an individual if medication was obtained from a pharmacy outside of the area where computer records are collated (Lam & Fresco, 2015). Due to the lack of a centralized system whereby all the clinics within the study area are included, analysis of pharmacy-based records was

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considered unsuitable for this study. Studies conducted by both Been at al. (2017) and Kabore et al. (2015) found that self-report measures and pharmacy records showed similar predictive value in identifying adherence to antiretroviral medication.

2.2.6 Self-report

Self-reported measures are brief, inexpensive, and relatively easy to use indirect and subjective methods to measure adherence. People are required to keep a record of their medication use in a diary, interviews can be conducted, and questionnaires or scales can be administered. The benefit of the self-reported method must be weighed up against error due to recall bias and social-desirability bias that tends to result in an over-estimation of adherence (Farmer, 1999; Valencia et al., 2017).

There is only one self-report adherence scale that has been specifically designed to be used for tuberculosis medication (Valenica et al., 2017). Yin et al. (2012) developed and validated a 30 item Tuberculosis Medication Adherence Scale (TBMAS). This scale measures nine factors: communication with healthcare provider (6 items), personal traits (5 items), confidence in curing tuberculosis (4 items), social support (4 items), mood disorders (3 items), living habits (2 items), active coping behaviour (2 items), forgetfulness (2 items), and access to healthcare (2 items) (Yin et al., 2012). The focus of the TBMAS is on reasons for non-adherence as opposed to pill-taking behaviour, and there are no items that specifically question whether treatment was taken by the participant.

There are numerous self-report scales that are available for use to measure general medication adherence, and in one systematic review 58 different scales were identified (Garfield et al., 2011). The most used self-report scales include the Brief Medication Questionnaire, Medication Adherence Rating Scale, Morisky Medication Adherence Scale and Visual Analogue Scale (Shi et al., 2010; Valencia et al., 2017). In studies where these self-reported questionnaires were compared to adherence based on electronic monitoring devices a moderate to high correlation was found, although in general a higher rate of adherence was reported when self - reported scales were used (Monnette et al., 2018).

Self- reported questionnaires have been criticized for measuring more than one latent variable yet not clearly defining these distinctions in the findings (Voils et al., 2011). The Brief Medication Scale for example consists of nine questions. Five items ask about the use of

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medication in the past week, two items focus on barriers and benefits of medication, and two items screen for difficulties in remembering to take treatment (Svarstad et al.,1999).

Nguyen et al. (2014) conducted a systematic review of 60 articles which included 43 adherence scales. They highlighted that some self-report adherence scales measured additional latent variables such as barriers to treatments as opposed to only medication taking behaviour (Nguyen et al., 2014). Some authors consider this additional information regarding reasons for non-adherence as a benefit of these self-rating scales (Garfield et al., 2011; Morisky & DiMatteo, 2011; Stirratt et al., 2015).

In this current study I had originally intended to use the MMAS-8. However as will be explained in Chapter Four of this dissertation, I experienced logistical challenges regarding the obtaining of rights to use this eight-question scale. I wanted to explicitly measure medication taking behaviour only. I thus purposively designed a questionnaire to measure adherence to tuberculosis treatment based on self-report and health care provider records as detailed in Chapter Four of this dissertation.

2.2.7 Health care provider estimation records

Adherence can be subjectively evaluated based on the opinion of a health care provider. Miller et al. (2002) conducted a study to compare provider estimates of adherence to treatment for HIV to a composite score of adherence derived from a self-report, pill counts and an electronic monitoring device. Providers were asked to estimate adherence over the previous four months and predict adherence for the following four-months for 82 participants (Miller et al., 2002). Their results showed than on average the health care provider over-estimated adherence by 8.9%.

Other records and data bases where providers capture patient records such as the national tuberculosis register, and district health information systems are available that can provide information regarding adherence (Loveday et al., 2013). In this current study, I examined the specific referral information recorded by the referring doctor in the electronic continuity of care record, as well as analysis of clinician notes made on admission. This information was used in addition to the self-report to calculate a composite adherence score.

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2.3 Impact of Non-Adherence

Prescribed treatment cannot work optimally unless the recommendations given by the health care provider are followed. Non-adherence to treatment may lead to costly complications requiring more expensive and intensive interventions and may result in hospitalization or even death (Jin et al., 2008; Martin et al., 2005; Sabaté, 2003). Results from a meta-analysis of patient adherence and medical treatment outcomes showed that the odds of a patient obtaining a good outcome such as survival, lower blood pressure in people with hypertension, and lower cholesterol level in people with hypercholesterolemia, were three times higher when adherent to medical treatment than not (DiMatteo et al., 2002).

Adherence to appropriate tuberculosis medication is critical to improve treatment outcomes, to decrease the development of further resistance and to decrease the infectivity of people who are on treatment (Farley et al., 2011, Kliiman & Altraja, 2010; O' Donnell et al., 2014). Treatment duration can be lengthened due to non-adherence to tuberculosis treatment. If a person has been found to have missed treatment for two consecutive months, the full course of treatment may need to be restarted (South African Department of Health, 2014).

A significant complication that may be caused by non-adherence to tuberculosis treatment is the development of drug resistant strains of tuberculosis (Pradipta et al., 2018). According to the Management of Drug Resistant Policy Guidelines, drug resistant tuberculosis is classified as a "man-made problem… born out of errors in any or all of the following: the management of drug supplies, management of patients, prescription of treatment, and patient adherence" (South African Department of Health, 2011a, p. 3). Drug-resistant tuberculosis requires a prolonged treatment regime on more expensive second-line drugs which have a higher potential for toxicity with more severe side effects and poorer outcomes (South African Department of Health, 2014). A cohort study that explored long-term outcomes of patients with XDR- tuberculosis in South Africa published in 2014, found that only 16% of patients were classified as cured after 24 months (Pietersen et al., 2014).

It was estimated that 82% of the nearly 230 000 who started treatment for drug sensitive tuberculosis in South Africa in 2016 (newly diagnosed or relapsed following cure) were successfully treated (WHO, 2018). In terms of drug resistant tuberculosis, 55% of people who started treatment for multi-drug resistant tuberculosis and only 48% of people who started

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treatment for extensively drug-resistant tuberculosis in South Africa in 2016 were cured (WHO, 2018).

Adherence to treatment is thus essential to reduce the number of new infections of tuberculosis, decrease development of resistance and decrease tuberculosis related deaths. Without a better understanding of the numerous different factors that contribute to non-adherence to tuberculosis medication within the South African context, successful treatment of tuberculosis cannot be achieved.

2.4 Factors Influencing Adherence to Tuberculosis Treatment

The WHO published a report in 2003 to explain the current knowledge of adherence to long term therapies (Sabaté, 2003). They identified five interacting dimensions that affect adherence to treatment: (1) condition-related factors, which are dependent on the specific illness such as impact on daily functioning or quality of life; (2) therapy–related factors, such as side-effects of medication or impact of treatment schedule on daily functioning; (3) health system factors, for example accessibility and availability of treatment; (4) social and economic factors, such as the potential financial burden of treatment; (5) patient-related factors, which includes individual aspects such as knowledge and beliefs about medication. Adherence to treatment is thus an interaction of what illness a person has, what type of treatment is required, where and how treatment is available, the wider context of social and economic influences and the personal characteristics of the individual involved.

2.4.1 Condition related factors

The severity of the symptoms experienced and the impact that these have on activities of daily life affect adherence. Pulmonary tuberculosis (PTB) is the most common form of tuberculosis and affects the lungs. Symptoms can vary from slight shortness of breath to dependency on oxygen and difficulties with basic activities of daily living (Joon, 2017). A study to explore the impact of PTB on lung function, exercise tolerance and quality of life indicated that 39% of the study participants had a moderately severe to severe impairment of lung function, which had an impact on exercise tolerance and quality of life (Maguire et al., 2009). One of the symptoms of tuberculosis is weight loss, muscle atrophy and a low body mass index which can result in extreme tiredness and general body weakness (WHO, 2016a). Physical

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weakness and tiredness may lead to poor adherence, especially if support that is required to access clinic or attend to basic needs is not available.

In the case of tuberculosis meningitis (TBM) or tuberculosis in the spine or other joints, the symptoms can be severe with a high level of disability. People with TBM may require constant care, are unlikely to be able to function independently and would need to be supported with treatment adherence (South African Department of Health, 2014).

The disease of tuberculosis can have an impact on the capacity of an individual to access treatment. However, the treatment for tuberculosis including the number of pills, duration of treatment and the side effects can affect adherence.

2.4.2 Therapy- related factors

One of the barriers of adherence that has been identified is the specific impact that the treatment or therapy itself has on the individual (Sabaté, 2003). The treatment for tuberculosis requires several pills to be taken, ideally at a specific time of the day especially if DOT is required (South African Department of Health, 2014). It is sometimes necessary for medication to be taken with food as this can assist with the gastrointestinal side effects (South African Department of Health, 2014). A patient on an injectable therapy, which may be the case for treatment of drug-resistant tuberculosis, requires daily trips to the clinic (South African Department of Health, 2011a).

2.4.2.1 Directly observed therapy (DOT)

Directly observed therapy was considered by the WHO as one of the core interventions required for adherence to treatment for tuberculosis (WHO, 1999, 2006). A systematic review and meta-analysis of interventions to improve adherence to treatment reported that the default rate decreased by 40% when patients were directly observed taking treatment with a 14% increase in cure rate (Müller et al., 2018).

The effectiveness of DOT to improve adherence is however inconsistent, and other factors such as relationship with providers may influence results (Pradipta et al., 2020). In some studies, it was reported that the need to attend frequent clinic appointments or comply with DOT was perceived as a barrier to treatment which resulted in poorer adherence to treatment (Noyes & Papay, 2006). A qualitative study conducted in India reported that 20% of patients on MDR

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treatment were lost to follow up (Shringarpure et al., 2016). Reasons provided for non-adherence to treatment based on therapy related factors included difficulties associated with duration of treatment, pill burden, requirements of DOT and side-effects of the treatment (Shringarpure et al., 2016). Other factors identified by Shirinagpure et al. (2016) included social and employment related difficulties, stigma, and lack of support. Kagee et al. (2011) identified problems regarding access to transport as structural barriers that can impact adherence. Daily trips to the clinic for DOT may require people who cannot afford transport to walk, which may be a challenge for people who are feeling unwell either due to their illness of because of medication side-effects that may be experienced.

2.4.2.2 Side effects

Side – effects of medication contribute to non-adherence and people stop treatment due to adverse drug reactions or side effects of treatment (Boru et al., 2017; Munro, Lewin, Smith, et al., 2007). Edwards and Aronson (2000) explained that the terms adverse drug reactions, adverse events and side effects are often used interchangeably although there are some differences related to the severity of harm. Any harmful event is defined as an unexpected or dangerous occurrence that is associated with the use of a medicinal product (Edwards & Aronson, 2000). People using tuberculosis treatment may experience relatively mild unpleasant effects such as feelings of nausea and vomiting. However, some people experience more serious adverse effects such as psychosis, permanent hearing loss, kidney failure and death (Javaid et al., 2018; Shean et al., 2013).

Drug-sensitive tuberculosis is usually treated with first-line drugs that are generally better tolerated with less side-effects experienced as compared to drug resistant treatment. The most common side effects for first-line medication include gastrointestinal disturbance (nausea and/or vomiting), rash, hepatotoxicity (liver damage), peripheral neuropathy and psychiatric disturbance (South African Department of Health, 2014). In a study with people on treatment for drug sensitive tuberculosis using four drugs (isoniazid, rifampicin, pyrazinamide, ethambutol, or streptomycin), 8.3 % of participants reported side effects (Gülbay et al., 2006). Liver disturbance was experienced by 4.9% of participants, ototoxicity (hearing or balance difficulties) in 3.2% of those on streptomycin and 0.7% experienced psychiatric changes (Gülbay et al., 2006).

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In a retrospective study of 350 people treated for MDR-TB in the Kwa-Zulu Natal province of South Africa, adverse events were reported in 80.6% of the cases (Jacobs & Ross, 2014). Jacobs and Ross (2014) reported that hearing loss was the most common adverse event reported (28.7%), followed by peripheral neuropathy (23.2%), gastrointestinal disturbance (20.5%) and joint pain (15.9%). Other reported adverse events included skin rash, abdominal pain and indigestion, and psychosis.

Shean et al. (2013) examined the case records of 115 people treated for XDR-TB in South Africa and found that 67 (58%) of patients experienced at least one drug-associated adverse events such as gastro-intestinal disturbances, body aches, psychosis, and fatigue. The severity of adverse events experienced was rated as moderate to severe in 27 (3%) patients. Two people experienced life-threatening events, and six people (9%) died due to renal failure or hypokalemia (low potassium) that was associated with medication use (Shean et al., 2013).

A study of doctors in South Africa who contracted tuberculosis revealed that nearly 50% considered stopping treatment due to side-effects of the medication (Naidoo, Naidoo et al., 2013). A recent systematic review to explore prevalence and determinants of non-adherence to tuberculosis in Ethopia determined that the fear of side effects contributed to poor adherence (Zegeye et al., 2019).

The medications that are available for treatment of drug resistant tuberculosis, as well as the common side effects are presented in Table 4.

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Table 4

Treatment available for drug-resistant tuberculosis and common side effects

Drug group	Drug name	Common adverse effects
Group A: Fluoroquinolones – in decreasing order of usual preference for use	Levofloxacin	CNS toxicity, gastrointestinal intolerance; hypersensitivity.
	Moxifloxacin Gatifloxacin[1]	Dizziness; increase liver enzymes; gastrointestinal intolerance; hallucinations; headache; QT prolongation.
Group B: Second line injectable	Amikacin Capreomycin Kanamycin Streptomycin[1]	Hearing loss and nephrotoxicity are most frequent and serious adverse reaction. Skin rash; hypersensitivity, peripheral neuropathy
Group C: Other core second-line agents (in decreasing order of usual preference for use)	Ethionamide/ prothionamide	Gastro-intestinal disturbance (specifically vomiting); hepatitis; hyperthyroidism.
	Cycloserine[1]/ Terizidone	CNS toxicity; dizziness; psychosis
	Linezolid	Lactic acidosis; anaemia; thrombocytopenia which can be severe and life threatening; neuropathy; hematologic toxicities.
	Clofazimine	Discolouration of the skin; gastrointestinal intolerance; ichthyosis
Group D: Add on agents	Pyrazinamide	Rash; hepatitis
	Ethambutol	Optic neuritis
	High-dose isoniazid	Rash; hepatitis; neurotoxicity
	Bedaquiline	QT prolongation
	Delamanide	Nausea; vomiting
	p-aminosalicylic acid	Gastrointestinal intolerance
	Imipenem-cilastatin	Gastrointestinal intolerance; rash; seizures; pain at injection site
	Meropenem	Gastrointestinal intolerance; headache; soreness, redness, or swelling at the injection site.
	Amoxicillin-clavulanate[1]	Gastrointestinal intolerance; rash
	Thiocetazone[1]	Gastrointestinal intolerance; hepatitis; vertigo

Note. [1] Medication not commonly used in South Africa (South African Department of Health, 2014).

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2.4.2.3 Pill burden

The number of pills that need to be ingested daily can be a barrier to adherence. People who are on treatment for drug-resistant tuberculosis (depending on weight) may be prescribed approximately 21 tablets daily (South African Department of Health, 2013; WHO, 2016b). The number of pills is increased if additional medication is prescribed for side-effects or for treatment of co-morbid conditions such as HIV and diabetes.

In a qualitative study conducted in Ethiopia with people who were on treatment for both tuberculosis and HIV, more than 50% of the people interviewed claimed that pill burden and side effects contributed to poor adherence (Gebremarian et al., 2010). Other factors identified by Gebremarian and colleagues (2010) included food insecurity, the challenge of DOT (especially as related to the impact on employment opportunities), the relationship with health care provider and stigma.

Some people who take treatment for both HIV and tuberculosis reportedly continued with HIV treatment but discontinued tuberculosis treatment as there are fewer pills with better tolerability for HIV medication as opposed to tuberculosis treatment (Daftarya et al., 2014). Other studies demonstrated that people are more likely to remain adherent to tuberculosis treatment as opposed to HIV treatment (Kigozi et al., 2017; Mazinyo et al., 2016). The decision as to which treatment was stopped may be influenced by the belief in the severity of each illness and the experience of side effects of different medications.

The need to attend clinic daily or to have treatment observed, along with numerous pills with unpleasant and potentially harmful side effects are therapy related barriers that impact adherence. The relationship that an individual has with health care providers and the suitability of the health care system to provide accessible care can be either a barrier or benefit to adherence.

2.4.3 Healthcare team and system factors

The logistical barriers to access health care, as well as the patients' perception of access to support, care, attitudes of health care workers and effective treatment has an impact on adherence.

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2.4.3.1 Access to care

People may fail to adhere to treatment when the requirements regarding treatment do not fit into their everyday lives (Jaiswal et al., 2003). Poor access to health care such as inconvenient opening hours of a clinic, distance to the clinic, long waiting times and long queues can lead to non-adherence to treatment (Coetzee et al., 2011; Jaiswal et al., 2003, Munro, Lewin, Smith, et al., 2007; O'Donnell et al., 2016). Within the South African context, people who are unemployed or those earning below a certain income threshold are more likely to attend government funded primary health clinics that tend to be over-crowded and under- resourced (Kagee, 2004). The financial cost to travel to the clinic, especially amongst impoverished people, may impact clinic attendance and thus affect adherence. According to Kagee et al. (2007) most people who attend public health clinics in South Africa utilize public transport which is not always considered to be safe or available in all areas. At times, the indirect routes that are used to reach the clinic extend travel time which can result in people being unwilling, or physically unable, to attend clinic appointments (Kagee & Delport, 2010). Social and economic factors thus influence access to care as well as the level of care that is provided including the relationship with health care provider.

2.4.3.2 Relationship with health care providers

Some health care providers assign the responsibility of adherence almost completely to individual characteristics and view people who are non-adherent as lazy, uncaring, uneducated, or deliberately remaining sick to qualify for financial aid (Munro, Lewin, Smith, et al., 2007). Several systematic reviews regarding adherence to tuberculosis treatment identify the perception of negative attitudes of health care workers and poor relationships and communication with health care providers as contributing to poor adherence (Jin et al., 2008; Martin et al., 2005; Tola et al., 2015; Zegeye et al., 2019).

Lack of privacy at some clinics, large numbers of people seeking care and staff shortages at clinics in South Africa can negatively impact on perceived standard of care and the relationship with health care providers (Coetzee et al., 2011; Kagee et al., 2011). Conversely, good communication and a supportive and caring relationship with health care providers promoted adherence to treatment (Munro, Lewin, Smith, et al., 2007; Skinner & Claassens, 2016; Zegeye et al., 2019). A meta-analysis of the link between physician communication and

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patient adherence to treatment across a range of settings showed a 19% higher risk of non-adherence among patients whose physician communicates poorly than among patients whose physician communicates well (Zolnierek & DiMatteo, 2009). Familiarity with the treating doctor resulted in less anxiety experienced during consultations and increased levels of satisfaction with medical treatment, which may contribute to improved understanding of expectations and better recall thus lower risk of poor adherence (Martin et al., 2005). A supportive relationship with health care workers and communication that is characterized by trust, where patients feel that they are included in the decision-making process improves adherence (DiMatteo, 2004a, 2004b; Lin et al., 1995; Martin et al., 2005; Sabaté, 2003).

Ease of access to health care facilities and a relationship of trust, support and co-operation with the health care providers are health care team and system factors that can improve adherence to tuberculosis treatment. Factors that are identified as potential barriers to adherence to treatment are related to the social and economic status of the individual.

2.4.4 Social and economic factors

Tuberculosis is associated with poor social and economic circumstances and the majority (95%) of deaths from this disease occurs in the global south (WHO, 2018). Factors such as overcrowding, poor ventilation, poverty and malnutrition can contribute to an increased risk of development of active tuberculosis and impact on clinical outcomes (Hargreaves et al., 2011). Poverty and associated financial burden, unemployment, low level of education, unstable living conditions, poor social and family support, and stigma are associated with poor adherence (Jin et al., 2008; Munro, Lewin, Smith, et al., 2007; Sabaté, 2003; Van Der Walt et al., 2009). Di Gennaro et al. (2017) conducted a literature review focusing on the relationship between social factors and therapy failure as well as development of MDR-TB. They concluded that low income, low education, and alcohol abuse were related to each other, and these factors increased the odds of therapy failure. The development of MDR-TB was associated with alcohol abuse and low income (Di Gennaro et al., 2017).

2.4.4.1 Poverty

The measurement and understanding of poverty extend beyond a specific absolute construct such as an income threshold. Determinants of poverty include the evaluation of access

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to certain social and economic factors such as safe housing, employment, basic services like electricity and running water, ability to provide basic needs, education, social inclusion including participation in decision making (Ruch, 2014). In a study with primary care patients in South Africa, poverty was found to be a predictor for non-adherence to medication for both HIV and tuberculosis (Naidoo, Peltzer et al., 2013).

Naidoo et al. (2009) conducted a qualitative study in the Cape Town Metro region of the Western Cape Province. Participants in their study reported that poverty, especially in the face of competing financial demands and food insecurity, was a barrier to adherence to treatment for tuberculosis. The financial burden of tuberculosis treatment was identified by Munro, Lewin, Smith, et al. (2007) as influencing adherence to tuberculosis medication. The impact is greater for people living in poverty where there are competing demands for limited resources (Naidoo et al., 2009; Sabaté, 2003).

Treatment for tuberculosis in South Africa is free. However, Ramma et al. (2015) determined that 52% of the total cost relating to treatment for tuberculosis in South Africa was due to indirect costs such as transport cost and inability to earn income either due to illness or time spent accessing health care.

People who are homeless have a greater risk of becoming infected with active tuberculosis. Dias et al. (2017) reported that the incidence of tuberculosis was five times higher among people who were homeless as opposed to those with a fixed abode in a study conducted in Portugal. Unsuccessful outcomes were reported for 28.6% of the homeless people included in the study, with 9.4% reported as lost to follow up (Dias et al., 2017). In the non-homeless participants in their study, 3% had unsuccessful outcomes with 1.5% reported as lost to follow up.

Jakubowiak et al. (2007) conducted a retrospective study in Russia and showed that the odds ratio for defaulting tuberculosis treatment (defined as missing two consecutive months of treatment) for unemployed people was 4.44 (95% CI 2.23-8.86); 3.49 for homelessness (95% CI 1.04 – 3.81) and 1.99 for alcohol abuse (95% CI 1.04–3.81).

Unemployment was related with both increased and decreased adherence across different studies. On the one hand, an unwillingness to be absent from place of employment to attend clinic appointments, adverse side-effects which impact on capacity to work, and fear related to potential negative consequences if employees are aware of diagnosis have been cited as reasons

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for poor adherence (Munro, Lewin, Smith, et al., 2007; Skinner & Claassens, 2016). One study conducted in South Africa reported that 19% of people who stopped taking their tuberculosis medication did so due to work commitments (Gust et al., 2011). Respondents in a study conducted by Naidoo et al. (2009) reported that non-adherence to treatment was associated with work or school commitments, or fear of termination of employment due to disclosure of illness.

On the other hand, unemployment and lack of income contributes to increased poverty, limited resources and food insecurity which are associated with poor adherence (Gebremariam et al., 2010; Munro, Lewin, Smith, et al., 2007). Boru et al. (2017) conducted in-depth interviews with 22 people who were not adherent to treatment in Ethiopia. Reasons provided for non-adherence in the interviews included the nature of their work (10 participants), stopping treatment due to decrease in severity of symptoms (11 participants), and side effects of medication (12 participants). However, most of the participants in this study (17 participants) indicated that the core reason for non-adherence was due to lack of money (Boru et al. 2017).

One study found that people who were non-adherent to treatment were more likely to have less frequent symptoms and more days without food than those who were adherent (McInerney et al., 2007). They suggested that people may attend clinic more regularly due to the hope of food parcels and other financial incentives at the clinics. Support and assistance from others can help people who are struggling financially to continue to adhere to treatment.

2.4.4.2 Family, community, and household support

Support, or perceived lack thereof, can influence adherence to treatment. Family support and positive influences from peers including encouragement and reminders to take treatment, resulted in improved adherence (Munro, Lewin, Smith, et al., 2007). Direct support from the community or from family such as financial assistance or the provision of food was reported as facilitating adherence in studies in South Africa (Naidoo et al., 2009; Naidoo, Peltzer, et al., 2013).

Social support including empathic expressions of concerns by others, and an environment where completion of treatment was socially acceptable and desirable, resulted in higher rates of adherence (DiMatteo, 2004a). Conversely, lack of support, stigmatization, or shame about having tuberculosis can result in lower rates of adherence. Tuberculosis is an infectious disease and people who are known to have active tuberculosis are thus sometimes excluded and socially

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isolated (Grebremariam et al., 2010). The connection between tuberculosis and HIV, an illness also associated with stigma, can add to unwillingness to attend the clinic, and thus adhere to treatment due to fear that their health status will be known, and consequent victimization and stigmatization will occur (Gebremariam et al., 2010; Munro, Lewin, Smith, et al., 2007).

In a study in the Eastern Cape province of South Africa, people from the community indicated that they believed that one of the main reasons that people with tuberculosis defaulted on treatment was based on their fear of being stigmatized (Cramme et al., 2010). Finlay et al. (2012) conducted a study in South Africa and 43% of participants who defaulted treatment claimed that they felt ashamed about having tuberculosis. Shame can be a potential barrier to adherence especially if it prevents people from attending the clinic to collect treatment due to fear of being observed by others.

2.4.5 Patient-related factors

The impact of economics and the therapy that is needed to treat tuberculosis is often outside of the control of the individual. Patient-related factors such as gender, age and beliefs may help people to overcome some of these barriers and can thus result in improved adherence. Comorbid conditions such as depression, substance use disorders, diabetes and HIV can add to the difficulties of adherence (Sabaté, 2003).

2.4.5.1 Gender and age

There are several factors that are specific to an individual that may impact on adherence. The inconsistent and sometimes contradictory findings regarding the relationship between gender and age on adherence highlights the complexity of personal factors and adherence.

A systematic review on the role of gender and tuberculosis control determined that once females enrolled in treatment, they were more likely than males to complete treatment (van Den Hof et al., 2010). It had been suggested that females may be more adherent to males due to accompanying their children to clinic appointments and thus filling their own prescriptions at the same time (Munro, Lewin, Smith et al., 2007). Men may be more likely to be viewed as the primary breadwinner in the household and are thus non-adherent due to attending to work and financial obligations (Munro, Lewin, Smith, et al., 2007). Some studies have shown that females have better outcomes to treatment for tuberculosis than men (Murphy et al, 2018; van Den Hof et

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al., 2010). Murphy et al. (2018) concluded that there may be poorly understood biological reasons that may explain the gender difference in responses to tuberculosis treatment found in their study. Thus, females may perceive greater benefits of treatment based on better outcomes, and therefore be more likely to remain adherent to treatment for tuberculosis.

The difference in adherence between male and female participants is, however, inconsistent. Marx et al. (2012), Kigozi et al. (2017) and Ndwandwe et al. (2014) conducted retrospective studies in South Africa to explore adherence to tuberculosis treatment based on an outcome of default (defined as missing two consecutive months of treatment) compared to cured or treatment completed. Both Marx et al. (2012) and Kigozi et al. (2017) found that males were significantly more likely to default treatment as compared to females, whereas Ndwandwe et al. (2014) found no significant differences between the genders. Like the results found by Ndwandwe et al. (2014), no significant gender difference for treatment default in the study by Mukherjee et al. (2014) in India, nor in the study by Ifebunandu and Ukwaja (2012) in Nigeria were found.

The association between gender and adherence may be influenced by multiple interconnected factors including biology, socioeconomics, and access to care. The impact of age on adherence is just as complex and inconsistence as gender. One study for example found that people older than 24 years of age were less likely to default treatment and the percentage of participants who had defaulted treatment in each sequential age band decreased as age increased (Kigozi et al., 2017). Ifebunandu and Ikwaja (2012) on the other hand found that being over 30 years of age was significantly associated with an outcome of default. Castelnouvo (2010) found that being above 25 years of age increased risk of defaulting treatment whereas Naidoo et al. (2009) found that being in the 25-to-34-year age group was more likely to be associated with adherence to tuberculosis treatment. Tola et al. (2017) collected information from 698 participants using a structured questionnaire in Ethiopia. They found that both the direct and non-direct effect of age on adherence were not significant. Similarly, Mazinyo et al. (2016) found that among the 1252 participants included in their study, age was not associated with adherence (defined as taking over 80% of treatment under DOTS). The discrepancy in the impact of age and gender on adherence emphasis that importance of understanding predictors of adherence to treatment for tuberculosis from a multidimensional approach.

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2.4.5.2 Knowledge, attitudes, and beliefs

The level of understanding regarding the disease, the treatment thereof, and the consequences of defaulting influences adherence to treatment (Munro, Lewin, Smith, et al., 2007; Skinner & Claassens, 2016). A review of literature regarding adherence conducted by Martin et al. (2005) revealed that people miss treatment if they do not understand recommendations, are unable to read instructions (either due to language barriers or illiteracy) or due to forgetting to take medication. AlHewiti (2014) conducted a study that included 408 participants. He concluded that low adherence to treatment for tuberculosis was related to negative beliefs regarding medication as measured by the Beliefs about Medicines Questionnaire (BMQ) and inadequate information shared with participants regarding their medication (Alhewiti, 2014). Cea-Calvo et al. (2019) explored the association between non-adherence behaviours and patients experiences with healthcare and beliefs about medicines in patients with four different chronic conditions. They found that low BMQ Necessity scores, high BMQ Concerns scores and low patient self-management scores were associated with non-adherence (Cea-Calvo et al., 2019). According to DiMatteo (2004b), people are more likely to be adherent to treatment when they have knowledge of what they need to do, are committed to the process, and have the required resources.

Knowledge regarding duration of treatment and the expected course of the disease can mitigate the impact that symptom reduction, or lack thereof, has on health behaviours. A decrease in symptoms was perceived by some people as an indication of the efficacy of treatment and they were thus motivated to continue treatment (Edginton et al., 2002; Munro, Lewin, Smith, et al., 2007). Conversely, lack of knowledge can result in premature discontinuation of treatment when symptoms resolve as people perceive that they have been successfully treated (Finlay et al., 2012). Theron et al. (2015), conducted a quantitative study across several clinics in South Africa. Results from their study showed that low health literacy and a lower score for symptom severity independently increased the odds of poor adherence (Theron et al., 2015). Over 50% of the 1020 respondents interviewed as part of a study conducted in South Africa reported that they believed that people with tuberculosis defaulted treatment because they mistakenly believed that they were cured (Cramm et al., 2010).

People are more likely to adhere to treatment if they believe that there are benefits from doing so (Horne et al., 2013; Naidoo et al., 2009; Rosenstock et al., 1988). Thus, if an individual

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believes in the efficacy of the treatment and has trust in the diagnosis and health care team, the likelihood of adherence to treatment is higher as compared to when individuals perceive a lack of trust in the diagnosis and prescribed treatment (Munro, Lewin, Smith, et al., 2007).

2.4.5.3 Psychological distress

According to a review of mental illness and tuberculosis conducted by Doherty et al. (2013), up to 70% of people diagnosed with tuberculosis were identified as having mental illness. Research indicated that psychological distress including anxiety and/or depression was high among people with tuberculosis (Ambaw et al., 2018; Duko et al., 2015; Peltzer et al., 2012). In a study with 1502 participants diagnosed with tuberculosis in South Africa, 22% showed signs of severe psychological distress (Theron et al., 2015). In the study by Theron et al. (2015), 26% of participants were not adherent to treatment (based on missing a scheduled DOT visit) with a higher score for psychological distress and heavy alcohol use related to poorer adherence. A recent systematic review and meta-analysis on the association between depression and outcomes of tuberculosis treatment found that the combination of depressive symptoms and psychological distress significantly increased the odds of a negative treatment outcome of death or lost to follow up (Ruiz-Grossa et al., 2020). Based on the eight studies included in the review by Ruiz-Grossa et al. (2020) depressive symptoms and psychological distress were not independently significantly associated with non-adherence. However, there were considerable differences across the included studies regarding how adherence was both measured and defined (Ruiz – Grossa at el., 2020).

Depression. The most recent available data indicated that the estimated prevalence of depression is 4.4% worldwide and 9% in the African Region (WHO, 2017c). Pengpid and Peltzer (2018) utilized data obtained from a national population-based survey of South African adults (n = 22 752) to assess depressive symptoms. Data on depression symptoms were collected from the 10-item version of Centers for Epidemiologic Studies Scale (CES-D-10) which was considered a valid and reliable screening tool for use in South Africa (Pengpid & Peltzer, 2018). They determined that about 13% of the sample experienced depressive symptoms based on a cut-off of twelve (Pengpid & Peltzer, 2018). In a cross-sectional community survey conducted in South Africa depression was assessed using the Patient Health Questionnaire among 4052 adults

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(Peltzer & Pengpid, 2020). They found that 47.3% of participants had minimal or mild depression and 17.7% had moderate to severe depression.

Research has shown that depression may have a physiological impact that affects immune response and increases the susceptibility to infectious disease (Irwin & Niller, 2007; Schuster et al., 2012; Zorrilla et al., 2001). Depression and tuberculosis share some physical risk factors such as low vitamin D, low body weight and behaviours such as increased use of alcohol and drugs that may explain the high correlation of depression and tuberculosis (Ambaw et al., 2018; Pachi et al., 2013). A nationwide population-based study conducted in Korea found that the risk of tuberculosis in the depression cohort (32 372 participants) was 2.63-fold higher (95% CI 1.74 – 3.96) than in the matched control cohort of people without mood disorders (Oh et al., 2017). The results of the study by Oh and colleagues suggested that people with depression may be at a higher risk for developing tuberculosis.

The results from a study in Ethiopia showed the prevalence of depression among people with tuberculosis was 51.9% (95% CI = 42.7, 62.2%) (Dasa et al., 2019). Duko et al. (2015) explored the prevalence of depression and anxiety among people with tuberculosis admitted to hospital in Ethiopia. They found that 43.4% of the participants in their study were assessed as having depression based a score of 8 or above on the Hospital Anxiety and Depression Scale. In their study co-morbid HIV, poor social support and perceived stigma were associated with increased likelihood of depression (Duko et al., 2015).

A systematic review and meta-analysis of the prevalence of depression among patients with tuberculosis concluded that the pooled estimated prevalence of depression among people with tuberculosis was relatively high (Duko et al., 2020). While the prevalence of depression across the studies varied depending on the measurement tool used, the difference was not significant. The overall pooled prevalence of depression among people with tuberculosis was 45.19% (95% CI 38.04 – 52.55) (Duko et al., 2020). This review however did not report on the relatively severity of depression or what cut-off score was used to classify depression.

It is well established that people who suffer from symptoms of depression are less likely to adhere to their treatment regimes. Research has suggested that one of the strongest predictors of non-adherence to medical treatment is depression (Martin et al., 2005). One meta-analysis of the effects of anxiety and depression and adherence found that while the relationship between anxiety and adherence was not significant, the relationship between depression and adherence

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was both substantial and significant (DiMatteo et al., 2000). A systematic review and meta-analysis of depression and adherence to antiretroviral therapy found that patients with depressive symptoms were less likely to adhere to treatment than those without symptoms of depression (Uthman et al., 2014).

A study was conducted in the Cape Metropole area of Cape Town to assess the prevalence and severity of feelings of helplessness and depression, as well as social support among people diagnosed with tuberculosis (Naidoo & Mwaba, 2010). Naidoo and Mwaba (2010) reported that 64.3% of the 166 participants evaluated using the Beck Depression Inventory met the criteria for depression based on having symptoms of at least the category of mild mood disturbance. Considering the relationship between depression and helplessness, a surprising finding in the study conducted by Naidoo and Mwaba (2010) was that only 10.9% of participants reported feeling helpless. Their study did not report on the percentage of participants who experienced support and it was hypothesized that immediate family members, other relatives as well as friends and neighbours would be sources of support within the community.

A recent study of people with drug sensitive tuberculosis conducted in Ethiopia found that untreated depression was associated with treatment default, death, greater disability, and poorer quality of life (Ambaw et al, 2018). In the study by Ambaw and colleagues, 53.9% of participants were classified as having probable depression based on a score of 10 or above on the nine-item Patient Health Questionnaire, and of these 3.9% had defaulted treatment at six months compared to 0.8% of those without probable depression.

Alcohol and substance use. The literature is unequivocal that harmful use of alcohol and/or drugs both increases the chance of infection with tuberculosis and has a negative impact on adherence to treatment (Ambaw et al., 2018; Chaulk & Moonan, 2020; Pellissari & Diaz-Quijano, 2018). A systematic review of alcohol use as a risk factor for tuberculosis concluded that the pooled relative risk for heavy drinkers to develop active tuberculosis is 2.94 (95% CI: 1.89-4.59) although low to moderate use of alcohol was not associated with an increased risk (Lönnroth et al., 2008). Results from studies included in a systematic review to explore the association between alcohol use, alcohol use disorders and tuberculosis, demonstrated that the odds of active tuberculosis increased with an increase in the amount of alcohol consumed daily (Rehm et al., 2009). People who are heavy drinkers are three times more likely to develop active

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tuberculosis than people who drink moderately or less (South African Department of Health, 2014).

Several factors may contribute to the increased risk of the development of active tuberculosis in people who consume alcohol. Heavy alcohol use negatively affects both the innate and adaptive immune system (Barr et al., 2016). In addition, other consequences of heavy drinking such as decreased liver functioning, nutritional deficits and poor hygiene may contribute to an increased risk of the development of active tuberculosis (Rehm et al., 2009). The social implication of alcohol use may increase exposure to people who are infected with tuberculosis if drinking is associated with frequenting crowded establishments such as bars or social groups (Classen et al., 1999; Lönnroth et al., 2008). Heavy alcohol use adversely impacts the course and outcome of tuberculosis due to an increased risk of interruption of treatment as well as the impact that alcohol has on pharmacokinetics of the drugs used to treat tuberculosis (Rehm et al., 2009).

Alcohol use has been found to contribute to non-adherence to tuberculosis medication in a variety of different contexts and countries (Chaulk & Moonan, 2020; Sabaté, 2003). Theron et al. (2015) reported that heavy alcohol use was independently associated with non-adherence in their study of people on tuberculous treatment in South Africa. A systematic review and meta-analysis of the impact of alcohol use on tuberculosis outcomes revealed that alcohol significantly increased the risk of death, treatment failure and lost to follow up (Ragan et al., 2020).

A study in South Africa concluded that one of the strongest individual factors for default of treatment for MDR-tuberculosis was smoking cannabis or Methaqualone (Mandrax) during treatment (Holtz et al., 2006). A systematic review of adherence to tuberculosis treatment listed nine studies where substance abuse was noted as a barrier to adherence (Munro, Lewin, Smith, et al., 2007).

Research conducted in Brazil found that 22% of the 77212 people on tuberculosis treatment used either alcohol or illegal substances (Pellisari & Diaz-Quijano, 2018). Alcohol use disorder only, drug use only, and use of both substances, were associated with a higher risk of an unsuccessful outcome and 15% of all unsuccessful outcomes were attributed to substance use (Pellisari & Diaz-Quijano, 2018).

The knowledge that people have regarding tuberculosis and treatment, as well as their attitudes and beliefs regarding the efficacy of treatment and their diagnosis, and their belief in

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their ability to take treatment regularly can all affect adherence. Other individual factors such as substance abuse and depression are associated with poorer adherence and poorer treatment outcomes.

The five core factors related to the condition, types of therapy, the healthcare team and system, socioeconomic conditions, and the individual interact with each other and simultaneously influence adherence to treatment (Jin et al., 2008; Munro, Lewin, Smith, et al., 2007; Sabaté, 2003; Van Der Walt et al., 2009). Psychologists and researchers have developed several theoretical paradigms to understand, predict and influence human behaviour.

2.5 Theoretical Models Applied to Adherence

Leventhal and Cameron (1987) identified five theoretical perspectives that have been commonly applied to understanding adherence to treatment: biomedical, behavioural learning, communication, self-regulatory and cognitive. The biomedical perspective is primarily concerned with the effectiveness of medical treatment and people are expected to obey instructions from their health care provider about taking medication. According to the behavioural learning perspective, people learn how to be adherent based on either positive or negative consequences of behaviour (Glanz et al., 2008). Based on the communication perspective, adherence is enhanced when there is good communication between the health care provider and the client (Leventhal & Cameron, 1987). The self-regulatory perspective suggests that people are motivated to act based on a subjective evaluation of health risks and an ongoing problem-solving process to avoid risk. Theories based on the cognitive perspective assume that attitudes, beliefs, and thoughts influence behaviour. (Glanz et al., 2002, 2008).

According to Munro, Lewin, Swart, et al. (2007) the most used theories that have been applied to adherence to treatment for tuberculosis and HIV/AIDS are based on the cognitive perspective namely the Social-Cognition Theory, the Protection Motivation Theory, Theory of Reasoned Action, Theory of Planned Behaviour, and the Health Belief Model. Cognitive theories have a commonly held premise that behaviour is chosen based on the subjective determination of the value and probability of an expected outcome (Glanz et al., 2008). There is no clear evidence that any theory is superior to another in terms of understanding health related behaviour (Amico et al., 2017; Holmes et al., 2014; Munro, Lewin, Swart et al., 2007). The different theories have been applied in different context and all have several limitations.

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2.5.1 The Social- Cognitive Theory

The Social – Cognitive Theory (SCT) was developed from Bandura's social learning theory. SCT takes into consideration the dynamic interaction between personal factors, such as thoughts and perceptions, and environmental influences (Glanz et al., 2002). According to the SCT there are core determinants of health behaviour (Bandura, 2004). Knowledge regarding the potential risks and benefits of the behaviour, and an understanding of the expected outcomes will influence behaviour. Perceived self-efficacy and the capacity to set goals and implement a plan to achieve the goal may affect health behaviour according to the SCT. Perceived facilitators as well as potential social and structural impediments may act as barriers to performing the health behaviour or achieving the goals (Bandura, 2004).

According to Munro, Lewin, Swart et al. (2007), while the SCT may be one of the most comprehensive theories to explain health behaviour, it is difficult to operationalize and the applicability to intervention development is questionable. The SCT was thus not used in the current study.

The Protection Motivation Theory (PMT), Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB) and Health Belief Model (HBM) are commonly used intrapersonal theories of health behaviour. These theories focus primarily on the influence that thoughts, beliefs, and perceptions of the individual have on their behaviour. These different theories have been applied in various context to predict health behaviours and inform intervention strategies and each present with certain strengths and limitations (Glanz et al., 2008; Munro, Lewin, Swart, et al., 2007).

2.5.2 The Protection Motivation Theory

The Protection Motivation Theory (PMT) was developed to explain health behaviours specifically as they relate to fear response (Milne et al., 2000). The core premise of the PMT is that the motivation to act is based on fear and the desire to protect against potential harm (Ajzen, 2011). The PMT considers that there are two cognitive processes that determine behaviour. The first one is threat appraisal whereby an individual evaluates a threat based on the perception of the severity and individual vulnerability to the threat. The second is the coping-appraisal element whereby the efficacy of the recommended behaviour to remove the threat, and the belief in self-efficacy to execute the recommendations are evaluated (Armitage & Conner, 2000). Based on the

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PMT, an individual will be more likely to adhere to treatment when both threat appraisal and coping appraisal are high. According to the protection-motivation theory, fear arousal based on highlighting the severity and likelihood of harm, combined with an emphasis on the effectivity of the protective behaviour and self-efficacy expectancy will result in behaviour change such as adherence (Maddux & Rogers, 1983). I did not use the Protection Motivation Theory in the current study as it does not take into consideration some of the barriers that may impact on adherence especially considering the various identified challenges that are experienced by people accessing care for tuberculosis.

2.5.3 Theory of Reasoned Action

The Theory of Reasoned Action (TRA) was developed in 1967 to understand the relationship between beliefs, attitudes, intentions, and behaviours (Ajzen & Fishbein, 1980). The main predictor of behaviour according to this model is the intention to perform the behaviour which is influenced by subjective and social norms and attitudes. According to the TRA, attitudes are a result of the individual's beliefs regarding the consequences of a specific behaviour and the subjective importance of these consequences (Linke et al., 2014).

Subjective norms are based on the belief that an individual has regarding what the expectations of others are regarding behaviour (Conner & Norman, 2005). Thus, if a person believes that adherence to treatment will be beneficial, and these benefits are perceived as being desirable (attitude) and if they believe that their friends and family would expect that they would adhere to treatment (subjective norms) then adherence is more likely. However, the premise of the TRA is that the desired behaviour is within the individual's capacity to control which is not always the case. The Theory of Planned Behaviour, proposed in 1985, is an extension of the TRA and includes behavioural control (Ajzen, 1991).

2.5.4 Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) has been effective in predicting adherence to health behaviors including condom use, health screening, dietary requirements, and medication adherence (Armitage & Conner, 2001; Rich et al., 2015). Perceived behavioural control was added to the TRA constructs to take into consideration that not all behaviours are entirely within the control of the individual (Ajzen, 1991). For example, a person may have the intention of

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adherence, but due to food insecurity feels unable to follow advice regarding treatment. Perceived behaviour control is thus similar to self-efficacy and is the belief that an individual has in their capacity to perform a specific action (Linke et al., 2013). In both the TRA and the TPB, intentions are considered the best predictor of behaviour (Munro, Lewin, Swart, et al., 2007). Behavioural intentions are influenced by the evaluation of the likelihood as well as the risk and benefits of the outcome and take into consideration subjective norms and social norms (Rich et al., 2015). However, neither the TRA nor the TPB take into consideration other barriers such as financial concerns or perceived threat that may impact on behavioural intention and behaviour.

In terms of adherence to treatment, beliefs regarding the necessity of treatment, as well as concerns regarding potential harm of treatment are not considered by either the TRB nor the TRA and these are considered important factors to predict adherence to treatment (Horne et al., 2013, Rich et al., 2015). The TRA and TRB were not used in the current study based on these limitations.

2.5.5 The Health Belief Model

I chose to use the Health Belief Model (HBM) as it is a commonly used approach with the constructs able to be measured using a questionnaire. Both the HBM and the PMT consider the impact of fear, and the avoidance of threat as impacting adherence. However, the HBM includes the additional constructs of benefits and barriers to adherence which are not included in the PMT. Interventions to improve adherence based on the HBM can focus primarily on an individual level as it is the perceptions of reality that are considered paramount. The TRA and the TPB on the other hand, assume that customary codes of behaviour or the social norms of a group of people, as well as the general acceptance and importance that others have regarding a behaviour will impact motivation to act (Amico et al., 2017).

One of the earliest applications of the HBM was with tuberculosis and many of the key factors identified in literature that affect adherence to tuberculosis can be explained using the HBM. The core concept of the HBM is that what is of relevance is not only the reality of the various factors, but the individual perception of these factors, that affect adherence (Rosenstock, 1974).

The HBM originated from the work of researchers in the US Public Health sector in the 1950's (Rosenstock, 1974). This model is the only model specifically developed to understand

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health behaviour (Abraham & Sheeran, 2005). One of the first applications of this model was to explain why relatively few people were taking advantage of free tuberculosis screening (Hochbaum, 1958). The U.S. Public Health sector researchers acknowledged that socioeconomic and demographic characteristics influenced health behaviours. However, they wanted to identify factors that could be changed by health education (Hochbaum, 1958; Rosenstock, 1974).

The HBM has since become one of the most widely used conceptual frameworks in the field of behaviours related to health (Glanz et al, 2002). Initially applied to preventative behaviours, this model has been extended to health service usage as well as adherence to medical advice. It has been applied to a broad range of health-related behaviours across a wide range of populations including preventative behaviours such as mammograms to screen for cancer, sick role behaviours focusing on adherence to medical treatment and advice, as well as utilization of services such as attending clinic appointments (Abraham & Sheeran, 2005). Within the South African context, the HBM model has been applied to adherence to health promotion activities such as screening for cancer, HIV testing and adherence to treatment for tuberculosis and hypertension (Hoque et al., 2014; Mabotja et al., 2021; Nöthling & Kagee, 2013; Peltzer et al., 2002; Peltzer, 2004).

2.5.5.1 Components of the Health Belief Model

When initially developed, the HBM consisted of four components: perceived severity, perceived susceptibility, perceived barriers, and perceived benefits (Abraham & Sheeran, 2005). When applied to adherence to treatment, the perceived threat (based on a subjective evaluation of the perceived susceptibility and severity of the disease) and consideration of barriers and benefits of treatment will influence behaviour. High perceived threat, high benefits and low barriers are considered to increase the likelihood of recommended health behaviours such as adherence being followed (Munro, Lewin, Swart, et al., 2007).

The component of self-efficacy was added as a separate construct in 1988 (Glanz et al., 2002). Cues to action were included in earlier explanations of the model and was later incorporated as a core HBM construct in some studies (Abraham & Sheeran, 2005). Studies have shown that high self-efficacy as well as the presence of cues to action increase the likelihood of adherence to treatment (Redding et al., 2000; Rezaei & Feizi, 2008). Variables such as demographics and personality are modifying variables that may impact on perceptions. The

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HBM constructs that I have included in this study are perceived susceptibility, perceived severity, perceived benefits, self-efficacy, and cues to action.

Perceived susceptibility. Perceived susceptibility is the belief that a person has regarding his/her risk of contracting an illness (Redding et al., 2000). Evidence suggests that certain people such as those with a compromised immune system, those living in poverty, and using substances (drugs and alcohol) have an increased susceptibility to infection with tuberculosis (Ambaw et al., 2018, South African Department of Health, 2014; WHO 2013). According to the HBM, the greater the perception is of the susceptibility of becoming infected with an illness, the more likely that a health behaviour to detect or prevent infection will be followed (Abraham & Sheeran, 2005). When applied to adherence to tuberculosis medication, increased belief in the susceptibility of development of drug-resistance is likely to result in increased adherence to treatment.

Perceived severity. Perceived severity is the judgment an individual has regarding the seriousness of the condition as well as the anticipated impact on lifestyle. The more severe a person believes a disease is, the more likely s/he is to take steps to prevent or treat the disease (Hochbaum, 1958). Tuberculosis can result in pain, shortness of breath, disability, and death. Tuberculosis is infectious thus social relationships and capacity to work can be affected. According to the HBM, the more severe an individual perceives tuberculosis to be the greater the likelihood of adherence to treatment.

Perceived susceptibility and perceived severity together determine the perception of threat. However how these two constructs, and indeed if these two constructs should be combined to form a single construct of perceived threat has not been clarified (Glanz at al., 2002). The perception of a threat motivates people to act and the subjective weighing up of the benefits and barriers of available choices will determine what action is taken (Hochbaum, 1958).

Perceived benefits. Benefits include any positive expectation from the chosen health behaviour. An individual is more likely to choose a health-related behaviour that is perceived to be beneficial (Redding et al., 2000). The perceived benefits of making the specific choice to

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adhere to tuberculosis medication will be influenced by the belief in the efficacy of available treatment as well as beliefs about benefits of medicine in general (Horne et al., 1999).

Perceived barriers. Perceived obstacles or potential negative consequences of treatment are barriers to a health-related action. This could include the belief that treatment is too costly, too painful or requires too much effort to obtain (Redding et al., 2000). There are numerous barriers to treatment that have been identified across several studies throughout the world. Most of these barriers relate to the five interacting dimensions identified by Sabaté (2003). These are factors relating to the condition itself, therapy or treatment, broader health system, social and economic conditions, and to the individual patient. A person is more likely to adhere to tuberculosis treatment in the context of decreased perceived barriers.

Self-efficacy. Self-efficacy is the individual's belief in his or her ability to effectively perform the chosen action. It is believed that people with high self-efficacy are more likely to believe that they can achieve goals and will be able to deal with disappointments more effectively and remain motivated to continue to try compared to those with low self-efficacy (Bandura, 1977). Low self-efficacy is a predictor of non- adherence (Rezaei & Feizi, 2008). People who are confident that they can follow their prescribed treatment and overcome difficulties and barriers that may arise in this regard, are more likely to adhere to their treatment.

Cues to action. Cues to action are defined as external or internal factors that motivate people to act (Redding et al., 2000). These cues can include getting a telephonic reminder to take treatment or media reports or advertisements that encourage a specific health related action to be taken. An individual with tuberculosis may feel motivated by gaining weight, or by seeing a friend successfully complete treatment or by a visit from a counsellor. A recent systematic review of studies regarding interventions to improve adherence to tuberculosis medication found that cues to action in the form of reminder text messages combined with education was effective in improving adherence (Pradipta et al., 2020).

This spectrum of how cues to action have been defined across the different studies is an example of one of the criticisms of this model in that the key dimensions are not always clearly defined and operationalized (Glanz et al., 2008).

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2.5.5.2 Strengths and limitation of the Health Belief Model

There have been several analyses done regarding the effectiveness of the HBM to predict health related behaviour (Carpenter, 2010; Harrison et al., 1992; Janz and Becker, 1984; Zimmerman and Verberg, 1994). Janz and Becker (1984) calculated the percentage of times that each of the four original HBM constructs of perceived severity, perceived susceptibility, perceived barriers, and perceived benefits were statistically significant across 46 studies. Perceived barriers were statistically significant in 89% of the studies, followed by perceived susceptibility (81%), perceived benefits (78%), with perceived severity significant the least number of times (65%). The results were slightly different when only the 19 studies that focused on sick role behaviours such as adherence to treatment were included. Perceived severity was significant in 88% of studies that explored sick role behaviour indicating that perceived severity may be more significant when applied to treatment for an illness as opposed to preventative behaviours (Janz & Becker, 1984).

Harrison et al. (1992) focused on the effect size of each HBM component in the studies that they included in their analysis. The weighted average of the effect size computed for each component was perceived severity (0.08), perceived benefits (0.13), perceived susceptibility (0.15), and perceived barriers (0.21). The rank order of the effect size across the components matches the frequency of reported significance of these constructs in the analysis conducted by Janz and Becker (1984) when all studies were included.

Carpenter (2010) only included longitudinal studies in his analysis. The results of Carpenter's analysis indicated that perceived susceptibility was the weakest predictor of health behaviours, with perceived benefits and barriers being the strongest predictors of health behaviour. This is similar to the findings of Janz and Becker (1984) when they only included studies that focused on sick role behaviour. In contrast, perceived severity was reported by Carpenter (2010) as having the largest effect size when only studies measuring adherence to medication regimes were included. Carpenter (2010) also found that overall, the effect size in studies examining adherence to medication was larger than in others.

Zimmerman and Verberg (1994) included studies that used only the four original HBM components as well as studies that included cues to action and self-efficacy. They considered the impact of the model in its entirety and did not explore the influence of individual variables. Their results indicated that the HBM was weakly predictive of health-related behaviour.

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These meta-analyses have highlighted some of the theoretical limitations of the HBM. This model has been criticized as not being a true theory of behaviour, but rather a list of contributing factors (Conner & Norman, 2005). The cumulative effects of the model are not always explored, and the way that the different constructs can be combined has not been clarified (Abraham & Sheernan, 2005). There are some differences in terms of how the components have been operationalized and conceptualized. In one study for example susceptibility was defined as the possibility of getting sick, and in another the probability of contracting an illness and in another the likelihood of recurrence (Conner & Norman, 2005).

Janz and Becker (1984) stated that although there is an "impressive body of findings linking HBM dimensions to health actions, it is important to remember that the HBM is a psychosocial model; and as such is limited to account for as much variance as can be explained by their attitudes and beliefs" (p. 44). Despite some of the weaknesses of the HBM, studies using this model have consistently shown a relationship between the constructs and adherence to treatment in the expected direction (Carpenter, 2010; Harrison et al., 1992; Janz & Becker, 1984; Zimmerman & Verberg, 1994).

2.5.5.3 Health Belief Model and tuberculosis

One of the first applications of the HBM was in the field of preventative behaviours related to tuberculosis (Hochbaum, 1958). In a study in Taiwan, the HBM was applied to analyze the intention of nursing students to participate in the compulsory annual tuberculosis chest x-ray screening campaign (Chang et al., 2007). Results indicated that perceived susceptibility and perceived severity were higher, and perceived barriers were lower with the nurses who claimed that they intended to receive the x-ray exam as opposed to those who indicated that did not plan to have the exam.

Poss (2001) found similar results in a study that combined components of the Theory of Reasoned Action and the HBM to investigate participation in screening for tuberculosis offered for migrant workers in Mexico. Intention and perceived susceptibility were considered as necessary to predict screening behaviour (Poss, 2001).

In a recent study conducted in Japan, the HBM constructs explained 17% of the variance in prevention behaviours aimed at early detection of possible tuberculosis (Yoshitake at al., 2019). In their study, it was found that perceived severity, desire to perform socially desirable

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behaviour, self-efficacy and cues to action were positively associated with participation in preventative tuberculosis screening programs. Yoshitake et al. (2019) found that perceived severity was not associated with preventative behaviour. The results of the study by Yoshitake and colleagues are similar to the findings of Janz and Becker (1984) and Harrison et al. (1992).

The results of a study in Bangladesh showed further support for the effectiveness of the HBM to explain variance in preventative behaviours (such as covering their mouth if someone who has tuberculosis coughs) among people who accompanied people with active tuberculosis to their clinic appointments (Jahan et al., 2014). As predicted by the HBM, higher perceived susceptibility, higher perceived severity and higher perceived benefits and lower perceived barriers were associated with more preventative behaviour (Jahan et al. (2014).

When applied to adherence to treatment for tuberculosis, the HBM has been shown to be a useful theory to predict behaviour and to inform interventions to improve adherence. A study conducted in India concluded that people who were adherent to treatment (non-adherence defined as missing more than 15 days of treatment) were more likely to perceive tuberculosis as severe, perceived greater benefits and less barriers to adherence and expressed higher self-efficacy than those with poor adherence (Barnhoorn & Adriaanse, 1992).

Peltzer et al. (2002) however, used the same 21-item questionnaire as Barnhoorn & Adriaanse in their study and found that perceived benefits, perceived barriers, perceived susceptibility, and perceived severity were not significantly associated with adherence to treatment for tuberculosis. Peltzer and colleagues conducted their study in three hospitals in the Limpopo Province in South Africa and measured adherence to treatment for tuberculosis based on DOTS records.

Karimy et al. (2014) conducted a study in Iran exploring factors affecting adherence to tuberculosis treatment utilizing HBM constructs. The HBM accounted for 29% of the variance observed in adherence to treatment in their study. Knowledge, self-efficacy, perceived benefits, and perceived threat were significant predictors of adherence to the treatment regimen (Karimy et al., 2014). Another study in Iran found similar results, with the HBM variables of perceived threat, perceived barriers, perceived benefits, and self-efficacy explaining 42% of variance in adherence to tuberculosis treatment (Azizi et al., 2018). Their study utilized a purposively designed HBM questionnaire consisting of 25 items and measured adherence based on a five-

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item checklist (Azizi et al., 2018). Azizi and colleagues included 297 participants in their study and gathered data through interviews, questionnaires, and the observation of medical records.

The HBM proved useful to explain both preventative and health seeking behaviour when applied to tuberculosis in a study conducted in China (Li et al., 2015). Results showed that knowledge and perceived benefits predicted both preventive behaviours and seeking treatment for tuberculosis. A path analysis of results from the study by Li and colleagues indicated that knowledge of tuberculosis was found to predict perceived susceptibility and perceived severity, and that these two constructs predicted benefits of preventative care. Li et al. (2015) concluded that there was a path from knowledge, through perceived severity and perceived susceptibility, then through perceived benefits which then predicted both prevention and treatment seeking behaviours.

A psychological and educational intervention based on the HBM in Ethiopia significantly decreased treatment non-adherence among the group that participated in the intervention (Tola et al., 2016). Prasetya et al. (2018) explored the effect of hypnotherapy treatment that focused on the HBM constructs and adherence to tuberculosis treatment. At baseline, both the experimental and the control group had similar scores for the HBM constructs of perceived severity, perceived severity, perceived threat, perceived barriers, self-efficacy, and cues to action. The experimental group attended hypnotherapy sessions that focused on all constructs except cues to action. Results obtained by Prasetya et al. (2018) showed that the mean score of the experimental group was higher for all constructs, and lower for perceived barriers following two months of hypnotherapy. Participants in the hypnotherapy group showed significantly greater adherence to treatment compared to the control group based on self-report (Prasetya et al., 2018). The results of the study by Prasteya et al. (2018) showed a direct link between changes in health beliefs relating to the HBM and improved adherence to treatment for tuberculosis.

2.6 Conclusion

Adherence to treatment for tuberculosis is essential to effectively manage this disease. The HBM has been used to explain health related behaviour for over 50 years. There are some limitations to the theory, however studies using this model have consistently shown results that support the influence of the HBM constructs on behaviour. The application of the HBM in the context of tuberculosis treatment can provide valuable information regarding adherence.

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The core aim of this dissertation was to explore the effectiveness of the Health Belief Model, along with additional factors, to predict medication adherence in people hospitalised with tuberculosis. The research design and methodology to achieve the aims of this study is presented in Chapter Three.

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Chapter Three: Method

The primary aim of this study was to explore the utility of the Health Belief Model, including additional variables, to predict adherence to treatment among people who are hospitalised with tuberculosis. Questionnaires to measure adherence and the HBM constructs relating to tuberculosis were developed and validated. This chapter outlines the overall research design and the methodology of the study.

3.1 Research design

A quantitative research methodology was chosen to evaluate the utility of the Health Belief Model to predict adherence to treatment for tuberculosis. Quantitative studies explain relationships between variables using statistical analysis and results may be able to be generalized (Blanche et al., 2006). Qualitative studies can provide a more detailed and in-depth description of behaviour (Babbie & Mouton, 2009). There are numerous qualitative studies that are included in the literature review that have been applied to understanding adherence behaviour. A qualitative component was thus not considered necessary for this study and a quantitative method was chosen.

This study is a non-experimental design using correlational research. The purpose of correlational studies is to both identify and quantify relationships between two or more variables. In this study, the independent variables are the Health Belief Model constructs, beliefs about medicine, depression, alcohol use and substance use. The dependent variable is adherence to treatment for tuberculosis.

The data collection technique was a cross-sectional survey. Participants completed a battery of psychometric instruments that were compiled into a questionnaire booklet. Booklets were self-completed on a single occasion, and data was gathered between May 2017 and August 2018. Foxcroft & Roodt (2013) cautioned that low literacy levels can be a challenge when questionnaires are required to be self-completed. However, according to De Leeuw (2008) people may be less likely to provide socially desirable answers, unintentional influence by the interviewer is minimized, and both financial and time cost is less when using a self-administered questionnaire format as compared to face-to-face administration. Self-administered

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questionnaires are useful in resource constrained settings such as within the public health system in South Africa and were thus used in the study.

3.2 Participants

A convenience sample of people admitted to either Brooklyn Chest Hospital or DP Marais Hospital was included in this study. All people over 18 years of age were screened for possible inclusion in this study within seven days of admission to either of the research sites. The pilot study (n=40) was conducted between May 2017 and August 2017. A further 175 participants completed the questionnaire booklets between September 2017 and August 2018.

The sample of 175 participants included 75 males and 100 females. The mean age of participants was 34.37 years (SD =10.02), and the age range was 18 years to 74 years.

3.2.1 Inclusion criteria

To be included in the study participants needed to meet certain inclusion criteria. Only people who were (1) hospitalised with a confirmed diagnosis of tuberculosis, (2) on the tuberculosis treatment programme for at least the previous sixty days, (3) in sufficiently good health to participate in the study, (4) not floridly psychotic at the time of data collection, (5) able to understand written English or Afrikaans and (6) willing and capable to give informed consent, were included in this study.

3.2.2 Exclusion criteria

People who did not fit the inclusion criteria, or who did not provide consent were excluded from the study. It was required that people were screened for inclusion to the study within seven days of admission to either DP Marais Hospital or Brooklyn Chest Hospital. People who were inpatients at either of these two hospitals for longer than seven days were excluded from the study. Adherence was thus measured based on accessing care in the community. The potential impact of hospitalization on other variables, such as symptoms of depression or current substance use was minimized.

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3.3 Setting

Two research sites were identified that offer in-patient specialised care for the treatment of tuberculosis. These sites form part of the Metro TB Complex based in the Cape Metropole and are in the Western Cape Province of South Africa. Although both research sites are located within the City of Cape Town area, there are only four other specialised tuberculosis hospitals within the Western Cape, three of which have less than 100 beds (South African Department of Health, 2014). Admission to Brooklyn Chest Hospital and DP Marais is thus not restricted to people residing within the Cape Metropole and people living throughout the Western Cape Province may be admitted at these two hospitals.

According to Stats SA (2012) based on the 2011 census, there were nearly 3.8 million people living in the City of Cape Town. There were 6.6 million people living in the Western Cape province in 2018 (Stats SA, 2019). The three languages most spoken in the home in Western Cape were Afrikaans (49.7%), IsiXhosa (24.7%) and English (20.2%) (Stats SA, 2012). The General Household Survey reported however that the two most common languages spoken outside the home in South Africa are isiZulu (25.1%) and English (16.6%) with English the most spoken language outside the home in urban areas such as the City of Cape Town (Stats SA, 2019). Almost half the population (47%) of Western Cape are Coloured, 34.4% are Black African, 17.9% are White and 0.7% are Indian/Asian (Stats SA, 2019).

The Western Cape has the highest literacy rate of adults over 20 years of age in South Africa (98.2%) with the lowest number of people (1.5%) who have no formal education (Stats SA, 2018). Most people in the Western Cape (75.4%) had attained an academic level that was at least Grade 9 or above (Stats SA, 2019).

Treatment for tuberculosis, including drug resistant strains of the disease, is decentralized. Referral to a tuberculosis hospital is indicated when appropriate support or care cannot be adequately provided by the clinic or community (South African Department of Health, 2014). People are admitted to a specialised tuberculosis hospital either due to a medical reason such as side-effects or complications; when they are too ill or weak to receive treatment at home; or due to social reasons such as alcohol or substance use difficulties, mental illness, a history of interrupting treatment or other social or economic reasons (South African Department of Health, 2014).

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3.3.1 Brooklyn Chest Hospital

Brooklyn Chest Hospital is located approximately 10km from Cape Town central business district. This hospital caters for complicated tuberculosis cases requiring admission and specialised care and is a designated multi drug resistant tuberculosis (MDR- TB) and extensively drug resistant (XDR-TB) specialist hospital. There were approximately 90 beds for adults with drug sensitive tuberculosis, 200 beds for adults with drug resistant tuberculosis (female MDR and male and female XDR) and 45 beds for children at the time of the study.

3.3.2 DP Marais Hospital

DP Marais is based in the South Peninsula Health District of the Cape Metro region and is nearly 25 km south of Cape Town central business district. During the data gathering phase of this study there were 55 beds available for adult females and 100 beds for adult males who have drug sensitive tuberculosis. There were 55 beds for adult men with MDR-TB.

3.4 Procedure

Seven people employed as health care professionals at the identified research sites were recruited as research assistants. There were two social workers, one social auxiliary worker, two physiotherapists, and two occupational therapists who voluntarily assisted in the research. The research assistants were given appropriate training with regards to the ethical consideration of informed consent and were able to explain the purpose of the study to potential participants.

All people over 18 years of age who were newly admitted to the research sites with a confirmed diagnosis of tuberculosis were potential candidates for inclusion in the study. Names of people admitted were obtained daily and potential participants were screened such that the questionnaire booklet could be completed within seven days of admission. In line with approval granted by the Health Research Ethics Committee of Stellenbosch University (Appendix A) and with permission obtained from the Western Cape Department of Health and the Medical Services Manager of Metro TB Complex to conduct the research (Appendix B), I obtained information from clinical notes and referral information relating to the expected planned length of time on treatment. People were excluded based on this initial screening if length of time they should have been enrolled in the treatment plan was less than 60 days.

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I obtained confirmation from relevant ward staff that the potential participants were physically and psychological capable of giving informed consent and of completing the questionnaire booklet. Either I, or one of the research assistants, approached the potential participants at the relevant hospital. The purpose of the study was explained to candidates who indicated that they were able to understand written English or Afrikaans. Potential candidates were given an opportunity to ask questions in whichever of these two languages they felt most comfortable. Only candidates who provided written consent were included in the study. Each participant was offered a copy of the signed consent form and information sheet (appendix C). I stored all consent forms separately from the completed test booklets.

Once written consent was obtained, a questionnaire booklet was presented to the participant in their chosen language of either English or Afrikaans. It was explained to participants that they could change their mind at any stage regarding participation in the study and that this would not have any negative consequences to the care provided at the hospital. Participants kept the booklet to complete in their own time in a setting where they felt comfortable. Participants were informed that they would be provided with an opportunity to ask questions when the booklet was collected if there was any item within the questionnaire booklet that required clarity. No identifying information was included in the questionnaire booklets.

Test booklets were collected after an agreed upon time (usually not more than 24 hours later). When booklets were collected, the researcher or research assistant explained that sometimes a question may be missed either by accident or because assistance to understand the question was required. With the consent of the participant, the booklet was scanned for completeness. Participants were encouraged to complete any missing items and clarity on any item was provided if needed.

In line with the ethical requirements of this study, research assistants were instructed to pay special attention to item nine on the Beck Depression Inventory, which relates to suicidal ideation, when they checked questionnaires for completeness. If this specific item was endorsed in the scorable direction the research assistant was required to inform me and an immediate request for psychological intervention was made.

I scored all psychometric tests within each booklet within one week to ensure that appropriate referrals to members of the multi-disciplinary team could be made timeously if

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necessary. Data were only captured from participants who answered all items in the entire test booklet. All participants were given a chocolate bar as a token of appreciation.

3.5 Instruments

The full test booklet consisted of demographic and socioeconomic questions, the Tuberculosis Health Belief Scale (TB-HBS), Belief about Medicine Questionnaire (BMQ) the Alcohol Use Disorders Identification Test (AUDIT), Drug Use Disorders Identification Test (DUDIT), Beck Depression Inventory (BDI) and the Tuberculosis adherence scale (TB-AS).

A validated Afrikaans translation of the Alcohol Use Disorders Identification Test and the Drug Use Disorders Identification Test was obtained (Nel, 2011). The TB-HBS and the TB-AS were translated to Afrikaans during the development phase outlined in Chapter Four of this dissertation. The remaining instruments were translated into Afrikaans by a professional translation service. These were reviewed by a team of three bilingual experts who confirmed that the Afrikaans versions were similar to the English version based on analysis of items. Two people from a similar socioeconomic and cultural background as the proposed participants adapted the wording used where necessary such that language used was applicable for the research context as suggested by Foxcroft and Roodt (2012). The Afrikaans translations of the scales are conceptually similar and culturally appropriate.

3.5.1 Demographic record

Questions relating to the participants' age, gender, marital status, tuberculosis history, employment history and education history were included in a purposively designed demographic record (appendix D). There are several methods that can be utilized to measure socioeconomic status. Social scientists have developed methods such as measuring consumption expenditure, analysis of household income and evaluation of household assets (Hruschka et al., 2015). Information collected regarding assets and household amenities from demographic and health surveys have been used to create a wealth index which can indicate a measure of economic status (Hruschka et al., 2015; Rutsein & Staveteig, 2014).

Ataguba et al. (2011) measured socioeconomic status based on information provided in the South Africa General Household Surveys (GHS) regarding common assets such as a working refrigerator and television, and household characteristics such as source of drinking water and

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type of toilet available. I included three items that are similar to the GHS in relation to household characteristics and five yes/no questions pertaining to availability of assets in this study in order to create a measure of socioeconomic status (appendix E). The three household characteristic items included were source of drinking water, source of energy for cooking and toilet facility usually used. The five yes/no items included pertained to access to electricity and owning a refrigerator, radio, television, and telephone. This information provided an indication of the relative socioeconomic status of the study population and enabled some comparison to be made with the larger population of the Western Cape based on the latest results obtained from the South Africa General Household Survey (Stats SA, 2019).

3.5.2 Tuberculosis Health Belief Scale.

The Tuberculosis Health Belief Scale (TB – HBS) was developed for this study to measure the health belief constructs related to the Health Belief Model (HBM). The development and validation of this scale will be described in Chapter Four of this dissertation.

The TB-HBS consists of five subscales designed to measure the HBM constructs of Perceived Threat, Perceived Benefits, Perceived Barriers, Cues to Action and Self-Efficacy. Perceived Threat measures both perceived susceptibility to and perceived severity of tuberculosis (appendix F). The Perceived Threat subscale consists of ten items. There are six items included in the Perceived Benefits subscale, ten items in the Perceived Barriers subscale, four items in the Cues to Action subscale and twelve items in the scale to measure Self-Efficacy. Items are scored on a Likert Scale with scores ranging from five (strongly agree) to one (strongly disagree). A higher score for each subscale indicates a stronger perception of the measured construct.

The Cronbach's alpha for the current study for Perceived Threat was 0.79, Perceived Benefits was 0.72, Perceived Barriers was 0.77, Cues to Action was 0.77 and Self-Efficacy was 0.81. The Cronbach's alpha above 0.7 indicated that there was a suitable internal consistency of each subscale (Field, 2013).

3.5.3 Belief about Medicines Questionnaire

The Beliefs about Medicines Questionnaire (BMQ) was developed by Horne et al. (1999) and is based on social cognition models including the Health Belief Model (appendix G). The BMQ was designed to measure beliefs about medication in people receiving medical treatment

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and has been widely used to understand adherence across a variety of contexts including HIV, hypertension, diabetes, asthma, and other illness (Horne et al., 2013; Gatti et al., 2009; Jamous et al., 2014).

The 18-item BMQ scale consists of two sections. The BMQ-General measures beliefs about medicine in general and the BMQ-Specific measures beliefs about the medication prescribed to treat a specific illness. This questionnaire is a reliable and valid measure of medication beliefs across a wide variety of patient populations (Horne et al., 1999; Jamous et al., 2014). The Cronbach's alpha calculated by Jamous et al. (2014), for the four BMQ subscales ranged from 0.7 to 0.8 indicating good internal consistency.

The BMQ-General is comprised of the General-Harm and the General-Overuse subscale. The four items on the General-Harm subscale assess beliefs pertaining to the potential harm associated with medications in general. The four items included in the General-Overuse subscale measures beliefs regarding the overuse and over prescription or over reliance on medication by doctors.

The BMQ-Specific scale was designed to be a flexible instrument that could be adapted to assess beliefs about medicines for any illness, or medicine within a regime (Horne at al., 1999). Responses are measured on a five-point Likert scale and range from strongly disagree to strongly agree, with a higher score indicating a stronger perception of the measured factor.

The BMQ- Specific is divided into the Specific-Necessity and the Specific-Concerns subscales. The Specific-Necessity subscale contains five items designed to measure the beliefs regarding the necessity of prescribed treatment. Concerns regarding the potential harm from medication based on long-term effects, dependency, and disruptions due to treatment are measured by the five items on the Specific-Concerns subscale.

Meta-analyses of studies using the BMQ show that people who reported higher adherence to treatment for various conditions scored higher in necessity of treatment and lower in concerns about treatment (Foot et al., 2016; Horne et al., 2013).

3.5.4 Alcohol Use Disorders Identification Test

The Alcohol Use Disorders Identification Test (AUDIT) was used in this study to identify alcohol use and risk for dependence (appendix H). The AUDIT is a validated 10-item self –

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rating questionnaire that was developed by the World Health Organization for use by health care professionals to identify persons with harmful patterns of alcohol use (Saunders at al., 1993).

The AUDIT consists of three questions related to consumption of alcohol, three questions on drinking behaviour and dependence, and four questions focusing on consequences and potential problems caused by alcohol use. The total AUDIT score (maximum 40) is used to determine the risk level for hazardous and harmful drinking. A total score of 8 or more was recommended as an indicator of possible harmful alcohol use (Saunders et al., 1993). A score between 8 and 15 indicates a medium risk of problematic drinking, a score between 16 to 19 represents harmful and hazardous alcohol use, and a score of above 20 is an indication of probable dependence on alcohol (Saunders et al., 1993).

A systematic review of the psychometric properties of the AUDIT confirmed the validity and efficiency of this test to identify harmful use, abuse, and dependence on alcohol across a range of populations (De Meneses-Gaya et al., 2009). According to the findings by Reinert and Allen (2007) the criterion validity and construct validity of the AUDIT is well supported across a range of studies. Cronbach's alpha for ten studies that evaluated the internal consistency of the AUDIT had a mean value of 0.80 (De Meneses- Gaya et al., 2009). A study conducted using the AUDIT to measure alcohol use among tuberculosis patients in South Africa indicated excellent reliability of the AUDIT with a Cronbach's alpha of 0.92 (Peltzer et al., 2012).

3.5.6 The Drug Use Disorders Identification Test

The Drug Use Disorders Identification Test (DUDIT) was used to measure drug abuse or drug dependence in this study (appendix I). The DUDIT was developed to identify people with drug-related problems (Berman et al., 2003).

The DUDIT consist of 11 items. Items one to nine are scored on a scale of zero to four, and Item nine and Item ten can be scored as either zero, two or four. A higher score indicates a greater severity of drug-related problems. The maximum score is 44 and this is calculated as the sum of points for each item (Berman et al., 2003) A score of six or above for males, and two or more for females indicates that problematic drug use is likely. A score of above 25 for either sex indicates a high probability of dependence on one or more drug (Berman et al., 2003).

A review of research conducted on studies utilizing the DUDIT concluded that the reliability and validity of this tool was satisfactory (Hilderbrand, 2015). Internal consistency

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based on Cronbach's alpha were generally above 0.90 and validity was supported with sensitivity ranging from 0.85 to 1.00 and specificity ranging from 0.85 to 1.00 in a variety of populations (Hilderbrand, 2015). The Cronbach's alpha for the DUDIT obtained from a study conducted in Cape Town, South Africa was calculated at 0.76 (Kader et al., 2015).

3.5.7 Beck Depression Inventory

Signs and symptoms of depression were measured using the Beck Depression Inventory (appendix J). The Beck Depression Inventory (BDI) is one of the most widely used measures of depression and has been used in over 5000 studies worldwide (McDowell, 2006). This self – administered questionnaire consists of 21 groups of questions in a Likert type scale. The BDI measures affective, cognitive, motivational, and vegetative indicators relating to symptoms of depression (Beck et al., 1988).

The items are rated on a scale of 0 to 3 that represents increased intensity of the measured construct. A score of 10 or below indicates a normal profile, a score of 11 to 30 indicates mild depression, a score of 31 to 40 indicates severe depression and over 40 indicates extreme depression (Beck & Beamesderfer, 1974). According to Beck et al. (1988), the calculation of the Cronbach's alpha for the BDI showed a mean of 0.86 for psychiatric patients and 0.81 for non-psychiatric patients which indicated a high internal consistency. A similarly high internal consistency with a Cronbach's alpha of 0.94 was obtained in a recent study conducted in the Western Cape among individuals seeking HIV testing (Saal, 2017) A meta-analysis of the BDI scale indicated a high correlation between the two available 21 item versions of the Beck Depression Inventory and both versions are valid and reliable instruments (Erford et al., 2016).

3.5.8 Tuberculosis Adherence Scale

Adherence to tuberculosis was measured by using the purposively designed Tuberculosis Adherence Scale (Appendix K). The development and validation of the Tuberculosis Adherence Scale (TB-AS) scale will be provided in Chapter Four of this dissertation.

The TB-AS consists of two sections. One section is based on self-reported adherence and the second section is based on a history of health care provider reports of poor adherence. The first self-report section consists of four items. Three items are in a yes/no format and one item is in a five option Likert format. A higher score is indicative of higher adherence to treatment for

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tuberculosis. The score assigned for section two was based on an evaluation of clinical notes and referral letters either in the medical file or the online system. A score of 0 was assigned to participants where no indication of poor adherence was mentioned in their clinical file or referral notes, and a score of 1 was assigned if specific mention of poor adherence was made. The total adherence of the TB-AS was the summed score of section one and section two. The scores range from zero to five with a higher score reflecting a higher degree of adherence.

The Cronbach's alpha for the TB-AS in this study was 0.69. This indicates that the scale has good internal consistency in this sample.

3.6 Data Analysis

All relevant data were coded, and scores entered in the Statistical Package for the Social Science (SPSS) version 26. Only data from test booklets that had no missing data were captured. To minimize errors in data capturing, all data from all participants were double-checked for accuracy. Information was initially captured by an assistant reading the data score from each questionnaire booklet aloud, which was captured in SPSS by the researcher. The data captured on SPSS were then read out aloud and the assistant confirmed that these were identical to the score in each questionnaire booklet.

The raw data from the questions relating to demographic information were coded and a numerical value assigned to each question. Coding of the relevant items were checked by displaying the value label in the data view window of SPSS and confirming that this matched the un-coded answer provided by the participant. Cronbach's alpha was calculated for each subscale to test for internal consistency.

Multiple regression analysis is a method used to understand the relationship between each separate as well as combined independent variables and the dependent variable (Field, 2013). Hierarchical regression is a form of multiple regression whereby variables are added to the model in separate steps in a pre-determined order (Field, 2013). This allows for investigation of the moderating effect of variables and exploration of whether the addition of variables to the model will improve variance that is predicted (To & Mandracchia, 2019) Accordingly, hierarchical regression analysis was the method chosen for this study in order explore the utility of the Health Belief Model constructs, and additional variables (beliefs about medicine, depression, alcohol use and substance use) to predict adherence to treatment for tuberculosis.

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3.7 Sample Size

There are various techniques explored in literature that have been applied to determining appropriate sample size. The rule of thumb sometimes used in the context of regression analysis, is to include between 10 and 15 participants per predictor (Field, 2013). Tabachnick and Fidell (2001) explained that a sample size based on the formula of $n \geq 104 + k$ (k representing the number of predictor variables) should yield sufficient power to test predictors in a regression model.

3.8 Ethical Considerations

Ethical approval was received from the University of Stellenbosch. Permission was obtained from the relevant authorities at the Department of Health and the Medical Services Manager at Metro TB Complex to conduct research at Brooklyn Chest Hospital and DP Marais Hospital.

The research assistants were informed about the purpose of the study and received full training on the primary ethical considerations such as providing information about the research, obtaining informed consent, protection of anonymity, confidentiality, and protection of data from harmful access or use. All answers given by the participants during the study remained confidential and anonymous and this was clarified in the consent form and verbally explained to each participant. No research assistant asked for consent from a potential participant with whom a clinical relationship had already been established. Data remained anonymous and the consent form and completed booklet were stored separately in a locked cabinet. No identifying information was included in the answer booklets. A unique code was assigned to each booklet and corresponding consent form such that only I could identify each participant.

I was the only person who scored the test instruments. If the scoring on the BDI, AUDIT or DUDIT indicated a possible mental health problem, feedback was provided to the relevant participant. If referral for appropriate treatment was indicated, then consent was obtained for the referral to be made. A total of 33 participants were referred for further input based on probable dependence to substances, and 26 were referred for psychological intervention based on symptoms of severe to extreme depression. If no potential mental health conditions were detected then no feedback regarding the findings of the study, or the individual results were provided to the participant.

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In addition to the follow up and referral of specific participants where a potential mental health problem has been detected, all participants received a standardized information sheet to explain how they can access additional support services should they feel distressed or concerned following their participation in the study (Please refer to appendix L).

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Chapter Four: Scale development

One aim of this study was to develop a suitable scale to measure the constructs of the Health Belief Model (HBM) and adherence to treatment in the context of tuberculosis. In Chapter Four the method for the development of the Tuberculosis Adherence Scale (TB-AS) and the Tuberculosis Health Belief Scale (TB-HBS) is outlined. The results of the process of establishing reliability and validity are discussed. The final items for the TB-AS and the TB-HBS that are included in the multiple regression analysis to explore the utility of the HBM to predict adherence to tuberculosis treatment are provided.

4.1 Tuberculosis Adherence to Medication Scale (TB-AS)

I had planned to use the Morisky eight item Medication Adherence Scale (MMAS-8) to measure adherence to tuberculosis treatment and included this scale in the test booklet used in the pilot study. This scale has been widely used to assess adherence to medication in a variety of different contexts and languages and is considered to have high validity and reliability among people with chronic diseases (Lam & Fresco, 2015). The MMAS-8 is copyrighted, although there is some debate as to the extent to which the copyright can be applied as this tool consists of eight broad questions (Park & Lee, 2019). There has been some controversy regarding what was suggested to be an “aggressive” protection of intellectual property and an unreasonably high cost of granting licenses (Marcus, 2017).

The developers of the MMAS-8 informed me that a fee of €2000.00 was required to use this scale which was financially prohibitive. I thus decided to develop a tuberculosis specific scale that focused on medication taking behaviour that could potentially be freely utilized for future research or in clinical work in a resource constrained setting such as South Africa.

The TB-AS consists of two sections. The first section contains self-report items. The second section consists of a single yes/no item which is based on whether there was mention in the referral letter or clinical notes by the health care provider regarding a history of poor adherence or treatment interruption. The second section is designed to be completed by the relevant health care provider or researcher that has the required right to access clinical information. The total adherence score is thus the sum of the self-report score and health care

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provider report. The procedure for the development of the self-report section of the scale to measure adherence included the generation of items for inclusion and establishment of reliability.

4.1.1 Item development of self-reported section

In designing the first section of the tuberculosis adherence scale, I first defined the construct to be measured, decided on the format for measurement and then generated items in consultation with a team of experts as suggested by De Vellis (2016) and Foxcroft and Roodt (2012).

4.1.1.1Definition of Measurable Constructs

I defined the construct of adherence as specific medication-taking behaviour (Nguyen et al., 2014). I aimed to ensure that no other latent variables, such as barriers to treatment, that may relate to potential reasons for non-adherence were included.

4.1.1.2 Measurement Format

I used the same response format and scoring method used in the MMAS-8 as this scale has been widely across a variety of contexts (Morisky & DiMatteo, 2011; Stirratt et al., 2015). The newly developed adherence self-report questionnaire initially consisted of four yes or no questions (either assigned a score of 1 or 0) such that a higher score reflected greater adherence. There was one question where adherence was indicated on a continuum from never to always. An indication of never or almost never reflected greater adherence and was allocated a score of 1, the remaining three options indicated poor adherence and was scored 0.

Length of time on treatment and previous exposure to tuberculosis drugs affect clinical decisions regarding treatment (South African Department of Health, 2014). It thus seemed reasonable to assume that such information would be provided in the referral letter or clinical notes. This assumption was confirmed in discussions with the team of experts who assisted in the generation of items for the self-report section. Information regarding physician noted history of adherence was obtained from the online referral letters made to the admitting physician, on the continuity of care record and clinical notes recorded by the admitting physician. A score of 1 was assigned if there was no mention made of poor adherence and a score of zero assigned if a history of poor adherence or defaulting treatment was mentioned.

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4.1.1.3 Generation of items with panel of experts

The item pool was generated in consultation with a team of experts employed at Brooklyn Chest Hospital and DP Marais Hospital. The team consisted of a medical doctor, a social auxiliary worker, two senior social workers, and a senior physiotherapist. The team was chosen as they each had more than five years' experience working within a tuberculosis setting. The medical doctor and senior physiotherapist both had experience with conducting research and the social workers had extensive experience in conducting adherence related therapeutic sessions with people diagnosed with tuberculosis. The purpose of the study and the intention of developing an easy-to-use questionnaire to measure medication taking behaviour was explained. The researcher and the team of experts met as a group and in collaboration agreed on the five items to be included in the self-report section of the adherence scale.

Three additional experts with a similar education and socioeconomic background as the intended participants provided feedback regarding the clarity, simplicity, and ease of understanding of the language used. The English version of the self-report section of the newly developed adherence scale was considered to have good construct and content validity based on the consultation and consensus agreement of the panel of experts. The items included in the self-report section of the newly developed scale to measure adherence to tuberculosis treatment is presented in Table 5.

Table 5

Items included in the self-report section

Item
1.Did you take your TB medication the day before you were admitted to hospital?
2. Have you ever skipped/missed your TB treatment?
3. Have you ever hidden your TB medication?
4. Have you ever skipped your TB treatment for two (or more) consecutive months?
5. How often have you skipped your TB medication for any reason?

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4.1.1.4 Translation into Afrikaans

The panel of experts used in designing the scale to measure adherence were all bilingual in English and Afrikaans. The panel translated the scale into Afrikaans and ensured that questions were both conceptually similar and culturally appropriate considering that most participants were expected to be Coloured and Black African. As recommended by De Vellis (2016), the English and Afrikaans version of the scale was examined by two experts who were bilingual and who were not involved in the development of the scale or in the translation process. Both experts agreed that the two versions were equivalent. Three Afrikaans speaking people with a similar socioeconomic and cultural background of the intended participants confirmed the semantic relevance of language used. The Afrikaans translation can thus be used with confidence based on the steps taken to ensure accurate translation from English and required adaptations to ensure questions are relevant and easily understandable (Foxcroft & Roodt, 2012).

4.1.1.5 Reliability analysis of self-report section.

The validation of the measure and the final item selection was achieved by the administration of the newly developed scale, along with the battery of instruments outlined in Chapter Three of this study, to a sample of 175 people hospitalised with tuberculosis. Reliability statistics were calculated using Cronbach's alpha. The Cronbach's alpha score for the five self-reported items initially used was 0.60. The item-total statistic for the self-report section of the scale developed for measuring adherence to tuberculosis treatment is presented in Table 6.

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Table 6

Item – total statistics for self-report section of the newly developed adherence scale

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Ever Skipped	2.42	1.40	0.45	0.36	0.49
Often skipped rescored	2.46	1.47	0.40	0.23	0.53
Hidden	2.07	1.62	0.34	0.17	0.55
Defaulted	2.20	1.36	0.52	0.27	0.45
Taken day before admitted	2.21	1.80	0.11	0.09	0.67

The deletion of the item relating to taking medication the day before admission increased the Cronbach's alpha score to 0.67. This item also has a lower item-total correlation, and I thus deleted this item from the scale. The four items included in the final self-report section of the adherence scale had a Cronbach's alpha score of 0.67.

The addition of the item based on physicians notes regarding adherence history resulted in a slight increase in the Cronbach's alpha to 0.69. The item statistics for the newly designed scale to measure adherence based on the four self-report items and the history of adherence is presented in Table 7.

Table 7

Item statistics for the TB-AS

Item	Corrected item – total correlation	SD	Mean	Alpha if deleted
Ever Skipped	0.55	0.42	0.50	0.60
Often skipped	0.47	0.38	0.49	0.63
Hidden	0.37	0.77	0.43	0.67
Defaulted	0.46	0.64	0.48	0.64
Adherence history in notes	0.38	0.34	0.48	0.67

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It is generally accepted that a Cronbach's alpha of 0.7 or above is an acceptable level, however it has also been suggested that a value of 0.5 is sufficient (Field, 2013). The Cronbach's alpha for this scale was within the region of about 0.7 to 0.8 which according to Field (2013) is a reasonable indicator of good reliability. The item-statistics for the adherence scale showed that the five items can all be retained. The Cronbach's alpha of 0.69 indicated that this composite scale can be considered a reliable measure of adherence to tuberculosis treatment. Content and construct validity were established through collaboration with a team of experts in the field of tuberculosis and consensus was required for inclusion of items. I named the newly designed measure the Tuberculosis Adherence Scale (TB – AS) (appendix K).

4.2 Tuberculosis Health Belief Scale (TB – HBS)

According to the review of available literature, the Health Belief Model (HBM) has seldom been used in the context of adherence to tuberculosis medication. A recent systematic review using health psychology theories to predict adherence reviewed 1756 articles, of which 67 articles were included in their final analysis (Holmes et al., 2014). Among these studies, the most commonly used theoretical model was the HBM (n = 20). None of the included articles focused specifically on adherence to tuberculosis medication. The literature search brought into focus the lack of a readily available tuberculosis specific scale based on the HBM. One of the aims of this study was thus the development of the Tuberculosis Health Belief Scale (TB-HBS).

4.2.1 Item development

I was guided by the steps recommended by De Vellis (2016) and Foxcroft and Roodt (2012) in terms of scale development as well as the advice provided by Abraham and Sheeran (2000) regarding the development of an HBM questionnaire. The process I followed was (1) defining each construct, (2) determining the format for measurement, (3) generating an item pool (4) having the initial item pool reviewed by experts, (5) translation of the tool into Afrikaans, (6) conducting a pilot study, (7) re-evaluation of all the items. Each step will be explored in more detail.

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4.2.1.1 Definition of measurable constructs

The aim of this study was to measure the HBM constructs related to adherence to tuberculosis medication .The constructs were thus specifically defined and chosen to reflect the following (1) perceived severity of tuberculosis; (2) perceived susceptibility to a more resistant form of tuberculosis; (3) perceived benefits of adhering to treatment; (4) perceived barriers to adherence to treatment; (5) cues to action as external triggers that promote adherence; (6) self-efficacy, or belief in one's own capacity to adhere to treatment (Abraham & Sheeran, 2000; Conner & Norman, 2005; Munro, Lewin, Swart et al., 2007)

4.2.1.2 Determine the format for measurement

I decided on a Likert scale format as this was the most used format for other scales designed to measure the HBM constructs (Becker & Janz, 1985; Champion, 2002; Erkin & Özsoy, 2012; Zagumny & Brady, 1998). This format was also used for the HIV Treatment Adherence Self-Efficacy Scale which I adapted to measure self-efficacy in this study (Johnson et al., 2007). The scale that I decided on for this study reflected five response options. The options ranged from strongly agree to strongly disagree such that a higher score reflected a greater belief in the construct.

4.2.1.3 Generating an item pool

To increase the likelihood of identifying items that could reliably measure the identified constructs, I adapted some items from existing scales such as the AIDS Health Belief Scale, Scales to Measure Beliefs of Diabetic Patients Champions' Health Belief Model Scale and the Health Belief Model Applied to Influenza scale that were designed to measure the HBM constructs, as suggested by Abraham and Sheeran (2000) (Becker & Janz, 1985; Champion, 1998; Erkin & Özsoy, 2012; Zagumny & Brady, 1998). Wording was changed to reflect tuberculosis specifically. Newly developed items based on the themes identified in a systematic review of quantitative studies of adherence to treatment for tuberculosis were included. These themes are related to organization of care and treatment; interpretation of illness and wellness; financial burden; knowledge, attitudes, and beliefs about treatment; and side effects of treatment (Munro, Lewin, Smith et al., 2007).

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The number of items in different questionnaires that have been designed to measure the HBM constructs varied. Zagumny and Brady (1998) for example developed a scale with four items for each construct, whereas Champion (1998) had a range of five to twelve items per subscale in her scale and Erkin and Özsoy (2012) had a range of five to eight items in each subscale. I thus aimed to have a minimum of five items for each construct in the final scale to measure the HBM constructs. According to Foxcroft and Roodt (2012), up to one third of items may be discarded during the development phase. I thus included a minimum of seven items that I believed would likely measure each construct in the original item pool. I took care to ensure that all newly constructed items were unambiguous and clearly stated (DeVellis, 2016). I did not use sentences that were too long or double-barreled and used vocabulary that was appropriate to the people who would be participants in the study (Foxcroft & Roodt, 2012). The total number of items in the original pool that were reviewed by a panel of experts was 57.

4.2.1.4 Item development and review by experts

A panel of experts consisting of a medical doctor, a nursing professional, a senior social worker, and a senior occupational therapist, all with at least five years' experience working in a specialised tuberculosis facility, and a psychometric expert from the University of Stellenbosch reviewed the item pool. The definition of each HBM construct was explained to each member of the panel. Each person was independently asked to comment on whether they believed the item sufficiently measured each construct as it related to tuberculosis, as well as the appropriateness of the wording, sentence construction, and linguistic appropriateness of each item (Foxcroft & Roodt, 2012). I collected all comments and discussed any concerns with the panel members individually and adjusted the questions accordingly. In the event where two or more panel members felt that a question was inappropriate or not relevant to the context of tuberculosis and consensus could not be reached regarding possible alterations to the wording, then the question was removed. In consultation with the psychometric expert, more general questions were asked first followed by more personal questions. Following the review by the team of experts, a final questionnaire of 43 items was constructed.

Perceived susceptibility. I adapted two items from the AIDS Health Belief Scale (AHBS) (Zagumny & Brady, 1998). The AHBS was considered to have good content validity

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and internal consistency (Zagumny & Brady, 1998). An example of a question adapted from the AHBS was “I am afraid that I might contract a more resistant strain of TB”.

Three items that were included were adapted from a scale developed to test the HBM and acceptability of HIV counselling (Nöthling & Kagee, 2013). This entire scale developed by Nöthling and Kagee (2013) had good internal consistency with a Cronbach’s alpha of 0.82. An item adapted from this scale was “I worry a lot about getting a more resistant form of TB”.

I adapted three items from Scales to Measure Beliefs of Diabetic Patients. The Scales to Measure Beliefs of Diabetic Patients was considered valid and reliable in measuring HBM factors (Becker & Janz, 1985). An example of an item that was adapted from this scale was “My TB would be worse if I did nothing about it.

After these eight items were reviewed by the team of experts, six items were retained. The items that were believed to measure the perception of susceptibility as it related to adherence to tuberculosis treatment are presented in Table 8.

Table 8

Items included to measure perceived susceptibility

Item
1. I do not think that I can get a more resistant type of TB than what I have.
2. I am very healthy so my body can fight off a TB infection.
3. My TB would be worse if I did not take any treatment for it.
4. I am afraid that I might contract a more resistant type of TB.
5. When I think about drug resistant TB, my heart beats faster.
6. I am afraid to think about drug resistant TB.

Perceived severity. I adapted five items from Champions’ Health Belief Model Scale (Champion, 1998). Champions’ scale is a commonly used instrument to measure the HBM variables and was considered valid and reliable for use in screening for cancer (Champion, 1998). An example of an item adapted from this scale was “The thought of TB scares me”.

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I included one item based on the Health Belief Model Applied to Influenza (HBMAI), which was considered a valid and reliable tool for measuring beliefs about influenza (Erkin & Özsoy, 2012). The question adapted from the HBMAI was "TB can be a serious disease if you don't treat it".

Three items were included that were adapted by the researcher from the AIDS Health Belief Scale (Zagumny & Brady, 1998). An example of an item was "I would rather have any other terminal illness than TB". An additional item "I am afraid to think about drug resistant TB" was added based on the review of the literature.

Following the review of the ten items by the team of experts, six items regarding the perception of the severity of tuberculosis and development of drug-resistance were retained. The six items designed to measure perceived severity of tuberculosis are presented in Table 9.

Table 9

Items included to measure perceived severity.

Item
1. The thought of TB scares me.
2. TB causes death.
3. I would rather have any other terminal illness than TB.
4. I would rather die from a violent death (e.g., gunshot, car accident etc.) than from TB.
5. If I had a more Drug resistant TB my whole life would change.
6. TB can be a serious disease if you don't treat it.

Perceived benefits of treatment. I adapted one item from Champions' Health Belief Model Scale related to benefits of treatment (Champion, 1998). I included three items that I adapted from the HBMAI (Erkin & Özsoy, 2012). An example of an item from the HBMAI was "Taking my TB medication can protect others in my household from getting TB".

Two items that I adapted from the Scale to Measure Beliefs of Diabetic Patients were included (Becker & Janz, 1985). "I believe that my TB medication can cure me from TB" was an example of an item adapted from this scale.

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An additional three newly developed items based on the literature such as “I feel supported by the staff at the clinic”, were added. A total of nine items were generated. Following the review of the items by the team of experts, five items believed to measure benefits of adherence to treatment for tuberculosis were retained. These five items included to measure benefits of treatment are presented in Table 10.

Table 10

Items included to measure perceived benefits of treatment.

Item
1. Taking my treatment properly will help prevent complications related to TB.
2. It is important to take TB medication regularly.
3. Taking my TB medication can protect others in my household from getting TB.
4. I believe that my TB medications will cure me from TB.
5. Taking TB treatment will decrease my chances of dying from TB.

Perceived barriers. Eleven items intended to measure the participants’ perception regarding barriers to adhering to tuberculosis treatment were developed. I adapted four items from the Scales to Measure Beliefs of Diabetic Patients to the tuberculosis context (Becker & Janz, 1985). An example of an item adapted from this scale was “Taking my TB medication interferes with my normal daily activities”.

Seven newly developed items based on a review of available literature were included. An example of an item relating to access to care was “I don’t like to go to the clinic for my treatment because the queues are too long”.

After the review of the eleven items by the team of experts, ten items were retained that were believed to measure perceived barriers to treatment. These ten items are presented in Table 11.

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Table 11

Items included to measure perceived barriers.

Item
1. I cannot afford the cost to travel to the clinic.
2. Before I was admitted to hospital I did not go to the clinic because it took too long to get there.
3. Before I was admitted to hospital, I did not like to go to the clinic to get treatment because the queues were too long.
4. Before I was admitted to hospital I did not like to go to the clinic because the staff members (nurses and doctors) don't treat me with respect.
5. I would have to change too many things in my life to follow my TB treatment plan.
6. Taking my TB medication interferes with my normal daily activities.
7. It has been difficult for me to take all the medication prescribed to me.
8. I do not understand what the doctor told me about my TB treatment.
9. The tablets make me feel sick and I sometimes vomit.
10. I experienced side effects from taking my TB treatment.

Cues to action. Four items were included that I adapted from a questionnaire used to measure the acceptability of routine HIV counselling (Nöthling & Kagee, 2013). An example of an item to measure cues to action adapted from this HIV related measure was "I have recently read a newspaper/magazine article on the importance of taking TB treatment".

One of the two items that I adapted from the HBMAI was "I take my medication because the doctor said that I should" (Erkin & Özsoy, 2012). One newly developed item based on literature was included.

Seven items were initially included to measure cues to action, however following the review by the team of experts, four items were retained. The items designed to measure cues to action are presented in Table 12.

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Table 12

Items included to measure cues to action.

Item
1. I have recently read a newspaper/magazine article on the importance of taking TB treatment.
2. I am aware of advertisements about the importance of taking TB treatment.
3. I have recently seen a poster to encouraging people with TB to stay on their treatment.
4. I know an adult or child that has been successfully treated (cured) from TB.

***Self – efficacy*.** The HIV Treatment Adherence Self-Efficacy Scale (HIV-ASES) scale is a 12-item scale that was developed specifically to measure self-efficacy regarding adherence to anti-retroviral medication (Johnson et al., 2007). This scale was considered valid and reliable with good internal consistency (Johnson et al., 2007).

All twelve items from the HIV-ASES scale have been included, two items of which I adapted to the tuberculosis context. I changed the wording of one item relating to continuing with treatment "even if your T-cells drop" to continuing with treatment "even if there is no improvement in my health". In the other item I changed the wording to reflect a diagnosis of tuberculosis as opposed to HIV.

Following the review of the items by the team of experts, it was agreed to retain all twelve items from the HIV-ASES scale. The items included to measure self-efficacy are presented in Table 13.

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Table 13

Items included to measure self-efficacy.

Item
1. I am confident that I can stick to my treatment plan even when side effects begin to interfere with daily activities.
2. I can integrate my treatment into my daily routine.
3. I can take my treatment if it means taking medication or doing other things in front of people who don't know I have TB.
4. I am confident that I can stick to my treatment plan even when my daily routine is disrupted.
5. I know that I will stick to my treatment plan even when I am not feeling well.
6. I can stick to my treatment plan even if it means changing my eating habits.
7. I can continue with my treatment even if doing so interferes with my daily activities.
8. I feel confident that I will continue with the treatment plan my doctor prescribed even if I don't feel better.
9. I will continue with my treatment even when I feel discouraged about my health.
10. I know I will continue with my treatment even when getting to my clinic appointments are a major hassle.
11. I believe that I will continue with my treatment even when people close to me tell me that they don't think that it is doing any good.
12. I am confident that I will get something positive out of my participation in treatment, even if the medication I am taking does not improve my health.

4.2.1.5 Translation and adaptation of the measure.

The final questionnaire was translated by the language department of the Western Cape Department of Health into Afrikaans. Three bilingual people familiar with both the source language and the target language were asked to determine the equivalence of the two versions based on analysis of the items. They agreed that the two versions were conceptually similar thus providing confidence in the Afrikaans version of the scale. Two Afrikaans speaking lay-

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counsellors from a similar racial background as the target population for the study, and experienced working in a tuberculosis setting, suggested adaptations to wording of questions to ensure relevance and applicability to the cultural context. The Afrikaans version of the scale is thus considered to be conceptually similar and culturally appropriate for the target population.

4.2.1.6 Conducting a pilot study.

The purpose of the pilot study was to allow for training of research staff, to address potential pitfalls in the data collection tools and to clarify the reporting process (Leon et al., 2011). The full battery of quantitative tests as outlined in Chapter Three of this study was thus provided to each participant.

According to Johanson and Brooks (2010) a pilot study sample size of 24 to 36 when chosen from the population of interest is sufficient for the purpose of scale development. Data were obtained from 40 participants during the pilot study between May 2017 and August 2017. There were no changes made to the items on the new measure designed to measure the HBM constructs following the pilot study. I included data from the pilot study pertaining to the statistical analysis of the scale.

4.2.1.7. Re-evaluation of all the items.

Statistical analysis of data was performed to develop a reliable and valid scale to measure the HBM constructs. I re-evaluated items based on the results of item analysis, exploratory factor analysis, reliability analysis and correlation as explained in the section focused on the quantitative development of scale. Data were collected from an additional 175 participants using a self-report questionnaire booklet thereby making the total sample size of 215 for the psychometric analysis of the scale.

4.2.2 Psychometric development of the scale to measure the HBM constructs

Exploratory factor analysis (EFA) is recommended for use in the early stages of scale development (Field, 2013). Factor analysis is a statistical technique used to identify the correlation between observed variables, thereby reducing the number of factors. To determine the number of factors to retain, a scree plot as was requested.

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According to Field (2013), there are theoretical reasons to believe that correlations of factors occur in all data pertaining to humans. Oblique rotations rather than orthogonal rotations are recommended if correlations of factors are expected in factor analysis (Field, 2013). Direct oblimin which is an oblique rotation method as opposed to an orthogonal rotation such as varimax was thus used in this study to determine which items loaded onto each factor.

4.2.2.1 Sample size.

There has been some debate regarding adequacy of sample size for factor analysis and principal component analysis (Field, 2013; Osborne & Costello, 2004). Comfrey and Lee (1992) suggested that a sample size of 100 is poor, 200 is fair, 300 is good, 500 is very good and 1000 or more is excellent. According to Kline (2013), a sample size of 200 when conducting exploratory factor analysis is reasonable.

Some authors have recommended that the cases to variables ratio as opposed to overall sample size is more relevant. According to Hatcher (1994) a sample size of at least five times the number of variables is adequate whereas Hinkin et al. (1997) suggested that an item-to -subject ratio of 1:4 was suitable. Anthoine et al. (2014) reported on studies that used an item-to-subject ratio that ranged from 1:1 to 1:10.

I used a sample of 215 participants with 43 items included in my questionnaire. This resulted in a ratio of five participants per variable based on the five HBM constructs extracted. The Kaiser-Meyer Olkin measure of sampling adequacy (KMO) was calculated. A KMO statistic ranges from 0 to 1, with a value close to 1 indicating that the data are suitable for factor analysis (Field, 2013).

4.2.3 Factor analysis results

A total of 215 participants completed the questionnaire booklets consisting of a battery of instruments, including the newly developed HBM measure. Of these 90 participants (41.9%) were male and 125 participants (58.1%) were female. Most participants (61.4%) completed the booklets in English, with 38.6% completing the booklet in Afrikaans. The ages of participants ranged from 18 years of age to 74 years of age, with a mean age of 34.23 years (SD = 10.09).

An examination of the inter-item correlation matrix revealed that item HBQ1 and item HBQ2 did not correlate above 0.3 with any other item. Both these items showed negative item-

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total correlations. These two items were thus omitted. The overall significance of all remaining correlations within the matrix was calculated using Bartlett's test of sphericity. The results were significant ($\chi 2$ (820) = 3564.441, $p<0.001$) indicating that items correlated with each other, and that factor analysis was appropriate. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value was 0.82. According to Hutcheson and Sofroniou (1999), KMO values between 0.80 and 0.89 are considered meritorious in terms of the suitability of the sample for factor analysis. The strength of the relationships among the variables was thus high, which indicated that factor analysis was suitable for the data collected in this study.

A factor analysis using principal component analysis as the method of extraction was conducted. As per the recommendations provided by Field (2013) an oblimin rotation was conducted as correlation among the components was anticipated. The results of the initial factor analysis indicated that eleven factors with an eigenvalue above one accounted for 62.43% of the total variance among the items. However, only two items loaded primarily on components nine, ten and eleven, respectively. Three of the eleven extracted factors were thus relatively weak and unstable, which indicated that the extraction of eleven factors based on eigenvalue above one may not be appropriate (Osborne and Costello, 2004). An examination of the downward curve of the scree plot showed that an extraction of between five and eight components was indicated. The scree plot is presented in Figure 2.

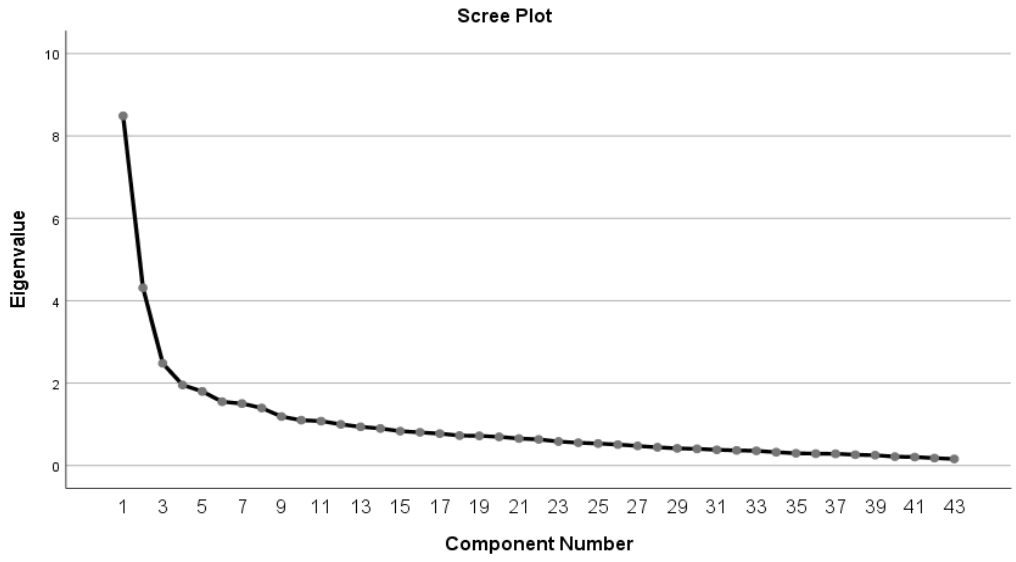

Figure 2. Scree plot of factors to be extracted

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I conducted multiple factor analyses setting the number of factors to be extracted from five to nine, respectively. The extraction of eight components resulted in the optimal fit for the data such that items loaded on only one component with an item loading above 0.35 and no component had less than three items. The resultant pattern matrix based on principal component extraction method with eight components and oblimin rotation showing loadings above 0.35 is presented in Table 14.

Table 14

Pattern matrix showing component loading.

	Component							
Item	1	2	3	4	5	6	7	8
HBQ38	0.85							
HBQ37	0.80							
HBQ35	0.78							
HBQ36	0.70							
HBQ33	0.63							
HBQ32	0.57							
HBQ34	0.47							
HBQ27		0.75						
HBQ26		0.71						
HBQ23		0.68						
HBQ24		0.63						
HBQ22		0.61						
HBQ3			-0.69					
HBQ5			-0.48				-0.40	
HBQ4			-0.47				-0.34	
HBQ15			-0.42			0.41		
HBQ28				0.73				
HBQ30				0.69				
HBQ31				0.65				

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	Component							
Item	1	2	3	4	5	6	7	8
HBQ29				0.64				
HBQ20					0.82			
HBQ19					0.79			
HBQ21					0.66			
HBQ18					0.63			
HBQ25					0.39			
HBQ14						0.68		
HBQ16						0.55		
HBQ8			-0.34			0.53		
HBQ17			-0.39			0.40		
HBQ11							-0.72	
HBQ13							-0.69	
HBQ12							-0.62	
HBQ6							-0.57	
HBQ10							-0.50	
HBQ9						0.32	-0.49	
HBQ43								0.77
HBQ39								0.71
HBQ40								0.69
HBQ42								0.66
HBQ7			-0.33			0.30		0.42
HBQ41	0.32							0.35
Eigenvalue	8.42	4.27	2.39	1.92	1.78	1.53	1.42	1.38
% of variance	20.53	10.40	5.82	4.68	4.34	3.74	3.47	3.37
Cumulative %	20.53	30.93	36.75	41.43	45.76	49.51	52.98	56.35

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The first component was robust with an eigenvalue of 8.42 which explained 20.53% of the variance in data. Seven items loaded on component one with a loading of 0.4 or greater. I named this component Self-Efficacy. The second component included five items explaining a further 10.40% of variance. I named this component Perceived Barriers-General. Four items loaded primarily on component three which I named Perceived Severity. The fourth component consisted of four items, and I named this component Cues to Action. The fifth component, which consisted of five items, I named Perceived Barriers-Structural. Four items loaded primarily on component six. I named this component Perceived Benefits. Six items loaded on component seven and I named this component Perceived Susceptibility and Severity. I named the final component Self-Efficacy/Resilience. Six items loaded primarily on component eight.

The components extracted by the initial principal component analysis were 1) Self-Efficacy -General, 2) Perceived Barriers-General, 3) Perceived Severity, 4) Cues to Action 5) Perceived Barriers-Structural, 6) Perceived Benefits, 7) Perceived Severity and Susceptibility, 8) Self-Efficacy/Resilience.

I created subscales designed to measure the core constructs of the HBM by combining the components extracted by principal component analysis where appropriate. The subscale Perceived Threat consisted of items from component three (Perceived Severity) and component seven (Perceived Severity and Susceptibility). The subscale Perceived Benefits consists of items from component six (Perceived Benefits). The subscale Perceived Barriers consists of items from component two (Perceived Barriers-General) and items from component five (Perceived Barriers-Structural). The subscale Cues to Action consist only of items from component four (Cues to Action). The subscale Self -Efficacy consist of items from component one (Self-Efficacy-general) and component eight (Self -Efficacy/Resilience).

4.2.4 Reliability of the subscales.

The Cronbach's alpha for the newly developed scale to measure the HBM pertaining to tuberculosis including 43 items was 0.85. After deletion of two items (TBHBQ1 and TBHBQ2) following the analysis of the item-item correlation matrix, Cronbach's alpha was 0.87.

The final scale consisted of five subscales namely Perceived Threat, Perceived Barriers, Perceived Benefits, Self-Efficacy and Cues to Action. I named this final 41 item questionnaire the Tuberculosis Health Belief Scale (TB-HBS) (Appendix F). The range of scores for each item

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is from 1 (strongly disagree) to 5 (strongly agree). A higher score reflects a greater belief in the construct.

4.2.4.1. Perceived Threat.

The Cronbach's alpha for the Perceived Threat subscale based on ten items was 0.78. However, as can be seen in Table 15, item HBQ15 has a corrected item-total correlation of below 0.3. In addition, the deletion of item HBQ15 from the Perceived Threat subscale increased Cronbach's alpha slightly to 0.79.

The pattern matrix showing component loadings presented in Table 14 shows that item HBQ15 also loaded onto component six (Perceived Benefits). According to the panel of experts consulted in the initial phase of item development, it seemed that on face value item HBQ15 measured perceived benefits of treatment. Item HBQ15 was thus deleted from the subscale to measure Perceived Threat and included in the subscale to measure Perceived Benefits.

There was only one other corrected item-total correlation below 0.4 (HBQ3). However, the deletion of this item had little impact on coefficient alpha and thus this item has been retained in the final subscale to measure Perceived Threat. The internal validity of the Perceive Threat subscale was thus supported with a Cronbach's alpha of 0.79.

For most items in the Perceived Threat subscale the mean score was high. The corrected item-total correlation, mean, standard deviation and Cronbach's alpha score for items included in the initial Perceived Threat subscale are presented in Table 15.

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Table 15

Item-by-item descriptive analysis for Perceived Threat subscale.

Item	Description	Corrected item-total correlation	Alpha if deleted	M	SD
HBQ3	TB can be a serious disease if you don't treat it	0.31	0.78	4.60	0.75
HBQ4	TB causes death	0.44	0.77	4.51	0.91
HBQ5	The thought of TB scares me	0.48	0.76	4.02	1.15
HBQ6	I would rather have any other terminal illness than TB	0.50	0.76	3.47	1.36
HBQ9	I am afraid that I might contract a more resistant type of TB	0.43	0.77	4.13	1.07
HBQ10	I would rather die from a violent death (e.g., gunshot. car accident etc.) than from TB	0.48	0.77	2.96	1.53
HBQ11	When I think about drug-resistant TB (such as MDR or XDR or worse) my heart beats faster	0.57	0.75	3.78	1.42
HBQ12	If I had a more drug resistant type of TB. my whole life would change	0.46	0.77	3.49	0.42
HBQ13	I am afraid to think about drug-resistant TB	0.64	0.74	3.78	1.20
HBQ15*	It is important to take TB medication regularly	0.27	0.79	4.67	1.07

Note: Item HBQ15 was deleted from the final Perceived Threat subscale

4.2.4.2. Perceived Benefits.

Based on the four items that loaded primarily on component six which I named Perceived Benefits, the Cronbach's alpha was 0.62. However, as can be seen in Table 14, two items (HBQ7 and HBQ15) both loaded additionally onto construct six although this was not their primary loading. According to the team of experts utilised in the earlier item development phase of the TB-HBS, based on face value both these items seemed to measure perceived benefits of adherence to treatment. Items HBQ7 and HBQ15 were thus included in the subscale to measure Perceived Benefits. A Cronbach's alpha of 0.72 was obtained for the six items included in the Perceived Benefits subscale. The corrected item-total correlation was above 0.4 for all items with

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no increase in Cronbach's alpha if deleted thus all items were retained. The subscale to measure Perceived Benefits showed good internal validity.

Based on the mean scores obtained for each item, the participants perceived benefits of treatment for tuberculosis was high. The item-by-item descriptive analysis for the final six items included in Perceived Benefits subscale is presented in Table 16.

Table 16

Item-by-item descriptive analysis for Perceived Benefits subscale

Item	Description	Corrected item-total correlation	Alpha if deleted	M	SD
HBQ14	Taking TB treatment will decrease my chances of dying from TB	0.42	0.72	4.20	1.16
HBQ16	Taking my TB medication can protect others in my household from getting TB	0.40	0.70	4.53	0.89
HBQ8	My TB would be worse if I did not take any treatment for it	0.53	0.66	4.55	0.81
HBQ17	I believe that my TB medications will cure me from TB	0.55	0.68	4.66	0.55
HBQ7	Taking my treatment properly will help prevent complications related to TB	0.47	0.68	4.45	0.80
HBQ15	It is important to take TB medication regularly	0.57	0.67	4.67	0.58

4.2.4.3 Perceived Barriers.

The Cronbach's alpha score for the ten items included in the Perceived Barriers subscale was 0.77 indicating good internal reliability. Overall, the mean scores were average with a standard deviation of above nearly 1.5 for each item in the Perceived Barriers subscale.

The item- by – item descriptive analysis for the Perceived Barriers subscale is presented in Table 17.

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Table 17

Item-by-item descriptive analysis for Perceived Barriers subscale

Item	Description	Corrected item-total correlation	Alpha if deleted	M	SD
HBQ27	I experienced side effects from taking my TB treatment	0.39	0.76	3.37	1.41
HBQ26	The tablets make me feel ill and I sometimes vomit	0.39	0.76	3.15	1.54
HBQ23	Taking my TB medication interferes with my normal daily activities	0.52	0.74	3.08	1.48
HBQ24	It has been difficult for me to take all the medication prescribed to me	0.49	0.75	2.85	1.48
HBQ22	I would have to change too many things in my life to follow my TB treatment plan	0.47	0.75	3.44	1.41
HBQ20	Before I was admitted to hospital, I did not like to go to the clinic to get treatment because the queues were too long	0.45	0.75	2.76	1.52
HBQ19	Before I was admitted to hospital I did not go to the clinic because it took too long to get there	0.36	0.77	2.88	1.53
HBQ21	Before I was admitted to hospital I did not like to go to the clinic because the staff members (nurses and doctors) don't treat me with respect.	0.56	0.74	2.39	1.38
HBQ18	I cannot afford the cost to travel to the clinic	0.42	0.76	3.17	1.54
HBQ25	I do not understand what the doctor told me about my TB treatment	0.35	0.76	2.43	1.38

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It appeared that participants included in this study had differing perspectives relating the barriers to treatment. Nearly all the corrected item-correlations were above 0.38, and the coefficient alpha remained stable if items were deleted thus no deletion of items was necessary.

4.2.4.4 Cues to Action.

The Cronbach's alpha score based on the four items measuring Cues to Action was 0.77. The item-by-item descriptive analysis of the items included in the subscale to measure Cues to Action is presented in Table 18.

Table 18

Item-by-item descriptive analysis for Cues to Action subscale.

Item	Description	Corrected item-total correlation	Alpha if deleted	M	SD
HBQ28	I have recently read an article on the importance of taking TB treatment	0.55	0.73	3.95	1.20
HBQ29	I am aware of advertisements about the importance of taking TB treatment	0.63	0.68	4.28	0.93
HBQ30	I have seen a poster encouraging people with TB to stay on treatment	0.64	0.68	4.36	0.94
HBQ31	I know an adult or child that has been successfully treated (cured) from TB.	0.47	0.76	4.33	1.01

The item-by-item descriptions showed that Cronbach's alpha was stable if items were omitted indicating that all items should be retained. The total Cronbach's alpha of 0.77 demonstrated reasonable internal consistency for the Cues to Action subscale. The mean score for all items was high, indicating that most participants were aware of some input from the media regarding taking their tuberculosis medication.

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4.2.4.5 Self-Efficacy.

The Cronbach's alpha obtained for the twelve items included in the Self-Efficacy subscale was 0.81. Item HBQ7 (Taking my treatment properly will help prevent complications related to TB) loaded primarily on the component that I named Self-Efficacy-General during principal component analysis. However, on face value this item appeared to measure perceived benefits of treatment rather than self-efficacy. Item HBQ7 had a secondary loading on factor six (Perceived Benefits) and this item was thus included in the Perceived Benefits subscale. The deletion of Item HBQ7 from the Self-efficacy subscale had no impact on the Cronbach's alpha score obtained for this scale. The item-by- item descriptive analysis for the items included in the final Self-Efficacy subscale is presented in Table 19.

Table 19

Item-by-item descriptive analysis for Self-Efficacy subscale.

Item	Description	Corrected item-total correlation	Alpha if deleted	M	SD
HBQ38	I can continue with my treatment even if doing so interferes with my daily activities	0.71	0.87	4.22	0.88
HBQ37	I can stick to my treatment plan even if it means changing my eating habits	0.68	0.87	4.20	0.93
HBQ35	I am confident that I can stick to my treatment plan even when my daily routine is disrupted	0.65	0.87	4.21	0.93
HBQ36	I know that I will stick to my treatment plan even when I am not feeling well	0.63	0.87	4.29	0.94
HBQ33	I can integrate my treatment into my daily routine	0.55	0.88	4.25	0.93
HBQ32	I am confident that I can stick to my treatment plan even when side effects begin to interfere with daily activities	0.59	0.88	4.18	0.96

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Item	Description	Corrected item-total correlation	Alpha if deleted	M	SD
HBQ34	I can take my treatment if it means taking medication or doing other things in front of people who don't know I have TB	0.56	0.88	4.16	1.01
HBQ39	I feel confident that I will continue with the treatment even if there is no improvement in my health	0.58	0.88	4.09	1.01
HBQ40	I will take my treatment even on the days when I feel that the treatment is not working	0.57	0.88	4.03	1.08
HBQ41	I know that I will continue with my treatment even when getting to my clinic appointments are a major hassle.	0.52	0.88	4.32	0.823
HBQ42	I will continue with my treatment even when people close to me tell you that they don't think that it is doing any good	0.57	0.88	4.27	1.04
HBQ43	I believe that I will get something positive out of my participation in treatment, even if the medication I am taking does not improve my health	0.45	0.88	4.06	1.07

The mean scores for the Self-Efficacy subscale indicated that most participants in this study had high self-belief in their capacity to be adherent to treatment for tuberculosis. The Self-Efficacy subscale scale showed good internal consistency.

4.3 Conclusion

The TB-AS was purposively designed to measure adherence to tuberculosis treatment. It was constructed in consultation with a team of experts. The final scale consisted of four self-

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report items and one item obtained from clinical notes. The Cronbach's alpha of 0.69 indicated that the TB-AS was a reliable measure of adherence to tuberculosis treatment.

The TB-HBS was designed to measure the Health Belief Model constructs pertaining to tuberculosis. The final TB-HBS consisted of five subscales. Ten items measured Perceived Threat, ten items measured Perceived Barriers, six items measured Perceived Benefits, four items measured Cues to Action and twelve items measured Self-Efficacy. The Cronbach's alpha for each subscale was above 0.7 which indicated that each subscale had high internal consistency. The construct validity of the subscales based on the items generated by the panel of experts was supported by the outcome of principle component analysis.

The final aim of this study was the explore the utility of the Health Belief Model, and the additional variables of beliefs about medicine, depression, alcohol use and drug use to predict adherence to tuberculosis medication. This aim was achieved by administering a battery of instruments, including the newly developed TB-AS and the TB-HBS, to a sample of 175 participants hospitalised for tuberculosis as explained in Chapter Three of this study. The results are presented in Chapter Five.

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Chapter Five: Results

This study explored the utility of the Health Belief Model plus the additional variables of beliefs about medicine, depression, alcohol use and drug use to predict adherence to treatment for tuberculosis. This chapter details the results of the study based on descriptive statistics, correlation, reliability analysis and multiple regression analysis.

5.1 Demographic characteristics of the participants

A total of 175 participants completed the questionnaire booklet and were included in the study. Most of the participants (60.6%) were hospitalised at Brooklyn Chest Hospital with 69 (39.6%) participants hospitalised at DP Marais Hospital. The age of participants ranged from 18 years to 74 years of age. The mean age was 34.37 (SD = 10.02). A total of 100 participants (57.1%) were female and 75 (42.9%) were male. Most of the participants completed the English questionnaire (59.4%) and 71 participants (40.6%) completed the Afrikaans version as expected based on the language most used outside the home in Western Cape. There were 94 (53.7%) Colored participants, 72 (41.1%) Black African participants (41.1%) and 5 participants (2.8%) where White. Most of the Coloured (59%) and White (60%) participants completed the Afrikaans questionnaire, and most of the Black African participants (86%) completed the English questionnaire.

In terms of relationship status, 23 (13.1%) of the participants were married or living together as if married, and the remaining 152 (77%) participants were single, widowed or divorced. Most participants (57.1%) indicated that they attended high school but did not complete. There were 38 participants that had completed high school, of whom six began tertiary education but did not complete and three graduated from a tertiary institution. I classified the 19 participants (10.9%) who indicated that they were full time employed as well as the three students and one scholar as having a full-time occupation. The 25 people (14.3%) who indicated that they were part-time employed were categorized as having a part-time occupation. I classified the 113 participants (64.6%) who indicated that they were unemployed, the one participant who indicated that he was retired, as well as the 13 participants (7.4%) who defined themselves as disabled (unemployed but receiving a disability grant) as having no occupation. There were 60 participants (34.3%) with drug sensitive tuberculosis, 76 participants (43.4%) with MDR-TB and

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39 participants (22.3%) had either pre-XDR TB or XDR-TB. The demographic characteristics of the participants included in the study are presented in table 20.

Table 20

Demographic characteristics of participants.

Description	Frequency	Percent
Language		
English	104	59.4
Afrikaans	71	40.6
Gender		
Male	75	42.9
Female	100	57.1
Relationship status		
Single	118	67.4
Separated	21	12
Widowed	4	2.3
Divorced	9	5.1
Married/living together	23	13.1
Highest level of education		
Graduated from tertiary	3	1.7
Attended tertiary – not yet completed	6	3.4
Completed grade 12	29	16.6
Attended high but not completed	100	57.1
Completed primary	19	10.2
Attended primary but not completed	15	8.6
None	3	1.7
Occupation		
Full time (employment, student, scholar)	23	13.2
Part time	25	14.3
None (Unemployed, Retired, Disabled)	12	72.6

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The socioeconomic status of participants presented in Table 21 was estimated based on access to essential resources and household assets. Most participants (60%) indicated that they had piped tap water in their home, 13.1% reported access to piped tap water in their yard and 18.9% accessed drinking water from a community tap. Thus 92% of participants reported having access to drinking water from a tap. This amount is less than the 98.7% of people living in the Western Cape who reported access to tap drinking water in the 2018 general household survey (Stats SA, 2019).

The main source of energy for cooking was electricity for 143 (81.7%) participants with slightly more participants (83.4%) indicating that they had access to electricity, which is less than the general population of the Western Cape. According to the community survey conducted in 2016, 97% of people living in the Western Cape had access to electricity and 90.1% reported using electricity for cooking (Stats SA, 2018).

A flush toilet was usually used by 141 (80.6%) of participants in this study, which is below the 93.4% of people in the Western Cape who reported using flush toilets in the community survey in 2016 (Stats SA, 2018). The socioeconomic status of the study population based on access to household services and basic assets is lower as compared to the general population of the Western Cape (Stats SA, 2018).

I calculated a socioeconomic index score for each participant based on the number of resources scored as being accessible, and availability of assets within the household. The Cronbach's alpha calculated for the socioeconomic index was 0.78 indicating good internal consistency. The highest possible score for the socioeconomic index was 18. The mean score of participants was 14.99 (SD = 3.80). A total of 25% of the participants scored 13 or below, 25% scored between 14 and 16 and 50% of the participants scored either 17 or 18 on the socioeconomic scale.

The socioeconomic profile of the participants compared to the available data of the general population of the Western Cape obtained from the 2018 General Household Survey (Stats SA, 2019), the Community Survey (Stats SA, 2018).) and the 2011 Census data (Stats SA, 2012) is presented in Table 21.

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Table 21

Socioeconomic profile of participants and comparative population data

Description	n	%	Comparative Percent
Main source of drinking water			
Piped tap water in home	105	60.0	
Piped tap in yard	23	13.1	
Community tap	33	18.9	
Water tanker	4	2.3	
Well, stream, river	3	1.7	
Other	7	4.0	
Tap water available (tap home, yard, community)	161	92	98.7[1]
Main source of energy for cooking			
Electricity	143	81.7	82.2[1]
Gas	7	4.0	9.9[1]
Paraffin	6	3.4	1.3[1]
Coal	6	3.4	0[1]
Wood	10	5.7	0.8[1]
Other	3	1.7	5.8[1]
Type of toilet facility usually used at home			
Flush toilet	141	80.6	93.4[2]
Chemical of bucket toilet	14	8.0	3.6[2]
Pit toilet	4	2.3	0.3[2]
Other	10	5.7	0.5[2]
No toilet	6	3.4	0.9[2]
Access to electricity			
Yes	146	83.4	97[2]

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Description	n	%	Comparative Percent
Household Assets			
Working refrigerator	117	66.9	80.5[3]
Working radio	119	68.0	69.2[3]
Working television	123	70.3	85.5[3]
Working telephone	127	72.6	88.9[3]

Note: [1]Stats SA (2018);[2] Stats SA (2019); [3]Stats SA (2012)

5.2 Internal consistency of scales

To evaluate the internal consistency of the instruments used in this study, I calculated the Cronbach's alpha score for each scale and subscale. According to Field (2013), a Cronbach's alpha score of 0.7 indicates good internal consistency.

The purposively designed Tuberculosis Adherence Scale (TB-AS) consists of four self-reported items, and one item based on physician record of adherence. This composite scale had good internal consistency of 0.69.

The Tuberculosis Health Belief Scale (TB-HBS) consists of five subscales. As detailed in the previous chapter of this thesis, the subscales were purposively designed to measure the constructs of the Health Belief Model in relation to tuberculosis. The Cronbach's alpha was calculated for each subscale with alpha above 0.7 for each subscale indicating good internal consistency.

The Cronbach alpha for three of the four Beliefs about Medicine Questionnaire (BMQ) subscales was above 0.7. This indicates that these subscales show good internal consistency and are reliable for this study population. The Cronbach's alpha score for the subscale Specific-Necessity however was 0.53. After the deletion of item 10 from the subscale, Cronbach's alpha increased to 0.60. Item 10 (My TB medication protects me from becoming worse) was thus deleted from the subscale.

The Cronbach's alpha for this study sample showed that the Alcohol Use Disorders Identification Test ($\alpha = 0.89$), the Drug Use Disorders Identification Test ($\alpha = 0.94$) and the Beck Depressive Inventory (0.88) had a high internal consistency. The Cronbach's alpha, number of

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items per scale, the mean score and standard deviation for each subscale are presented in Table 22.

Table 22

Internal consistency of each scale.

Scale	Cronbach's Alpha	No. of Items	Scale Mean	SD
Tuberculosis Adherence Scale	0.69	5	2.58	1.58
Tuberculosis Health Belief Scale				
Perceived Threat	0.79	9	34.67	6.57
Perceived Barriers	0.79	10	29.78	8.54
Perceived Benefits	0.72	6	26.92	3.24
Cues to Action	0.78	4	16.89	3.05
Self -Efficacy	0.88	12	49.69	7.77
Beliefs About Medicine Questionnaire				
Specific - Necessity	0.60	4	17.46	2.60
Specific -Concerns	0.73	5	14.72	4.84
General -Overuse	0.71	4	11.83	3.97
General - Harm	0.71	4	9.11	3.59
Alcohol Use	0.90	10	5.97	8.03
Drug Use	0.94	11	8.56	1
Depression Inventory	0.88	21	17.55	11.5

5.3 Adherence

Adherence was measured using the purposively designed TB-AS which consists of five items. The total adherence score on the TB-AS has a range of 0 to 5 with a higher score indicating a higher degree of adherence. The mean total adherence score obtained in this sample was 2.55 (SE = 0.12, Median = 2. SD =1.59). The results showed that 58 participants (33.1%) had a score of either 0 or 1 which indicated low adherence, 60 participants (34.3%) scored either a 2 or a 3 which indicated medium adherence and 57 participants (32.5%) scored either a 4 or 5

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which indicated high adherence. Table 23 shows the frequency of each of the six possible total adherence scores.

Table 23

Frequency of adherence scores

Adherence Score	Frequency	Percent	Cumulative Percent
0	14	8.0	8.0
1	44	25.1	33.1
2	33	18.9	52.0
3	27	15.4	67.4
4	30	17.1	84.6
5	27	15.4	100.0

5.4 Tuberculosis Health Belief Scale.

Each item on the five subscales measuring health beliefs was scored on a Likert Scale with a minimum score of 1 (strongly disagree) and a maximum score of 5 (strongly agree). Thus, a higher score on each subscale indicates a higher belief in the measured construct.

The mean score for Perceived Threat was 34.67 out of a possible highest score of 45 (SD = 6.57). The mean score for Perceived Barriers was 29.78 (SD = 8.54) out of a possible highest score of 50 indicating that most participants perceived high barriers to adherence. Most participants indicated that they recognized the benefits of adherence to treatment and the mean score calculated for Perceived Benefits was 26.9 (SD = 3.24) out of a possible maximum score of 30. The mean score for each item on the Perceived Benefits subscale was above 4 and over 80% of participants agreed or strongly agreed with each statement. Most participants scored high (M = 16.9, SD = 3) on the subscale that measured Cues to Action. Over 75% of the participants in this study either agreed or strongly agreed with each statement in the Cues to Action subscale.

Overall, the participants in this study were confident in their ability to adhere to treatment (M = 49.7, SD = 7.66). Over 70% of the participants either agreed or strongly agreed with each item on the Self-Efficacy subscale and the mean score was above 4 for every item except one (I

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will take my treatment even on days when I feel that treatment is not working) where the mean score was 3.95.

5.5 Belief about Medicines Questionnaire

Each item of the Belief about Medicines Questionnaire (BMQ) was rated on a Likert Scale of 1 to 5 with a higher score indicating a stronger agreement with the measured construct. Most participants in this study scored high on the Specific -Necessity subscale (M = 17.46). Over 75% of all participants either agreed or strongly agreed with every statement in the subscale indicating that most participants believed in the necessity of tuberculosis treatment.

Scores were slightly lower for the subscales that measured Specific-Concerns (M = 14.72), General-Overuse (M = 11.83) and General-Harm (M = 9.11). Over 50% of participants disagreed or strongly disagreed with three of the four items in the Specific-Concerns subscale. Thus, most people did not express concern regarding taking tuberculosis treatment, believed that they understood their medication and did not feel that medication disrupted their lives. However, 65% of the participants strongly agreed or agreed that they felt concerned regarding the long-term effects of tuberculosis medication.

More people disagreed or strongly disagreed with two of the four items on the General-Overuse subscale, namely that doctors use too many medicines, and that natural remedies were safer than medicines. However, only 28 participants (16%) disagreed or strongly disagreed that doctors place too much trust on medicine. There were 72 participants (41.14%) that agreed or strongly agreed that doctors would prescribe fewer medicines if they spent more time with patients.

Most participants scored high on the General-Harm subscale. Over 65% of participants indicated that they disagreed or strongly disagreed with three of the four statements relating to the belief that medicines are generally harmful. However less than half of the participants (43.43%) disagreed or strongly disagreed that most medicines are addictive.

5.6 Alcohol Use Disorders Identification Test.

The Alcohol Use Disorders Identification Test (AUDIT) which comprises of 10 items was used to measure alcohol use. The mean score obtained by participants included in this study was 5.97 with a standard deviation of 8.03.

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Most participants (68%) scored below the clinically significant cut-off of 8 indicating a low risk of harmful drinking. Thirty participants (17%) scored between 8 and 15, representing a potential medium level of problematic alcohol use. A total of 16 participants (9.14%) scored above the suggested cut-off of 20 which indicated potential dependence on alcohol.

5.7 Drug Use Disorder Identification Test.

The Drug Use Disorder Identification Test (DUDIT) was used to measure drug use. This test comprises of 11 items scored on a scale of 0 to 4, with a maximum total score of 44. A score of 6 or more for men and 2 or more for women is indicative of problems related to drug use. A score of 25 or above, regardless of gender, suggests probable dependence (Berman et al., 2005).

The mean score for the study sample was 8.56. with a standard deviation of one. A total of 77 participants (48%) scored above the respective gender related cut-off points representing problematic drug use. Of these 25 participants (14.3%) scored 25 or above suggesting probable dependence on drugs.

5.8 Beck Depression Inventory

The Beck Depression Inventory consists of 21 items that are rated on a scale from 0 to 3. The mean score obtained by the participants in this study was 17.55 with a standard deviation of 11.5. Most participants (50.9%) scored between 1 and 16 which indicates normal to mild symptoms of depression. Borderline to moderate depressive symptoms were reported by 60 (34.3%) participants. A total of 26 (14.8%) participants scored above the suggested cut-off score of over 31 points indicating severe to extreme depression.

5.9 Bivariate correlations between variables

The bivariate correlation matrix created to summarize the correlations between the variables is presented in Table 24. I included the continuous and ranked ordinal demographic variables.

The results showed that a higher level of adherence was associated with older age ($r = 0.20$, $p < 0.01$) and having a full-time occupation ($r = 0.19$, $p < 0.05$). A lower level of adherence is associated with greater drug use ($r = -0.21$, $p < 0.01$), greater alcohol use ($r = -0.24$, $p < 0.01$) and higher scores of depressive symptoms ($r = -0.27$, $p < 0.01$).

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Table 24

Bivariate correlation matrix between variables

Variable	Age	Education	Occupation	SES[1]	Threat	Barriers	Benefit	Cue to action	S-E[2]	Harm	Overuse	Necessity	Concerns	Drug use	Alcohol use	Depression	Adherence
Age	1.00																
Education	-0.13	1.00															
Occupation	-0.01	0.26**	1.00														
SES[1]	-0.06	0.09	0.07	1.00													
Threat	-0.03	-0.06	-0.03	-0.05	1.00												
Barrier	-0.02	0.08	0.06	-0.19**	0.33**	1.00											
Benefit	0.03	0.07	-0.10	0.03	0.46**	-0.05	1.00										
Cues	0.05	0.02	-0.07	-0.01	0.32**	-0.06	0.50**	1.00									
S-E.	0.03	0.00	0.02	-0.01	0.43**	0.07	0.52**	0.55**	1.00								
Harm	-0.05	0.05	0.05	-0.09	0.06	0.43**	-0.40**	-0.32**	-0.22**	1.00							
Overuse	-0.23**	0.08	0.11	-0.07	0.10	0.43**	-0.14	-0.23**	0.00	0.54**	1.00						
Necessity	0.13	-0.07	-0.18*	-0.04	0.24**	-0.09	0.43**	0.39**	0.38**	-0.30**	-0.20**	1.00					
Concern	-0.01	0.05	0.04	-0.07	0.28**	0.53**	-0.05	0.00	0.09	0.32**	0.50**	0.08	1.00				
Drug	-0.03	-0.17*	-0.13	-0.10	-0.09	-0.15	-0.13	-0.03	-0.20**	-0.07	-0.23**	0.02	-0.13	1.00			
Alcohol	-0.05	-0,05	0.07	-0.08	0.14	0.04	0.16*	0.03	0.12	-0.08	-0.04	0.10	0.03	-0.10	1.00		
Depression	0.09	0.04	-0.08	-0.27**	0.03	0.19*	-0.09	-0.13	-0.19*	0.05	-0.02	-0.14	0.13	0.20*	0.09	1.00	
Adherence	0.20**	0.08	0.19*	0.14	-0.10	-0.02	-0.02	0.06	0.11	0.07	0.01	0.01	-0.12	-0.21**	-0.24**	-0.27**	1.00

Note: [1]Socioeconomic; [2]Self-Efficacy; *p<0.05; p<0.01

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5.10 Between group effects of dichotomous demographic variables and adherence

I conducted independent t–tests to evaluate the between–group effects of the dichotomous demographic variables and adherence to treatment. I dichotomised marital status into single; which included people who classified themselves as separated, widowed, or divorced; and married or living together as if married to ensure that there were enough observations in each category to make comparisons meaningful.

Male participants (n = 75) had a slightly higher mean score for adherence (M=2.91, SD = 1.595) than the mean score for adherence (M=2.28, SD = 2.28) of the female participants (n=100). The difference between the means of adherence however was not significant [t (173) = 0.19; p = 0.85]. There was no significant difference in the adherence scores for English speaking participants (M = 2.57, SD = 1.66) and Afrikaans speaking participants (M = 2.52, SD=1.48); t (173) = 0.19, p =0.85. The mean adherence score (M = 2.53, SD = 1.61) for the 152 unmarried participants was lower than the mean adherence score (M = 2.65, SD = 1.40) for the 23 participants who indicated that they were married or living together as if married. The difference between the two groups was not significant [t (173) = -0.34, p = 0.74]. According to these results gender, language and marital status were not significantly related to adherence to treatment for tuberculosis.

5.11 Multiple-Regression Analysis

5.11.1 Regression diagnostics.

According to the residuals statistics the standardized residuals had a range of -1.93 and 2.26 which were within acceptable limits. Some outliers were identified based on the analysis of the z scores for each variable. However, the Cooks distance was below 1 indicating that these outliers did not exert undue influence on the model (Field, 2013).

The distribution of standardized residuals and the distribution of the outcome variable of adherence were approximately normally distributed based on visual inspection of the graphical representation of the data as presented in Figure 3.

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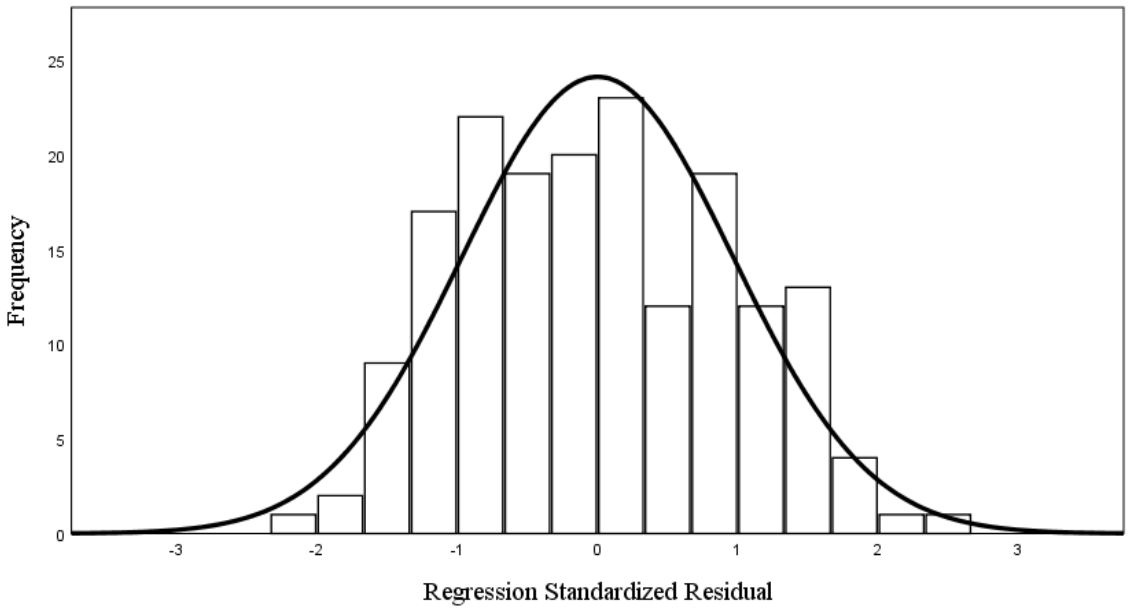

Figure 3. Histogram and normal probability plot of the standardized residuals

The Pearson's correlation between predictors was below 0.7 and the Variance Inflation Factor (VIF) for the predictor variables was well below 10 indicating that no significant multicollinearity was present between the predictor variables. There appeared to be a linear relationship between the predictor variables and adherence score as can be seen in the P- P Plot as presented in Figure 4.

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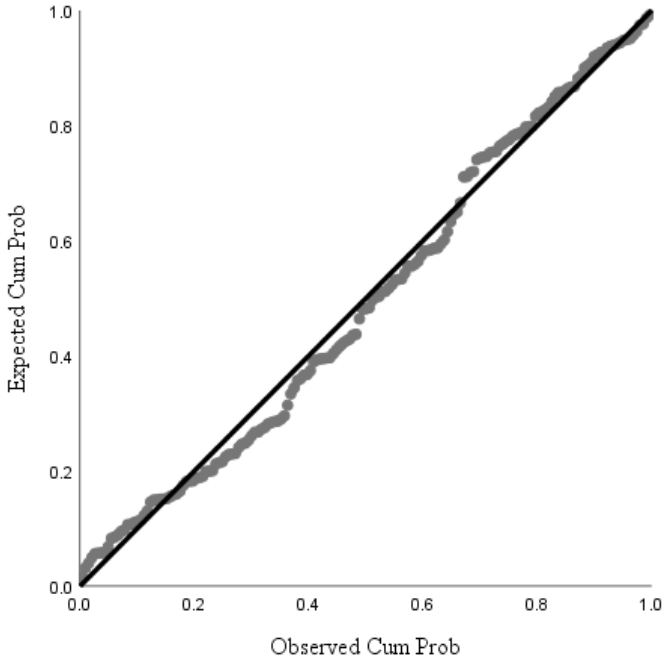

Figure 4. Normal P-P plot of regression standardized residual

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The scatterplot of the regression standardized predicted value and the regression standardized residual showed that no data points were below minus three or above three on either the x or the y axis indicating that the assumptions of homoscedasticity and linearity were met as shown in Figure 5. The Durbin-Watson result of 1.84 was very close to 2 indicating that the assumption of independence had not been violated (Field, 2013).

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Figure 5. Standardized residuals/standardized predicted values plot

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5.11.2 Four-step hierarchical multiple regression analysis

I conducted a four-step hierarchical multiple regression analysis to achieve the aim of exploring the utility of the Health Belief Model (HBM) and the identified additional factors to predict adherence to tuberculosis medication.

Demographic factors are modifying variables according to the HBM. In the first step I thus simultaneously entered four continuous demographic variables. The variables included were age, occupation, employment, and socioeconomic status which accounted for 9% ($R^2 = 0.12$; Adj $R^2 = 0.9$) of the variance in adherence. Older age [$\beta = 0.25$, t (170) = 3.44, $p < 0.01$] and full-time occupation [$\beta = 0.19$, t (170) = 2.46, p = 0.01] were significant predictors of improved adherence.

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At step two of the analysis the HBM constructs of Perceived Threat, Perceived Benefits, Perceived Barriers, Cues to Action and Self-Efficacy were entered simultaneously. The demographic variables and the HBM explained 11% ($R^2 = 0.15$; Adj $R^2 = 0.11$) of the variance in adherence. The change in variance in adherence was not significant [F (5, 165) = 2.95, p = 0.21)]. Age and occupation remained significant predictors of adherence in step two of the model. Perceived Threat was a significant predictor to adherence [β = -0.18, t (165) = - 2.05, p = 0.04] indicating that a higher perception of threat predicts poorer adherence.

I added the BMQ constructs of Specific-Concerns, Specific-Benefits, General-Overuse and General-Harm simultaneously at step three of the analysis. The third model that included demographic factors, HBM and BMQ constructs accounted for 15% ($R^2 = .0.21$; Adj $R^2 = 0.15$) of variance in adherence. The change made by adding the BMQ constructs was significant [F (4, 161) = 2.95, p = 0.02]. Older age and full-time occupation remained significant predictors of adherence in the third model. Socioeconomic status [β = 0.05, t (161) = 1.95, p = 0.05] and Perceived Threat [β = -0.16, t (161) = -1.91, p = 0.06] were marginally significant. Increased belief in the general harm of medication [β = 0.24, t (161) = 2.51, p = 0.01] and low specific concerns regarding tuberculosis treatment [β = -0.19, t (161) = -2.06, p = 0.04], significantly predicted higher adherence.

In the fourth step I added depression, alcohol use and drug use simultaneously to the analysis. This final model accounted for a statistically significant 21% ($R^2 = 0.28$; Adj $R^2 = 0.21$) of the variance in adherence [F (3, 158) = 5.12, p< 0.01]. In the final model age [β = 0.24, t (158) = 3.37, p < 0.01], occupation [β = 0.18, t (158) = 2.47, p = 0.01], belief in general harm of medication [β = 0.20, t (158) = 2.07, p = 0.04], specific concerns about tuberculosis treatment [β = -0.04, t (158) = -2.11, p = 0.04], alcohol use [β = -0.20, t (158) = -2.76, p = 0.01], depression [β = -0.16, t (158) = -2.09, p = 0.04] significantly predicted adherence to treatment for tuberculosis. The results from the four-step regression analysis are presented in Table 25.

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Table 25

Four step multiple regression analysis

Step and predictor variable	R^2	Adj R^2	F change	*B*	*SE B*	*β*	p	*f*2
Step 1	0.12	0.09	5.53**					0.14
Age				0.04	0.01	0.25	0.00**	
Occupation				0.42	0.17	0.19	0.01**	
Education				0.09	0.12	0.06	0.46	
SES				0.05	0.03	0.11	0.13	
Step 2	0.15	0.11	1.44					0.18
Age				0.04	0.01	0.25	0.00**	
Occupation				0.41	0.17	0.18	0.02*	
Education				0.05	0.12	0.04	0.65	
SES				0.05	0.03	0.12	0.11	
Threat				-0.04	0.02	-0.18	0.04*	
Benefits				-0.01	0.04	-0.02	0.82	
Barriers				0.00	0.01	0.02	0.76	
Self-Efficacy				0.03	0.02	0.15	0.11	
Cues				0.02	0.04	0.05	0.59	
Step 3	0.21	0.15	2.95**					0.26
Age				0.04	0.01	0.26	0.00**	
Occupation				0.44	0.17	0.20	0.01**	
Education				0.03	0.12	0.02	0.80	
SES				0.06	0.03	0.14	0.05	
Threat				-0.04	0.02	-0.17	0.06	
Benefits				-0.01	0.04	-0.02	0.85	
Barriers				0.00	0.02	0.00	1.00	
Self-Efficacy				0.03	0.02	0.16	0.07	

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Step and predictor variable	R^2	Adj R^2	F change	*B*	*SE B*	*β*	p	*f*2
Cues				0.04	0.05	0.08	0.38	
Harm				0.11	0.04	0.24	0.01**	
Overuse				0.02	0.04	0.04	0.68	
Necessity				0.03	0.05	0.05	0.51	
Concerns				-0.06	0.03	-0.19	0.04*	
Step 4	0.28	0.21	5.12**					0.39
Age				0.04	0.01	0.24	0.00**	
Occupation				0.41	0.17	0.18	0.01**	
Education				0.04	0.11	0.03	0.73	
SES				0.02	0.03	0.06	0.44	
Threat				-0.03	0.02	-0.12	0.17	
Benefits				-0.02	0.04	-0.04	0.68	
Barriers				0.01	0.02	0.04	0.68	
Self-Efficacy				0.03	0.02	0.13	0.15	
Cues				0.03	0.04	0.06	0.50	
Harm				0.09	0.04	0.20	0.04*	
Overuse				0.00	0.04	0.00	1.00	
Necessity				0.03	0.05	0.05	0.55	
Concerns				-0.06	0.03	-0.19	0.04*	
Drug Use				-0.01	0.01	-0.11	0.15	
Alcohol				-0.04	0.01	-0.20	0.01**	
Depression				-0.02	0.01	-0.16	0.04*	

Note: **p < 0.01; *p < 0.05; R^2 = Variance explained; Adj R^2 = adjusted R^2; F Change = Change in variance explained; B = Unstandardised beta coefficient; SE = Standard error for unstandardised beta coefficient; *β* = Standardised beta coefficient; *f*2 = Cohen's effect size measure for the squared multiple correlation coefficient based on R^2.

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5.12 Summary of findings

The sample consisted of slightly more female than male participants, more participants completed the English questionnaire than Afrikaans questionnaire and the age ranged from 18 to 74 years in age. Overall, the participants had a slightly lower socioeconomic index score than the general population of the Western Cape. Almost all the subscales showed good internal consistency.

Independent t-tests showed that the demographic variables of gender, marital status and language were not significantly associated with adherence. The bivariate correlation between the variables indicated that older age and having a full-time occupation were significantly correlated with higher adherence. Conversely, greater drug use, greater alcohol use and increased symptoms of depression were significantly correlated with poorer adherence.

The addition of the Health Belief Model constructs to the linear combination of the demographic variables at the second step of the multiple regression analysis showed a non-significant change in the amount of variance explained. The HBM variables overall did not significantly predict adherence to treatment for tuberculosis. However higher levels of Perceived Threat were a significant predictor of poorer adherence in step two of this model.

A four-step linear multiple regression analysis showed that the combination of the demographic variables, HBM variables, Belief about Medicine, drug use, alcohol use and depression accounted for 21% in the variance of adherence to treatment for tuberculosis. Cohen's f^2 is a measure for determining the effect size in multiple regression (Cohen, 1988). The Cohen's effect size of $f^2 = 0.27$ calculated for the variables included in the fourth step of this study was moderate (Cohen, 1988).

When all variables were included older age, more regular occupation, more beliefs about the general harm of medicines, less specific concerns regarding tuberculosis treatment, less alcohol use and fewer symptoms of depression were significant predictors of good adherence.

The results of the study are discussed, and a conclusion presented in Chapter Six.

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Chapter 6: Discussion and Conclusion

The WHO declared tuberculosis a global emergency in 1993 amid fears that annual tuberculosis deaths might reach 4 million by 2000 if trends continued unchecked (WHO Global Tuberculosis Programme, 1994). There has been considerable success in the global strategies to manage tuberculosis which has resulted in a gradual decline in annual tuberculosis deaths. However, according to latest available data, there were still approximately 1.4 million deaths due to tuberculosis worldwide in 2019 (WHO, 2020).

Perfect or near perfect adherence to treatment for tuberculosis is one of the essential requirements if the goal set by the WHO to eradicate tuberculosis worldwide by 2035 is to be met (WHO, 2014b, 2016). Poor adherence to treatment can lead to an increased period of infectivity, spread of the disease to other areas of the body, increased chance of the development of resistance to treatment and poorer health outcomes (O' Donnell, et al., 2014). Drug resistant tuberculosis requires medications that have more serious side-effects, have a longer treatment duration, and are more expensive to treat with a higher mortality rate than drug sensitive tuberculosis.

There are numerous factors described in literature that impact adherence. The literature review revealed that most dimensions that impact adherence to treatment could be categorized in the manner suggested by the WHO which are condition related factors, therapy related factors, health system factors, social and economic factors, and patient related factors (Sabaté, 2003).

The Health Belief Model (HBM) was chosen for this study as it is a model that has been widely used to predict how health beliefs impact adherence to treatment. To my knowledge this is one of the first studies utilizing the HBM to understand and predict adherence to treatment for tuberculosis in South Africa. In this current study, demographic factors, beliefs about medicine, substance use and depression were included as additional variables based on the evidence provided in literature that these factors affected adherence to treatment.

The purpose of the current study was to explore the relationship between the HBM constructs plus the additional variables to explain variance in adherence to treatment for tuberculosis. If adherence can be predicted by this model, then optimal evidence-based interventions can be designed to improve adherence. Improved adherence to tuberculosis treatment is essential to decrease tuberculosis related deaths, prevent the spread of the illness and

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to minimize the development of drug resistance – especially in line with the new drugs that have recently become available.

6.1 Summary

The Health Belief Model (HBM) has been effective in predicting adherence to several health-related behaviours including adherence to medication. In this present study I used a non-experimental design using correlation research based on a cross-sectional survey to evaluate the utility of the HBM and additional variables of demographic factors, beliefs about medicines, substance use and symptoms of depression to predict medication adherence in people hospitalised with tuberculosis.

A review of the literature revealed a lack of available questionnaires based on the HBM designed for use in the context of adherence to tuberculosis treatment. My first aim of the study was thus to develop an appropriate instrument to measure health beliefs regarding adherence to tuberculosis treatment based on the HBM.

The Tuberculosis Health Belief Scale (TB-HBS) consisting of five subscales Perceived Threat, Perceived Barriers, Perceived Benefits, Cues to Action and Self-Efficacy was purposively designed for use in this study. Finalization of items extracted was based on quantitative analysis and the internal validity and consistency were supported by the calculation of Cronbach's alpha for each subscale. The Perceived Threat subscale consisted of nine items ($\alpha = 0.79$) and included items that measured perceived severity and perceived susceptibility. The Cronbach's alpha was 0.72 for the six items included in Perceived Benefits subscale. Ten items were included in the Perceived Barriers subscale ($\alpha = 0.77$). The Cues to Action subscale consisted of four items ($\alpha = 0.77$). There were twelve items included in the Self-Efficacy subscale with a Cronbach's alpha of 0.81. Construct and content validity was established though adapting items from existing scales designed to measure the HBM constructs and consensus from the team of experts regarding the applicability of items. The underlying factor structure of the TB-HBS was supported by factor analysis. The results indicated that the TB-HBS was a valid and reliable measure of the HBM constructs as applied to adherence to treatment for people hospitalised with tuberculosis.

The second aim of this study was to develop a simple, free to use and reliable tuberculosis specific adherence scale that measured only medication taking behaviour. The final

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measure consisted of four self-report items, and one item based on health care providers' mention of poor adherence in the clinical notes. I named this scale the Tuberculosis Adherence Scale (TB-AS). The Cronbach's alpha for the TB-AS in this sample was 0.69 indicating a reasonable internal consistency.

The discussion of the results, as well as clinical implications and recommendations for future research should be considered within the light of the study limitations.

6.2 Limitations of the study

There are several limitations of this study which may have affected the results.. Firstly, the decision was made to utilize a self-report questionnaire battery based on the identified benefits of decreasing social desirability bias, minimizing potential unintentional influence by the interviewer, and to create a useful assessment tool that could be used in a resource constrained setting such as the public health system in South Africa. However, this resulted in people who were illiterate or unable to understand English or Afrikaans to be excluded from this study which limits the generalizability of the results.

Most participants (57%) indicated that they had attended high school but did not complete it. There were 19 participants with primary school as their highest level of education, 15 participants did not complete primary school and three indicated that they had no formal education. While care was taken to ensure that the language used was understandable by the target study group, the low level of education of participants may have resulted in inaccurate completion of the questionnaires due to lack of understanding of items or the response format. According to Foxcroft and Roodt (2012), challenges pertaining to poor literacy levels in countries such as South Africa, especially when psychometric instruments are used, are common. Some instruments were translated into Afrikaans from English for the purpose of this study. Foxcroft and Roodt (2012) explained that it is possible that there may be some conceptual inconsistencies between items despite due diligence to follow the appropriate steps to ensure validity of instruments.

Another limitation of this study is sampling bias. All participants in this study were required to be hospitalised with tuberculosis. According to the treatment guidelines for tuberculosis, people may be hospitalised at a specialised tuberculosis hospital for medical reasons such as deterioration in their condition, complicated management, unstable social

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conditions, or recurrent treatment interruption (South African Department of Health, 2014). The strategy to collect data from people who were hospitalised may have resulted in a skewed sample as people included in this study may have been more likely to have experienced severe symptoms, faced more challenges regarding adherence and have poorer socioeconomic circumstances than people who access treatment in a community setting.

An additional limitation of this study relates to social desirability bias. Although participants were reassured of the confidentiality and anonymity of the study, and a self-report format was used, the results may have been confounded by social desirability bias considering that questions related to personal views, beliefs, and perceptions were asked.

A larger sample size would have added more power to the obtained results. Recruiting participants that met my inclusion criteria from the only two specialised tuberculosis hospitals within the Cape Town area was a challenge. It took me eleven months to obtain data from 215 participants. The limitations relating to sample size and sampling bias affect the generalizability of the results. Caution should be used to generalize the results beyond the population of people hospitalised for tuberculosis who could read and understand English or Afrikaans within the Western Cape, South Africa.

6.3 Discussion

According to the results obtained from the TB-AS, 33.1% of the participants had low adherence, 34.4% had medium adherence and 32.5% of participants had high adherence to treatment in my study. This is lower than the level of adherence required to achieve the target set by the South African Department of Health to successfully treat 90% of people with tuberculosis and the WHO goal of the eradication of tuberculosis by 2035.

The model included in this study explained 21% of the variance in adherence to treatment for tuberculosis. Cohen's effect size of $f^2 = 0.27$ calculated for the variables included in the model was moderate (Cohen, 1988). Although there was a moderate effect size, there was nearly 80% of variance unexplained by this model which highlights that the factors that impact adherence to treatment for tuberculosis are complex and multi-faceted and may not have been identified in the present study.

The literature showed that demographic variables such as age, gender, marital status, and occupation have an inconsistent and occasionally contradictory impact on adherence (Mukherjee

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et al., 2002; Munro, Lewin, Smith, et al., 2007). In the current study, the mean adherence score for male participants was slightly higher than for females, and single participants were less adherent than people living with their partners. Ndwandwe et al., (2014) who conducted a study in South Africa found that neither age nor gender were associated with adherence to tuberculosis treatment. Ifebunandu and Ukwaja (2012), who conducted a study in Nigeria, and Kigozi (2017) in South Africa, found that females were less likely to default than males, however they had contradictory finding as to the association between age and adherence to tuberculosis treatment. In my study, older age and full-time occupation were significantly associated with improved adherence to treatment.

As expected, based on the relationship between socioeconomic status and tuberculosis, the socioeconomic status of the study population was lower as compared to the general population of the Western Cape. However, while poverty and low socioeconomic status were associated with both an increased risk in the development of tuberculosis and lower adherence in numerous studies, adherence was not significantly impacted by socioeconomic status in the current study (Dias et al., 2017; Naidoo et al., 2009; Naidoo, Peltzer et al., 2013; Sabaté, 2003). Interestingly, despite the low socioeconomic status of the study population, only 49.14% of participants indicated the cost to get to the clinic was a barrier to treatment. The result might suggest that like the findings by Leavitt et al. (2021), the system level interventions to improve access to care such as decentralization and free medication may be experienced among the study population

The addition of the HBM constructs to the regression analysis increased the adjusted R^2 by only 0.02 indicating that the HBM explained 2% of variance in adherence. This is considerably less than the amount of variance explained by the HBM in other studies such as those conducted in Iran by Azizi et al. (2018) and Karimy et al. (2014) with 42% and 29% variance explained, respectively. Azizi et al., (2014) used a five-item checklist to assess adherence and data was collected using interviews and questionnaires, as well as observing checklists. One possible explanation for these differences in explained variance could be due to lack of consistency across studies regarding the questionnaires and methods used to measure both the HBM variables as well as adherence.

The participants included in the current study were hospitalised for tuberculosis. The results indicated that most participants perceived high threat, many benefits, numerous barriers,

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multiple cues to action and had high levels of self-efficacy. While the HBM explained only a small percentage of variance in adherence scores, the scores obtained on each subscale provide valuable information regarding the perceptions of tuberculosis and treatment that can inform strategies to improve adherence.

According to the HBM, people make decisions regarding health behaviour based on a cognitive process of subjectively evaluating the value and probability of the expected outcome (Glanz et al., 2008). Thus, higher perception of tuberculosis as a threat based on susceptibility and severity, lower perceived barriers to adherence, and greater perception of benefits of treatment, combined with high self-efficacy and cues to action are theorized to increase likelihood of adherence to treatment (Abraham & Sheeran, 2005).

The results of the current study indicated that overall, the HBM factors of Perceived Barriers, Perceived Barriers, Cues to Action and Self-Efficacy were associated with adherence in the expected direction but were not statistically significant. Janz and Becker (1984) however found that Perceived Barriers was statistically significant in 89% of the studies included in their meta-analysis, followed by Perceived Susceptibility (81%), Perceived Benefits (78%), and Perceived Severity (65%).

Surprisingly, Perceived Threat was significantly negatively associated with adherence in the present study when only demographics and the HBM factors were included in the regression analysis. Higher Perceived Threat was associated with poorer adherence which is in contradiction to the core premise of the HBM that increased perception of threat will increase adherence to medication. Tuberculosis specific studies such as those conducted in Iran by Karimy et al. (2016) and Azizi et al. (2018) found that high perceived threat of the disease was associated with increased adherence to treatment for tuberculosis. Most participants in the current study scored high for Perceived Threat. Closer inspection of items included in the Perceived Threat subscale showed that162 participants (92.57%) agreed or strongly agreed with the statement that “TB can be a serious disease if you don’t treat it” and 168 (96%) participants indicated that they agreed or strongly agreed with the statement “TB causes death”. However, this fear did not result in improved adherence as was expected but rather the reverse.

On the Perceived Benefit subscale over 80% of participants agreed or strongly agreed with every statement. A total of 97% of participants indicated that they agreed or strongly agreed with the importance of taking tuberculosis treatment regularly and that treatment would result in

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cure. It would thus seem that most participants were aware of the benefits of treatment, although this was not significantly associated with adherence.

All participants in this present study perceived some barriers to adherence to treatment. Numerous studies have found that limited access to care contributed to non-adherence to treatment (Coetzee et al., 2011; Jaiswal et al., 2003, Munro, Lewin, Smith, et al., 2007; O'Donnell et al., 2016). It is thus concerning that in this current study 39.5% of participants indicated that queues at the clinic were too long, 42.3% reported that it took too long to get to the clinic, and 47% of participants believed that taking treatment interfered with normal daily activities. Poor relationships and ineffective communication with health care provider was found to significantly impact adherence in previous studies identified in the literature review (Jin et al., 2008; Munro, Lewin, Smith, et al., 2007; Tola et al., 2015; Zegeye et al., 2019). It is therefore encouraging that in the current study 70% of participants disagreed or strongly disagreed that they did not like to attend the clinic due to lack of respect shown by staff members and only 56 participants (26%) indicated that they did not understand what the doctor had told them about treatment. Side-effects were experienced by 97 (55.43%) of participants in this study. Side effects are common among people who receive tuberculosis medication and is an anticipated barrier to treatment adherence.

The participants in the current study indicated that that they had a strong belief in their own ability to adhere to treatment for tuberculosis. Over 70% of participants agreed or strongly agreed with each item on the Self-Efficacy subscale. This result is in line with some previous studies. Tola et al. (2015) for example found that the mean Self-Efficacy score in their study was high and did not show a significant effect on adherence to treatment for tuberculosis. Several other studies have found that higher levels of self-efficacy were significantly associated with improved adherence to treatment in general as well as to tuberculosis treatment specifically (Azizi et al., 2018; Okuboyejo et al., 2018; Rezaei & Feizi, 2008). Utilising the TB-HBS can identify those who may doubt their ability to adhere to treatment such that strategies to improve self-belief can be implemented if required.

Over 75% of all participants agreed or strongly agreed with every statement on the Cues to Action subscale. Clearly the strategies implemented to share information regarding treatment for tuberculosis have been effective, although in this study Cues to Action was not significantly associated with improved adherence. The use of reminders and information about the importance

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of adherence in the form of posters and advertisements may be a cost-effective method to encourage adherence to treatment for tuberculosis.

The premise of the Beliefs about Medicine Questionnaire (BMQ) is that beliefs regarding both the specific prescribed medication, and about medicine in general, will impact on adherence to treatment (Horne et al., 1999). It is theorized that a greater belief in the necessity of prescribed medication with lower concerns regarding the specific treatment, with less concern about the harm and overuse of medication in general will increase adherence to treatment (Horne et al., 1999)

In the current study the BMQ-Specific and BMQ-General scales were used to measure beliefs about medicine. Higher scores on the Specific-Necessity subscale were associated with improved adherence, and higher scores on the Specific-Concerns subscale significantly predicted poorer adherence. These findings are in accordance with other studies that explored BMQ and adherence to treatment. AlHewiti (2014) for example found that negative beliefs regarding medication were associated with low adherence to treatment for tuberculosis. Similarly, Azizi et al. (2018) found that the perception that tuberculosis drugs were harmful was a key contributing factor to non-adherence to tuberculosis treatment. Byer and Myers (2000) explored the influence of beliefs on adherence to asthma treatment, and Gauchet et al. (2004) looked at adherence to HIV treatment. They obtained similar results as in the present study in that higher Specific-Concerns significantly predicted lower adherence, while high Specific-Necessity was non-significantly associated with improved adherence. Cea-Calvo et al. (2019) on the other hand found that both high Specific-Concerns and low Specific-Necessity scores were significantly associated with non-adherence with patients with four different chronic conditions. In line with the theory, the results in the current study show that when people believe that tuberculosis treatment is necessary, and they have fewer concerns regarding the potential negative effects of medication the adherence to treatment is higher.

An unexpected finding of the current study was that high General-Harm was significantly associated with higher adherence. General-Overuse was also in the unexpected direction although this result was not significant in this study. These findings are contrary to the expectation that high beliefs in the harm of medication generally and high belief that medication is generally overused will result in poorer adherence (Horne & Weinman, 1998). A recent systematic review reported that 65% of included studies found a negative association between

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BMQ General-Harm and adherence and only 30% found a negative association between BMQ General-Overuse and adherence (Shahin et al., 2020). These findings highlight some of the inconsistent results obtained regarding the association between BMQ-General and adherence.

The literature review strongly suggested a higher prevalence of depression in people with tuberculosis, and that increased symptoms of depression were associated with poor adherence. The results of the current study were no exception. There were 60 participants (34.4%) who reported borderline to moderate symptoms of depression and 26 participants (14.86%) reported severe or extreme symptoms of depression in the current study. Similar results to the current study were reported in a recent systematic review and meta-analysis where the pooled estimated prevalence of depression among people with tuberculosis was 45.19% (Duko et al., 2020). Naidoo and Mwaba (2010) reported that 64.3% of the 166 participants included in a study conducted in Cape Town metropole met the criteria for depression based on having symptoms of at least mild mood disturbance according to scores obtained on the Beck Depression Inventory (BDI). Their result was slightly higher than the 49.26% of the participants in the current study that had symptoms suggestive of at least borderline to moderate depression according to the BDI. The results of the current study support the literature that there is a significant correlation between symptoms of depression and tuberculosis. This may be due to some shared risk factors between tuberculosis and depression as suggested by Ambaw et al. (2018) or due to the physiological impact that depression has on the immune response (Irwin & Niller, 2007). However, it is also reasonable to suggest that a diagnosis of an illness such as tuberculosis and the associated symptoms and impact on quality of life may trigger a depressive episode in vulnerable individuals (Goodwin, 2006). Continuous motoring of symptoms of depression for the duration of treatment for tuberculosis will allow for appropriate interventions to manage depression and limit possible impact on adherence to treatment.

The bivariate matrix in the current study showed a significant correlation between lower levels of adherence and higher scores of depressive symptoms. Depression was added at the fourth step of the multiple regression analysis, and it was found that less depression symptoms significantly predicted increased adherence to treatment for tuberculosis. The findings in the current study are similar to results obtained in other studies regarding the relationship between depression and non-adherence to treatment for tuberculosis. Ambaw and colleagues, for example found that 53.9% of participants with tuberculosis included in their study were classified as

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having probable depression and of these 3.9% had defaulted treatment at six months compared to 0.8% of those without probable depression (Ambaw, 2015). Similarly, Yan et al., (2018) found a significant association between depressive symptoms and adherence to treatment for tuberculosis.

As in the case of depression, numerous studies have shown that greater use of substances increased both the likelihood for development of active tuberculosis and the risk of poor adherence to treatment. For example, Pellisari and Diaz-Quijano (2018), found that 22% of the 77212 people on tuberculosis treatment included in their study used either alcohol or illegal substances with 15% of unsuccessful outcomes attributed to substance use. Similarly, Pelzter et al. (2012) found that 23.2% of patients with tuberculosis included in their study were hazardous or harmful drinkers as determined by their AUDIT scores. Comparable results were obtained in the current study with high reported levels of alcohol use and substance use which significantly predicted poor adherence.

The results obtained in my study can inform how people with tuberculosis can be effectively assisted to optimize adherence to treatment. Methods to identify people who are at higher risk for poor adherence, as well as ongoing monitoring of adherence, can facilitate targeted interventions in resource constrained settings.

6.4 Clinical recommendations

The Tuberculosis Adherence Scale (TB-AS) showed promise as a freely available, easy to use and reliable tool to measure adherence to tuberculosis. I recommend the use of a standard scale such as the TB-AS to measure adherence across all treatment settings at regular intervals to ensure that adherence is routinely monitored. Timely identification of poor adherence is essential to allow challenges to be addressed before potential drug resistance is amplified, disease progresses, and period of infectivity increased. This is especially true considering the recent introduction of new medications to treat drug resistant tuberculosis.

This current study showed that younger people, and those without full time occupation were significantly less adherent to treatment. Other people who may be at risk for poor adherence can be identified by completing the TB-HBS and the BMQ. Appropriate conversations with people who perceived few benefits, high barriers, or low self-efficacy, and discussions regarding the impact of perceived threat and beliefs about treatment may ensure optimal

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adherence. Fear related to the severity of tuberculosis and susceptibility to drug resistant tuberculosis did not result in improved adherence as was expected, but rather the reverse. Thus, it may be helpful for health care providers to refrain from utilizing strategies aimed primarily at heightening fear of the consequences of poor adherence without also highlighting benefits of treatment with people hospitalised with tuberculosis.

A high number of participants in the current study indicated concern related to the long-term harmful effects of tuberculosis medication and the addictive potential of medication in general. Health care workers providing a service within a tuberculosis setting should be mindful of the beliefs that people have about medication – especially regarding long-term effects and addiction and offer support and information where applicable.

Screening people with tuberculosis for symptoms of depression and substance use and the implementation of appropriate therapeutic intervention where appropriate is highly recommended. The target set in The South African Strategic Plan include that 90% of people in vulnerable populations should be screened for tuberculosis (South African National AIDS council, 2017). I recommend that people who present at health facilities in South Africa with symptoms of depression or are identified as using substances at a harmful level, should be considered to have an increased vulnerability to tuberculosis. They should thus and be screened for tuberculosis by checking if they have any symptoms and provided with information and education about tuberculosis.

6.5 Recommendations for future research

The literature review revealed a paucity of research conducted in South Africa regarding adherence to tuberculosis. Some information has been extrapolated from research conducted with people with HIV/AIDS. However, the beliefs and experiences of people living with tuberculosis and how this may impact on adherence may differ from those living with HIV/AIDS. I recommend future research using the TB-HBS to explore the impact of health beliefs on adherence to tuberculosis treatment while taking into consideration common dual diagnosis of tuberculosis and HIV/AIDS. Additional information such as length of time on treatment, the specific medication that is being used, and the anatomical site that is infected should be included and may provide valuable information regarding adherence to treatment.

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Information regarding potential differences between people who have been newly diagnosed with tuberculosis as compared to those who have been on treatment for several months can inform decisions regarding the optimal timing for appropriate interventions. Research regarding health beliefs, substance use and depression and the potential impact on adherence to treatment of people diagnosed with tuberculosis during different phases of the treatment journey is thus recommended.

Further investigation into the applicability of the HBM within the South African context considering the impact of the demographic factors such as culture, race, education, and language is needed. Some studies with participants from universities in South Africa found significant correlations with health behaviours relating to HIV testing and Pap smears, and the HBM model constructs (Hoque et al., 2014; Nöthling & Kagee, 2013). Other studies however conducted with people accessing treatment from primary health clinics or public hospitals found that only some, or none, of the HBM constructs were significantly associated with health behaviours such as Pap smears, tuberculosis treatment and hypertension treatment (Mabotja et al., 2021; Peltzer, 2004; Peltzer et al., 2002)

The TB-HBS and TB-AS both require further testing and validation. Confirmatory factor analysis is recommended with a larger sample size to confirm the factor structure of the TB-HBS. There is no gold standard for the measurement of adherence, however research aimed at comparing the results obtained from the TB-AS with objective measures of adherence such as DOTS records can further validate the TB-AS.

Research regarding the impact on adherence to tuberculosis treatment resulting from interventions that are implemented to address depression, alcohol use, drug use, and health beliefs is essential. Strategies to enhance adherence to treatment of tuberculosis based on evidence-based research is required if the goal to end tuberculosis by 2035 is to be achieved.

6.6 Conclusion

The central aim of this study was to explore the applicability of the Health Belief Model, along with the additional variables of demographics, beliefs about medicine, depression, and substance abuse to predict adherence to treatment for tuberculosis. To achieve this aim, two purposively designed scales to measure tuberculosis related health beliefs and adherence to

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treatment for tuberculosis were created. These instruments were shown to have good internal consistency and are considered reliable measures that can be used for future research.

This study showed that participants who were hospitalised for treatment for tuberculosis had lower socioeconomic status than the general population of the Western Cape, had high levels of substance use and just under 50% had symptoms of depression that were above the normal to mild category of severity. Most participants believed in their ability to adhere to treatment and believed in the benefits and necessity of treatment. However numerous barriers to treatment as well as concerns about medications and perceived threat of development of drug-resistant tuberculosis was also high. Despite the many challenges faced by participants, approximately one third of the participants had low, moderate, and good adherence, respectively.

The Health Belief Model did not significantly predict adherence to tuberculosis treatment; however, this model may be useful in future research aimed at understanding how health beliefs may impact adherence in differing contexts

The TB-HBS can provide important information regarding potential challenges and barriers to adherence that people with tuberculosis may face. The TB-AS showed promise as a reliable tool that could be routinely used in both clinical and research setting to measure adherence to treatment for tuberculosis.

Adherence to treatment is essential to reduce the development and spread of drug resistant tuberculosis, improve treatment outcomes, and eventually eradicate tuberculosis. A multi-dimensional collaborative approach aimed at the identification of challenges to adherence is paramount to the success of treatment for tuberculosis.

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References

Abraham, C., & Sheeran, P. (2000). Understanding and changing health behaviour: From health beliefs to self-regulation. In Norman, C. Abraham, & M. Conner (Eds.), *Understanding and changing health behaviour* (pp. 3-24). Amsterdam: Harwood.

Abraham, C. & Sheeran, P. (2005) The Health Belief Model. In: Conner, M., and Norman, P., Eds., *Predicting Health Behaviour: Research and Practice with Social Cognition Models*, 2nd Edition, Open University Press, Maidenhead, 28-80.

Ajzen, I (2011) The theory of planned behaviour: Reactions and reflections, *Psychology & Health*, 26:9, 1113-1127. https://doi.org/ 10.1080/08870446.2011.613995.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. New Jersey: Prentice-Hall.

AlHewiti, A (2014) Adherence to Long Term Therapies and Beliefs about Medications. *International Journal of Family Medicine.* https://doi.org/10.1155/2014/479596.

Alsultan, A., & Peloquin, C. A. (2014). Therapeutic drug monitoring in the treatment of tuberculosis: an update. *Drugs*, *74*(8), 839-854. https://doi.org/10.1007/s40265-014-0222-8.

Ambaw, F., Mayston, R., Hanlon, C., & Alem, A. (2015). Depression among patients with tuberculosis: determinants, course and impact on pathways to care and treatment outcomes in a primary care setting in southern Ethiopia—a study protocol. *BMJ open*, *5*(7). https://doi.org/10.1155/2013/489865

Ambaw, F., Mayston, R., Hanlon, C., Medhin, G., & Alem, A. (2018). Untreated depression and tuberculosis treatment outcomes, quality of life and disability, Ethiopia. *Bulletin of the World Health Organization*, *96*(4), 243. https://doi.org/10.2471/BLT.17.192658.

Stellenbosch University https://scholar.sun.ac.za

Amico, K. R., Mugavero, M., Krousel-Wood, M. A., Bosworth, H. B., & Merlin, J. S. (2018). Advantages to using social-behavioral models of medication adherence in research and practice. *Journal of General Internal Medicine, 33*(2), 207-215. https//doi.org/:10.1007/s11606-017-4197-5

Anthoine, E., Moret, L., Regnault, A., Sebille, V., & Hardouin, J. B. (2014). Sample size used to validate a scale: A review of publications on newly-developed patient reported outcomes measures. *Health and Quality of Life Outcomes, 12*(1), 176-186. https://doi.org/ 10.1186/s12955-014-0176-2

Armitage, C. J., & Conner, M. (2000). Social cognition models and health behaviour: A structured review. *Psychology and health, 15*(2), 173-189. https://doi.org/ 10.1080/08870440008400299.

Ataguba, J. E., Akazili, J., & McIntyre, D. (2011). Socioeconomic-related health inequality in South Africa: evidence from General Household Surveys. *International journal for equity in health, 10*(1), 48. http://www.equityhealthj.com/content/10/1/48

Azizi, N., Karimy, M., & Salahshour, V. N. (2018). Determinants of adherence to tuberculosis treatment in Iranian patients: Application of health belief model. *The Journal of Infection in Developing Countries, 12*(09), 706-711. https://doi.org/10.3855/jidc.9653.

Babbie, E. and Mouton, J. (2010) The Practice of Social Research. 10th Edition, Republic of South Africa, Oxford University Press Southern Africa, Cape Town

Babor, T. F., Higgins-Biddle, J. C., Saunders, J. B., & Monteiro, M. G. (2001). AUDIT: The Alcohol Use Disorders Identification Test. Guidelines for use in primary care, Geneva. *World Health Organization*. https://apps.who.int/iris/bitstream/handle/10665/67205/WHO_MSD_MSB_01.6a.pdf;jsessionid=663408AFE77D0C0AEA8152B812FD825D?sequence=1

Stellenbosch University https://scholar.sun.ac.za

Banta, D. (2000). International Group of Health Experts Issues Global Declaration to Stop TB. *JAMA*, *283*(18), 2375-2377. https://doi.org/10.1001/jama.283.18.2375.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioural change. *Psychological Review*, 84(2):191-215. https://doi.org/10.1037/0033-295X.84.2.191.

Bandura, A. (2004). Health promotion by social cognitive means. *Health education & behaviour, 31(2*), 143-164. https://doi.org/10.1177/1090198104263660.

Barnhoorn, F., & Adriaanse, H. (1992). In search of factors responsible for noncompliance among tuberculosis patients in Wardha District, India. *Social science & medicine*, *34*(3), 291-306. https://doi.org/ 10.1016/0277-9536(92)90271-Q

Barr, T., Helms, C., Grant, K., & Messaoudi, I. (2016). Opposing effects of alcohol on the immune system. *Progress in Neuro-Psychopharmacology and Biological Psychiatry, 65,* 242-251. https://doi.org/10.1016/j.pnpbp

Beck, A. T., & Beamesderfer, A. (1974). Assessment of depression. The depression inventory. *Modern Problems of Pharmacopsychiatry, 7*, 151-169 https://doi.org/10.1159/000395074

Beck, A.T., Steer, R.A., & Garbin, M.G. (1988). Psychometric properties of the Beck Depression Inventory: twenty-five years of evaluation. *Clinical Psychology Review 8* (1), 77-100. https://doi.org/ 10.1016/0272-7358(88)90050-5

Becker MH & Janz N. (1985). The Health Belief Model Applied to Understanding Diabetes Regimen Compliance. *The Diabetes Educator 11(1):* 41-47. https://doi.org/10.1177/014572178501100108.

Stellenbosch University https://scholar.sun.ac.za

Been, S. K., Yildiz, E., Nieuwkerk, P. T., Pogány, K., Van De Vijver, D. A., & Verbon, A. (2017). Self-reported adherence and pharmacy refill adherence are both predictive for an undetectable viral load among HIV-infected migrants receiving cART. *PloS one*, *12*(11). https://doi.org/10.1371/journal.pone.0186912.

Berman, A. H., Bergman, H., Palmstierna, T., & Schlyter, F. (2005). DUDIT manual the drug use disorders identification test. *London: Karolinska Institutet Department of Clinical Neuroscience*. www.paihdelinkki.fi/sites/default/files/duditmanual.pdf.

Bionghi, N., Daftary, A., Maharaj, B., Msibi, Z., Amico, K. R., Friedland, G., ... & O'Donnell, M. R. (2018). Pilot evaluation of a second-generation electronic pill box for to Bedaquiline and antiretroviral therapy in drug-resistant TB/HIV co-infected patients in KwaZulu-Natal, South Africa. *BMC infectious diseases,* 18(1), 171. https://doi.org/10.1186/s12879-018-3080-2.

Blanche, M. T., Blanche, M. J. T., Durrheim, K., & Painter, D. (Eds.). (2006). *Research in practice: Applied methods for the social sciences*. Juta and Company Ltd.

Boru, C. G., Shimels, T., & Bilal, A. I. (2017). Factors contributing to non-adherence with treatment among TB patients in Sodo Woreda, Gurage zone, southern Ethiopia: a qualitative study. *Journal of infection and public health*, *10*(5), 527-533. https://doi.org/10.1016/j.jiph.2016.11.018.

Brown, M. T., & Bussell, J. K. (2011, April). Medication adherence: WHO cares?. In *Mayo clinic proceedings* (Vol. 86, No. 4, pp. 304-314). Elsevier. https://doi.org/10.4065/mcp.2010.0575.

Bujang, M. A., Omar, E. D., & Baharum, N. A. (2018). A Review on Sample Size Determination for Cronbach's Alpha Test: A Simple Guide for Researchers. *The Malaysian journal of medical sciences : MJMS*, *25*(6), 85–99. https://doi.org/ org/10.21315/mjms2018.25.6.9

Stellenbosch University https://scholar.sun.ac.za

Burger, R., & Christian, C. (2020). Access to health care in post-apartheid South Africa: availability, affordability, acceptability. *Health Economics, Policy and Law*, *15*(1), 43-55. https://doi.org/10.1017/S1744133118000300

Byer, B., & Myers, L. B. (2000). Psychological correlates of adherence to medication in asthma. *Psychology, Health & Medicine*, *5*(4), 389-393. https://doi.org/org/10.1080/713690213

Carpenter, C. J. (2010). A meta-analysis of the effectiveness of health belief model variables in predicting behavior. *Health communication*, *25*(8), 661-669. https://doi:10.1080/10410236.2010.521906.

Castelnuovo, B. (2014). A review of compliance to anti tuberculosis treatment and risk factors for defaulting in Sub Saharan Africa. *African Health Sciences* 10 (4) 320 – 324. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3052808/

Cea-Calvo, L., Marín-Jiménez, I., de Toro, J., Fuster-RuizdeApodaca, M. J., Fernández, G., Sánchez-Vega, N., & Orozco-Beltrán, D. (2020). Association between non-adherence behaviours, patients' experience with healthcare and beliefs in medications: a survey of patients with different chronic conditions. *Current medical research and opinion*, *36*(2), 293-300. https://doi.org/10.1080/03007995.2019.1676539.

Champion, V.L. (1999). Revised susceptibility, benefits and barriers scale for mammography screening. *Research in Nursing & Health.* 22(4): 341-348. http://www.ncbi.nlm.nih.gov/pubmed/10435551.

Chaulk, C. P., & Moonan, P. K. (2020). Over the limit: tuberculosis and excessive alcohol use. *The international journal of tuberculosis and lung disease*, *24*(1), 3. https://doi.org/ 10.5588/ijtld.19.0325.

Stellenbosch University https://scholar.sun.ac.za

Chang, L. C., Hung, L. L., Chou, Y. W., & Ling, L. M. (2007). Applying the health belief model to analyze intention to participate in preventive pulmonary tuberculosis chest X-ray examinations among indigenous nursing students. *The journal of nursing research: JNR*, *15*(1), 78-87. https://doi.org/ 10.1097/01.JNR.0000387601.24908.45.

Classen, C. N., Warren, R., Richardson, M., Hauman, J. H., Gie, R. P., Ellis, J. H., ... & Beyers, N. (1999). Impact of social interactions in the community on the transmission of tuberculosis in a high incidence area. *Thorax*, *54*(2), 136-140. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1745413/pdf/v054p00136.pdf.

Cloete, K (2017, October 02). *Circular number H132/2017 - Clinical guidelines & standard operating procedure for the implementation of the shorter DR-TB regimen for adults and children.* [circular]. Norton House Cape Town, HAST directorate.

Coetzee, B., Kagee, A., & Vermeulen, N. (2011). Structural barriers to adherence to antiretroviral therapy in a resource-constrained setting: the perspectives of health care providers. *AIDS care*, *23*(2), 146-151. https://doi.org/ 10.1080/09540121.2010.498874.

Cohen, J. (1988). *Statistical power analysis for the behavioural sciences*. Academic press.

Cox, H., Hughes, J., Daniels, J., Azevedo, V., McDermid, C., Poolman, M., ... & Van Cutsem, G. (2014). Community-based treatment of drug-resistant tuberculosis in Khayelitsha, South Africa. *The International Journal of Tuberculosis and Lung Disease*, *18*(4), 441-448. https://doi.org/10.1111/tmi.12544

Comfrey, A. L., & Lee, H. B. (1992). *A First Course in Factor Analysis*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Conner, M., & Norman, P. (2005). *Predicting health behaviour*. McGraw-Hill Education (UK).

Stellenbosch University https://scholar.sun.ac.za

Cramm, J.M., Finkenflügel, H.J., Moller, V. & Nieboer, A.P. (2010). TB treatment initiation and adherence in a South African community influenced more by perceptions than by knowledge of tuberculosis. *BMC Public Health* 10:72. https://doi.org/10.1186/1471245810-72.

Daftarya, A., Padayatchi, N., & O'Donnell, M. (2014). Preferential adherence to antiretroviral therapy over tuberculosis (TB) treatment: a qualitative study of drug–resistant TB/HIV co–infected patients in South Africa *Glob Public Health*. 2014 9(9): 1107–1116. https://doi.org/10.1080/17441692.2014.934266.

Daniel, T.M. (2006). The history of tuberculosis. *Respiratory Medicine 100* (11): 1862-1870. https://doi.org//10.1016/j.rmed.2006.08.006.

Dasa, T. T., Roba, A. A., Weldegebreal, F., Mesfin, F., Asfaw, A., Mitiku, H., ... & Tesfaye, E. (2019). Prevalence and associated factors of depression among tuberculosis patients in Eastern Ethiopia. *BMC psychiatry*, *19*(1), 1-7. https://doi.org/10.1186/s12888-019-2042-6

De Leeuw, E. (2008). Self-administered questionnaires and standardized interviews. *Handbook of social research methods*, 313-327.

De Meneses-Gaya, C., Zuardi, A. W., Loureiro, S. R., & Crippa, J. A. S. (2009). Alcohol Use Disorders Identification Test (AUDIT): An updated systematic review of psychometric properties. *Psychology & Neuroscience*, *2*(1), 83. https://doi.org/10.3922/j.psns.2009.1.12

DeVellis, R. F. (2016). *Scale development: Theory and applications* (Vol. 26). Thousand Oaks, Calif: Sage publications.

Dheda K, Barry CE & Maartens G. (2016). Tuberculosis. *Lancet*; 387: 1211–26. https://doi.org/10.1016/ S0140-6736(15)00151-8.

Stellenbosch University https://scholar.sun.ac.za

Dias, M., Gaio, R., Sousa, P., Abranches, M., Gomes, M., Oliveira, O., ... & Duarte, R. (2017). Tuberculosis among the homeless: should we change the strategy?. *The International Journal of Tuberculosis and Lung Disease*, *21*(3), 327-332. https://doi.org/10.5588/ijtld.16.0597.

Diaz, E., Levine, H. B., Sullivan, M. C., Sernyak, M. J., Hawkins, K. A., Cramer, J. A., & Woods, S. W. (2001). Use of the Medication Event Monitoring System to estimate medication compliance in patients with schizophrenia. *Journal of Psychiatry and Neuroscience*, *26*(4), 325.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC167186/

Di Gennaro, F., Pizzol, D., Cebola, B., Stubbs, B., Monno, L., Saracino, A., ... & Veronese, N. (2017). Social determinants of therapy failure and multi drug resistance among people with tuberculosis: a review. *Tuberculosis*, *103*, 44-51. https://doi.org/10.1016/j.tube.2017.01.002.

DiMatteo, M.R. (2004a). Social support and patient adherence to medical treatment: a meta-analysis. *Health Psychol*, 23:207–18. https://doi.org/10.1037/0278-6133.23.2.207.

DiMatteo, M.R. 2004b. Evidence-based strategies to foster adherence and improve patient outcomes. *JAAPA*, 17 (11):18–21. https://link.gale.com/apps/doc/A125954971/AONE?u=27uos&sid=AONE&xid=f79eead

DiMatteo, M.R. 2004c. Variations in patients' adherence to medical recommendations: a quantitative review of 50 years of research. *Med Care*, 42:200–9. https://doi.org/10.1097/01.mlr.0000114908.90348.f9.

Dimatteo, M. R., Giordani, P. J., Lepper, H. S., & Croghan, T. W. (2002). Patient adherence and medical treatment outcomes a meta-analysis. *Medical care*, 794-811. https://doi.org/ 10.1097/01.MLR.0000024612.61915.2D.

Stellenbosch University https://scholar.sun.ac.za

DiMatteo, M.R., Lepper, H.S., & Croghan T.W. (2000). Depression is a risk factor for noncompliance with medical treatment: a meta-analysis of the effects of anxiety and depression on patient adherence. *Arch Intern Med*, 160 (2):101–107. https://doi.org/10.1001/archinte.160.14.2101.

Directorate, DR-TB. (2015). Introduction of new drugs and drug regimens for the management of drug-resistant tuberculosis in South Africa: policy framework. http://www.nicd.ac.za/assets/files/Acrobat%20Document.pdf.

Doherty, A. M., Kelly, J., McDonald, C., O'Dwyer, A. M., Keane, J., & Cooney, J. M. (2013). 2808–A review of the interplay between tuberculosis and mental health. *European Psychiatry*, *28*(S1), 1-1. https://doi.org/ 10.1016/S0924-9338(13)77395-4

Duko, B., Bedaso, A., & Ayano, G. (2020). The prevalence of depression among patients with tuberculosis: a systematic review and meta-analysis. *Annals of general psychiatry*, *19*, 30. https://doi.org/10.1186/s12991-020-00281-8

Duko, B., Gebeyehu, A., & Ayano, G. (2015). Prevalence and correlates of depression and anxiety among patients with tuberculosis at WolaitaSodo University Hospital and Sodo Health Center, WolaitaSodo, South Ethiopia, Cross sectional study. *BMC psychiatry*, *15*(1), 1-7. https://doi.org/ 10.1186/s12888-015-0598-3

Edginton, M., Sekatane, C., & Goldstein, S. (2002). Patients' beliefs: do they affect tuberculosis control? A study in a rural district of South Africa. *The International Journal of Tuberculosis and Lung Disease*, 6(12), 1075-1082. https://pubmed.ncbi.nlm.nih.gov/12546115/.

Edwards, I. R., & Aronson, J. K. (2000). Adverse drug reactions: definitions, diagnosis, and management. *The lancet*, *356*(9237), 1255-1259. https://doi.org/10.1016/S01406736(00)02799-9.

Stellenbosch University https://scholar.sun.ac.za

Erford, B,T., Johnson, E. & Bardoshi, G. (2016). Meta-analysis of the English version of the Beck Depression Inventory-second edition. *Measurement and Evaluation in counselling and development*. 49 (1): 3-33. https://doi.org/10.1177/074815596783.

Erkin, Ö & Özsoy, S. (2012). Validity and reliability of health belief model applied to influenza, *Academic Research International 2* (3) 31-36. http://www.savap.org.pk/journals/ARInt./Vol.2(3)/2012(2.3-03).pdf.

Farley, J.E., Ram, M., Pan. W., Waldman, S., Casell, G.H., Chaison, R.E. Weyer, K., Lancaster, J. & Van Der Walt, M.(2011). Outcomes of Multi – Drug Resistant Tuberculosis (MDR – TB) among a Cohort of South African Patients with High HIV Prevalence. *PLoS ONE* 6 (7): e 20436. https://doi.org/ 10.1371/journal.pone.0020436.

Farmer, K. C. (1999). Methods for measuring and monitoring medication regimen adherence in clinical trials and clinical practice. *Clinical therapeutics,* 21(6), 1074-1090. https://doi.org/10.1016/S0149-2918(99)80026-5.

Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics*. SAGE.

Finlay, A., Lancaster, J., Holtz, T. H., Weyer, K., Miranda, A., & van der Walt, M. (2012). Patient-and provider-level risk factors associated with default from tuberculosis treatment, South Africa, 2002: a case-control study. *BMC public health*, *12*(1), 56. Finlay et al. BMC Public Health 2012. https://doi.org/10.1186/1471-2458-12-56.

Foot, H., La Caze, A., Gujral, G., & Cottrell, N. (2016). The necessity-concerns framework predicts adherence to medication in multiple illness conditions: A meta-analysis. *Patient Educ Couns* May: 99 (5) 706-717 https://doi.org/10.1016/j.pec.2015.11.004.

Foxcroft, C., & Roodt, G. (2012). *Introduction to psychological assessment in the South African context.* Cape Town, South Africa: Oxford University Press Southern Africa.

Stellenbosch University https://scholar.sun.ac.za

Frieden, T. R., & Sbarbaro, J. A. (2007). Promoting adherence to treatment for tuberculosis: the importance of direct observation. *Bulletin of the World Health Organization*, *85*, 407-409. https://doi.org/ 10.2471/blt.06.038927.

Garfield, S., Clifford, S., Eliasson, L., Barber, N., & Willson, A. (2011). Suitability of measures of self-reported medication adherence for routine clinical use: a systematic review. BMC medical research methodology, 11(1), 1-9. https://doi.org/10.1186/1471-2288-11-149.

Gatti, M. E., Jacobson, K. L., Gazmararian, J. A., Schmotzer, B., & Kripalani, S. (2009). Relationships between beliefs about medications and adherence. American Journal of Health-System Pharmacy, 66(7), 657-664. https://doi.org/ 10.2146/ajhp080064

Gauchet, A., Tarquinio, C., & Fischer, G. (2007). Psychosocial predictors of medication adherence among persons living with HIV. *International Journal of Behavioural Medicine*, *14*(3), 141-150. https://doi.org/ 10.1007/BF03000185.

Glanz, K., Rimer, B.K. and Lewis, F.M. (2002) Health Behaviour and Health Education. Theory, Research and Practice. Wiley & Sons, San Fransisco.

Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). (2008). Health behaviour and health education: theory, research, and practice. John Wiley & Sons.

Goodwin G. M. (2006). Depression and associated physical diseases and symptoms. *Dialogues in clinical neuroscience*, *8*(2), 259–265. https://doi.org/10.31887/DCNS.2006.8.2/mgoodwin

Gebremariam, M. K., Bjune, G. A., & Frich, J. C. (2010). Barriers and facilitators of adherence to TB treatment in patients on concomitant TB and HIV treatment: a qualitative study. *BMC public health*, *10*(1), 651. https://doi.org/ 10.1186/1471-2458-10-651.

Stellenbosch University https://scholar.sun.ac.za

Ginsberg, A. M., & Spigelman, M. (2007). Challenges in tuberculosis drug research and development. *Nature medicine*, *13*(3), 290-294. https://doi.org/10.1038/nm0307-290.

Gülbay, B. E., Gürkan, Ö. U., Yıldız, Ö. A., Önen, Z. P., Erkekol, F. Ö., Baççıoğlu, A., & Acıcan, T. (2006). Side effects due to primary antituberculosis drugs during the initial phase of therapy in 1149 hospitalised patients for tuberculosis. *Respiratory medicine, 100*(10), 1834-1842. https://doi.org/10.1016/j.rmed.2006.01.014.

Gust, D. A., Mosimaneotsile, B., Mathebula, U., Chingapane, B., Gaul, Z., Pals, S. L., & Samandari, T. (2011). Risk factors for non-adherence and loss to follow-up in a three-year clinical trial in Botswana. *PloS one*, *6*(4), e18435. https://doi.org/10.1371/journal.pone.0018435.

Gutierrez, M. C., Brisse, S., Brosch, R., Fabre, M., Omaïs, B., Marmiesse, M., ... & Vincent, V. (2005). Ancient origin and gene mosaicism of the progenitor of Mycobacterium tuberculosis. *PLoS Pathog*, *1*(1), e5. https://doi.org/ 10.1371/journal.ppat.0010005.

Hanifa, Y., Mngadi, K., Lewis, J., Fielding, K., Churchyard, G., & Grant, A. D. (2007). Evaluation of the Arkansas method of urine testing for isoniazid in South Africa. *The international journal of tuberculosis and lung disease*, *11*(11), 1232-1236. https://www.ingentaconnect.com/content/iuatld/ijtld/2007/00000011/00000011/art00014;jsessionid=30r8raatb787q.x-ic-live-03#

Hargreaves, J. R., Boccia, D., Evans, C. A., Adato, M., Petticrew, M., & Porter, J. D. (2011). The social determinants of tuberculosis: from evidence to action. *American journal of public health*, *101*(4), 654-662. https://doi.org/10.2105/AJPH.2010.199505.

Harrison, J. A., Mullen, P. D., & Green, L. W. (1992). A meta-analysis of studies of the Health Belief Model. *Health Education Research, 7*, 107–116. https://doi.org/org/10.1093/her/7.1.107

Stellenbosch University https://scholar.sun.ac.za

Haynes, R. B., McDonald, H. P., Garg, A., & Montague, P. (2002). Interventions for helping patients to follow prescriptions for medications. *Cochrane database of systematic reviews*, (2). https://doi.org/ 10.1002/14651858.CD00001.

Hlabangane, S (24 March 2017). Smart Pill Device Keeps TB Medication Adherence on Track. *eHealth News South Africa*. https://ehealthnews.co.za/smart-pill-device-tb-medication/.

Hochbaum, G. M. (1958). *Public participation in medical screening programs: A socio-psychological study* (No. 572). US Department of Health, Education, and Welfare, Public Health Service, Bureau of State Services, Division of Special Health Services, Tuberculosis Program.

Holmes, E. A., Hughes, D. A., & Morrison, V. L. (2014). Predicting adherence to medications using health psychology theories: a systematic review of 20 years of empirical research. *Value in Health: the journal of the International Society for Pharmacoeconomics and Outcomes Research 17*(8), 863-876. https://doi.org/10.1016/j.jval.2014.08.2671.

Holtz, T. H., Lancaster, J., Laserson, K. F., Wells, C. D., Thorpe, L., & Weyer, K. (2006). Risk factors associated with default from multidrug-resistant tuberculosis treatment, South Africa, 1999–2001. *The International Journal of Tuberculosis and Lung Disease*, *10*(6), 649-655. https://doi.org/ 10.1086/588292.

Hoque, M. E., Ghuman, S., Coopoosmay, R., & Van Hal, G. (2014). Cervical cancer screening among university students in South Africa: a theory-based study. *PloS one*, *9*(11), e111557. https//doi.org/10.1371/journal.pone.0111557

Horne, R., Chapman, S. C., Parham, R., Freemantle, N., Forbes, A., & Cooper, V. (2013). Understanding patients' adherence-related beliefs about medicines prescribed for long-term conditions: a meta-analytic review of the Necessity-Concerns Framework. *PloS one*, *8*(12), e80633. https://doi.org/ 10.1371/journal.pone.0080633.

Stellenbosch University https://scholar.sun.ac.za

Horne, R., Weinman, J., Barber, N., Elliott, R., Morgan, M., Cribb, A., & Kellar, I. (2005). Concordance, adherence and compliance in medicine taking. *London: NCCSDO*, *2005*, 40-6. http://www.netscc.ac.uk/hsdr/files/project/SDO_FR_08-1412-076_V01.pdf.

Horne, R., Weinman, J., & Hankins, M. (1999). The beliefs about medicines questionnaire: the development and evaluation of a new method for assessing the cognitive representation of medication. *Psychology and health*, *14*(1), 1-24. https://doi.org/10.1080/08870449908407311.

Horwood, H., Williams, M. J., & Mandic, S. (2015). Examining motivations and barriers for attending maintenance community-based cardiac rehabilitation using the health-belief model. *Heart, Lung and Circulation*, *24*(10), 980-987. https://doi.org/10.1016/j.hlc.2015.03.023.

Hruschka, D. J., Gerkey, D., & Hadley, C. (2015). Estimating the absolute wealth of households. *Bulletin of the World Health Organization*, *93*, 483-490. https://doi.org/10.2471/BLT.14.147082.

Hutcheson, G. D., & Sofroniou, N. (1999). *The multivariate social scientist: Introductory statistics using generalized linear models*. Sage.

Ifebunandu, N. A., & Ukwaja, K. N. (2012). Tuberculosis treatment default in a large tertiary care hospital in urban Nigeria: prevalence, trend, timing and predictors. *Journal of infection and public health*, *5*(5), 340-345. https://doi.org/10.1016/j.jiph.2012.06.002.

Irwin, M. R., & Miller, A. H. (2007). Depressive disorders and immunity: 20 years of progress and discovery. *Brain, behaviour, and immunity*, *21*(4), 374-383. https://doi.org/10.1016/j.bbi.2007.01.010

Stellenbosch University https://scholar.sun.ac.za

Jacobs, T. Q., & Ross, A. (2012). Adverse effects profile of multidrug-resistant tuberculosis treatment in a South African outpatient clinic. *South African Family Practice*, *54*(6), 531-53. https://doi.org/10.1080/20786204.2012.108742889.

Jaggarajamma, K., Sudha, G., Chandrasekaran, V., Nirupa, C., Thomas, A., Santha, T., ... & Narayanan, P. R. (2007). Reasons for non-compliance among patients treated under Revised National Tuberculosis Control Programme (RNTCP), Tiruvallur district, south India. *Indian Journal of tuberculosis*, *54*(3), 130-135. https://eprints.nirt.res.in//806/1/200717.pdf

Jahan, F., Rattanagreethakul, S., & Toonsiri, C. (2014). Factors Related to Tuberculosis Preventive Behaviours among Tuberculosis Patient Attendants in Dhaka, Bangladesh. *Thai Pharmaceutical and Health Science Journal* 9(2), 68-74. http://ejournals.swu.ac.th/index.php/pharm/article/view/4852/4639.

Jaiswal, A., Singh, V., Ogden, J. A., Porter, J. D. H., Sharma, P. P., Sarin, R., ... & Jain, R. C. (2003). Adherence to tuberculosis treatment: lessons from the urban setting of Delhi, India. *Tropical Medicine & International Health*, *8*(7), 625-633. https://doi.org/10.1046/j.1365-3156.2003.01061.x

Jakubowiak, W. M., Bogorodskaya, E. M., Borisov, E. S., Danilova, D. I., & Kourbatova, E. K. (2007). Risk factors associated with default among new pulmonary TB patients and social support in six Russian regions. *The international journal of tuberculosis and lung disease, 11*(1), 46-53. https://www.ingentaconnect.com/content/iuatld/ijtld/2007/00000011/00000001/art00008.

Jamous, R. M., Sweileh, W. M., Taha, A. S. E. D. A., & Zyoud, S. E. H. (2014). Beliefs about medicines and self-reported adherence among patients with chronic illness: a study in Palestine. *Journal of Family Medicine and Primary Care*, *3*(3), 224. https://doi.org/10.4103/2249- 4863.141615.

Stellenbosch University https://scholar.sun.ac.za

Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. Health education quarterly, 11(1), 1-47. https://doi.org/ 10.1177/109019818401100101.

Javaid, A., Khan, M. A., Jan, F., Rauf, M., Khan, M. A., Basit, A., & Mehreen, S. (2018). Occurrence of adverse events in patient receiving community-based therapy for multidrug-resistant tuberculosis in Pakistan. *Tuberkuloz ve toraks*, *66*(1), 16-25. https://doi.org/ 10.5578/tt.64054.

Jin, J., Sklar, G. E., Oh, V. M. S., & Li, S. C. (2008). Factors affecting therapeutic compliance: A review from the patient's perspective. *Therapeutics and clinical risk management*, *4*(1), 269. https://doi.org/ 10.2147/tcrm.s1458.

Johanson, G. A., & Brooks, G. P. (2010). Initial scale development: sample size for pilot studies. *Educational and Psychological Measurement*, *70*(3), 394-400. https://doi.org/ 10.1177/0013164409355692.

Johnson, M. O., Neilands, T. B., Dilworth, S. E., Morin, S. F., Remien, R. H., & Chesney, M. A. (2007). The role of self-efficacy in HIV treatment adherence: validation of the HIV Treatment Adherence Self-Efficacy Scale (HIV-ASES). *Journal of behavioural medicine*, *30*(5), 359-370. https://doi.org/ 10.1007/s10865-007-9118-3.

Joon, D., Nimesh, N., Nimesh, M., (2017) Clinical Manifestations of Tuberculosis, *Voyager: Vol. VIII, No*. 1, pp.37- 46. http://anubooks.com/wp-content/uploads/2017/08/Voyager-June-2017-6.pdf

Jose, R., Narendran, M., Bindu, A., Beevi, N., Manju, L., & Benny, P. V. (2020). Public perception and preparedness for the pandemic COVID 19: a health belief model approach. *Clinical Epidemiology and Global Health*, *9*, 41-46. https://doi.org/ /10.1016/j.cegh.2020.06.009

Stellenbosch University https://scholar.sun.ac.za

Kabore, L., Muntner, P., Chamot, E., Zinski, A., Burkholder, G., & Mugavero, M. J. (2015). Self-report measures in the assessment of antiretroviral medication adherence: comparison with medication possession ratio and HIV viral load. *Journal of the International Association of Providers of AIDS Care (JIAPAC)*, *14*(2), 156-162. https://doi.org/10.1177/2325957414557263.

Kader, R., Seedat, S., Govendar, R., Koch, J. R., & Parry, C. D. (2014). Hazardous and harmful use of alcohol and/or other drugs and health status among South African patients attending HIV clinics. *AIDS and Behaviour, 18*, 525-534. https://doi.org/10.1007/s10461013-0587-9.

Kader, R., Govender, R., Seedat, S., Koch, J. R., & Parry, C. (2015). Understanding the impact of hazardous and harmful use of alcohol and/or other drugs on ARV adherence and disease progression. *PLoS One*, *10*(5), e0125088. https://doi.org/org/10.1371/journal.pone.0125088

Kagee, A. (2004). Treatment adherence in South African primary health care. *Family* Practice, 46:10, 26 – 30. https://doi.org/10.1080/20786204.2004.10873151.

Kagee, A., & Delport, T. (2010). Barriers to Adherence to Antiretroviral Treatment. *Journal of Health Psychology, 15(7*), 1001-1011. https://doi.org/10.1177/1359105310378180.

Kagee, A., Le Roux, M., & Dick, J. (2007). Treatment adherence among primary care patients in a historically disadvantaged community in South Africa: A qualitative study. *Journal of Health Psychology*, 12(3), 444-460. https://doi.org/ 10.1177/1359105307076232.

Kagee, A., Remien, R. H., Berkman, A., Hoffman, S., Campos, L., & Swartz, L. (2011). Structural barriers to ART adherence in Southern Africa: challenges and potential ways forward. *Global public health*, *6*(1), 83-97. https://doi.org/ 10.1080/17441691003796387.

Stellenbosch University https://scholar.sun.ac.za

Kaplan, R., Caldwell, J., Hermans, S., Adriaanse, S., Mtwisha, L., Bekker, L. G., ... & Wood, R. (2016). An integrated community TB-HIV adherence model provides an alternative to DOT for tuberculosis patients in Cape Town. The *International Journal of Tuberculosis and Lung Disease, 20(9*), 1185-1191. https://doi.org/ 10.5588/ijtld.15.0855.

Karimy, M., Zareban, I., Sarani, M., Rakhshani, F., Kuhpayehzadeh, J., & Baradaran, H. (2014). Factors affecting adherence to the treatment regimen of tuberculosis patients: Assessing the efficiency of health belief model constructs. [Abstract – article in Persian] *Journal of Kermanshah University of Medical Sciences (J Kermanshah Univ Med Sci)*, *18*(4), 213-219. https://doi.org/ 10.22110/jkums.v18i4.1745.

Kamran, A., Ahari, S. S., Biria, M., Malpour, A., & Heydari, H. (2014). Determinants of patient's adherence to hypertension medications: application of health belief model among rural patients. *Annals of medical and health sciences research*, *4*(6), 922-927. https://doi.org/ 10.4103/2141-9248.144914.

Keshavjee, S., & Farmer, P. E. (2012). Tuberculosis, drug resistance, and the history of modern medicine. *New England Journal of Medicine*, *367*(10), 931-936. https://doi.org/ 10.1056/NEJMra1205429.

Khan, M. S., Rego, S., Rajal, J. B., Bond, V., Fatima, R. K., Isani, A. K., ... & Kranzer, K. (2021). Mitigating the impact of COVID-19 on tuberculosis and HIV services: a cross-sectional survey of 669 health professionals in 64 low and middle-income countries. PloS one, 16(2), e0244936. https://doi.org/10.1371/journal.pone.0244936

Kigozi, G., Heunis, C., Chikobvu, P., Botha, S., & van Rensburg, D. (2017). Factors influencing treatment default among tuberculosis patients in a high burden province of South Africa. *International Journal of Infectious Diseases*, *54*, 95-102. https://doi.org/10.1016/j.ijid.2016.11.407.

Stellenbosch University https://scholar.sun.ac.za

Kliiman K & Altraja A. (2010). Predictors and Mortality associated with Treatment Default in Pulmonary Tuberculosis *Int j Tuberc Lung Dis.* 454 – 463. http://www.ncbi.nlm.nih.gov/pubmed/20202304

Kline, R. B. (2013). Exploratory and confirmatory factor analysis. In Petscher, Y. & Schatsschneider, C. (Ed.), *Applied quantitative analysis in the social sciences* (pp. 171-207). New York: Routledge

Lam, W. Y., & Fresco, P. (2015). Medication adherence measures: an overview. *BioMed research international*, *2015*. https://doi.org/10.1155/2015/217047.

Leon, A. C., Davis, L. L., & Kraemer, H. C. (2011). The role and interpretation of pilot studies in clinical research. *Journal of psychiatric research*, *45*(5), 626-629. https://doi.org/10.1016/j.jpsychires.2010.10.008.

Leventhal, H., & Cameron, L. (1987). Behavioural theories and the problem of compliance. *Patient education and counseling*, *10*(2), 117-138. https://doi.org/10.1016/0738- 3991(87)90093-0

Li, Z. T., Yang, S. S., Zhang, X. X., Fisher, E. B., Tian, B. C., & Sun, X. Y. (2015). Complex relation among Health Belief Model components in TB prevention and care. *public health*, *129*(7), 907-915. https://doi.org/10.1016/j.puhe.2015.04.008.

Lin, E. H., Von Korff, M., Katon, W., Bush, T., Simon, G. E., Walker, E., & Robinson, P. (1995). The role of the primary care physician in patients' adherence to antidepressant therapy. *Medical care*, *33*(1), 67–74. https://doi.org/10.1097/00005650-199501000-00006

Linke, S. E., Robinson, C. J., & Pekmezi, D. (2014). Applying psychological theories to promote healthy lifestyles. *American Journal of Lifestyle Medicine, 8*(1), 4-14. https://doi.org/10.1016/j.jpsychires.2010.10.008.

Stellenbosch University https://scholar.sun.ac.za

Liu, X., Blaschke, T., Thomas, B., De Geest, S., Jiang, S., Gao, Y., ... & Huan, S. (2017). Usability of a medication event reminder monitor system (MERM) by providers and patients to improve adherence in the management of tuberculosis. *International journal of environmental research and public health*, *14*(10), 1115. https://doi.org/10.3390/ijerph14101115.

Lönnroth K, Williams BG, Stadin S & Jaramillo E & Dye C. (2008). Alcohol use as a risk factor for tuberculosis-a systematic review. *BMC Public Health* 8: 269. https://doi.org/10.1186/1471-2458- 8-289

Loveday, M., Smith, J., & Day, C. (2013). Knowing our TB epidemic: key challenges facing the TB Programme in South Africa. *South African Health Review*, *2013*(1), 139-153. http://www.hst.org.za/publications/south-african-health-review-2013/14

Lutge, E., Lewin, S., & Volmink, J. (2014). Economic support to improve tuberculosis treatment outcomes in South Africa: a qualitative process evaluation of a cluster randomized controlled trial. *Trials*, *15*(1), 1-12. http://www.trialsjournal.com/content/15/1/236

Mabotja, M., Levin, J., & Kawonga, M. (2021). Beliefs and perceptions regarding cervical cancer and screening associated with Pap smear uptake in Johannesburg: A cross-sectional study. PloS one, 16(2), e0246574 https://doi.org/10.1371/journal.pone.0246574

Maguire, G. P., Anstey, N. M., Ardian, M., Waramori, G., Tjitra, E., Kenangalem, E., & Kelly, P. M. (2009). Pulmonary tuberculosis, impaired lung function, disability and quality of life in a high burden setting. *The International Journal of Tuberculosis and Lung Disease, 13*(12), 1500-1506. https://www.ingentaconnect.com/content/iuatld/ijtld/2009/00000013/00000012/art00010#

Malcolm, S.E., Ng. J.J., Rosen, R.K., & Stone, V.E. (2003). An examination of HIV/AIDS patients who have excellent adherence to HAART. *AIDS Care* 15:251 – 261. https://doi.org/10.1080/0954012031000068399.

Stellenbosch University https://scholar.sun.ac.za

Marcus, A. (2017). Pay up or retract? Survey creator's demands for money rile some health researchers. *Science*, *15*(3), 169-182. https://www.sciencemag.org/news/2017/09/pay-or-retract-survey-creators-demands-money-rile-some-health-researchers

Martin, L. R., Williams, S. L., Haskard, K. B., & Dimatteo, M. R. (2005). The challenge of patient adherence. *Therapeutics and clinical risk management*, *1*(3), 189–199. https://www.ncbi.nlm.nih.gov/pmc/articles/PMc1661624/.

Mazinyo, E. W., Kim, L., Masuku, S., Lancaster, J. L., Odendaal, R., Uys, M., ... & Van der Walt, M. L. (2016). Adherence to Concurrent Tuberculosis Treatment and Antiretroviral Treatment among Co-Infected Persons in South Africa, 2008–2010. *PloS one*, *11*(7), e0159317. https://doi.org/10.1371/journal.pone.0159317.

McDowell, I. (2006). *Measuring health: a guide to rating scales and questionnaires*. Oxford University Press, USA.

McInerney, P. A., Nicholas, P. K., Wantland, D., Corless, I. B., Ncama, B., Bhengu, B., ... & Gallagher, D. M. (2007). Characteristics of anti-tuberculosis medication adherence in South Africa. *Applied Nursing Research*, *20*(4), 164-170. https://doi.org/ 10.1016/j.apnr.2006.06.006.

Monnette, A., Zhang, Y., Shao, H., & Shi, L. (2018). Concordance of adherence measurement using self-reported adherence questionnaires and medication monitoring devices: an updated review. *PharmacoEconomics*, 1-1. https://doi.org/10.1007/s40273-017-0570-9.

Morisky, D. E., Ang, A., Krousel-Wood, M., & Ward, H. J. (2008). Predictive validity of a medication adherence measure in an outpatient setting. *The Journal of Clinical Hypertension*, *10*(5), 348-354. https://doi.org/ 10.1111/j.1751-7176.2008.07572.x.

Stellenbosch University https://scholar.sun.ac.za

Morisky, D. E., & DiMatteo, M. R. (2011). Improving the measurement of self-reported medication nonadherence: response to authors. *Journal of clinical epidemiology*, *64*(3), 255-257. https://doi.org/ 10.1016/j.jclinepi.2010.09.002.

Miller, L. G., Liu, H., Hays, R. D., Golin, C. E., Beck, C. K., Asch, S. M., ... & Wenger, N. S. (2002). How well do clinicians estimate patients' adherence to combination antiretroviral therapy? *Journal of general internal medicine*, *17*(1), 1-11. https://doi.org/10.1046/j.1525-1497.2002.09004.x.

Milne, S., Sheeran, P., & Orbell, S. (2000). Prediction and intervention in health-related behaviour: A meta-analytic review of protection motivation theory. *Journal of Applied Social Psychology*, *30*(1), 106-143. Https://doi.org/10.1111/j.1559-1816.2000.tb02308.x

Mukherjee, A., Saha, I., Sarkar, A., & Chowdhury, R. (2012). Gender differences in notification rates, clinical forms and treatment outcome of tuberculosis patients under the RNTCP. *Lung India: official organ of Indian Chest Society*, *29*(2), 120. https://doi.org/10.4103/0970-2113.95302

Müller, A. M., Osório, C. S., Silva, D. R., Sbruzzi, G., de Tarso, P., & Dalcin, R. (2018). Interventions to improve adherence to tuberculosis treatment: systematic review and meta-analysis. *The International Journal of Tuberculosis and Lung Disease*, *22*(7), 731-740. https://doi.org/10.5588/ijtld.17.0596.

Munro, S., Lewin, S., Smith, H., Engel, M., Fretheim, A. & Volmink, J. (2007). Patient Adherence to Tuberculosis Treatment: A Systematic Review of Qualitative Research. *PLoSMedicine,* 4: 1230 – 1245. https://doi10.1371/journal.pmed.0040238.

Munro, S., Lewin, S., Swart, T., & Volmink, J. (2007). A review of health behaviour theories: how useful are these for developing interventions to promote long – term medication adherence for TB and HIV/AIDS? *BMC Public Health* 7: 104 https://doi.org/10.1186/1471-2458-7-104.

Stellenbosch University https://scholar.sun.ac.za

Murphy, M. E., Wills, G. H., Murthy, S., Louw, C., Bateson, A. L. C., Hunt, R. D., ... & Gillespie, S. H. (2018). Gender differences in tuberculosis treatment outcomes: post hoc analysis of the REMoxTB study. *BMC medicine, 16(1)*, 1-11. https://doi.org/10.1186/s12916-018-1169-5

Naidoo, P., Dick, J., & Cooper, D. (2009). Exploring tuberculosis patients' adherence to treatment regimens and prevention programs at a public health site. *Qualitative Health Research*, *19*(1), 55-70. https://doi.org/ 10.1177/1049732308327893.

Naidoo, A., Naidoo, S., Gathiram, P., & Lalloo, U. (2013). Tuberculosis in medical doctors–a study of personal experiences and attitudes. *South African Medical Journal*, *103*(3), 176-180. https://doi.org/10.7196/SAMJ.6266.

Naidoo, P., Peltzer, K., Louw, J., Matseka, G., Mchunu, G., & Tutshana, B. (2013). Predictors of tuberculosis (TB) and antiretroviral (ARV) medication non-adherence in public primary care patients in South Africa: a cross sectional study. *BMC Public Health* 13:396. https://doi.org/ 10.1186/1471-2458-13-396.

Naidoo, P., & Mwaba, K. (2010). Helplessness, depression, and social support among people being treated for tuberculosis in South Africa. *Social Behaviour and Personality: an international journal*, *38*(10), 1323-1333. https://doi.org/ 10.2224/sbp.2010.38.10.1323.

Ndwandwe, Z. S., Mahomed, S., Lutge, E., & Knight, S. E. (2014). Factors affecting nonadherence to tuberculosis treatment in uMgungundlovu Health District in 2010. *Southern African Journal of Infectious Diseases*, *29*(2), 56-59.

Nel, A. (2011). Perceived social support, symptoms of common mental disorders and adherence levels of patients receiving antiretroviral treatment (Doctoral dissertation, Stellenbosch: University of Stellenbosch).

Stellenbosch University https://scholar.sun.ac.za

Nguyen, T. M. U., Caze, A. L., & Cottrell, N. (2014). What are validated self-report adherence scales really measuring?: a systematic review. *British journal of clinical pharmacology*, 77(3), 427-445. https://doi.org/ 10.1111/bcp.12194.

Nöthling, J., & Kagee, A. (2013). Acceptability of routine HIV counselling and testing among a sample of South African students: Testing the Health Belief Model. *African Journal of AIDS Research*, *12*(3), 141-150. https://doi.org/ 10.2989/16085906.2013.863214.

Noyes, J., and Popay, J. (2006) Directly observed therapy and tuberculosis: how can systematic review of qualitative research contribute to improving services? A qualitative meta-synthesis. *Journal of Advanced Nursing* 57(3), 227–243. https://doi.org/10.1111/j.13652648.2006.04092.x

O'Donnell, M. R., Daftary, A., Frick, M., Hirsch-Moverman, Y., Amico, K. R., Senthilingam, M., ... & Zelnick, J. R. (2016). Re-inventing adherence: toward a patient-centered model of care for drug-resistant tuberculosis and HIV. *The International Journal of Tuberculosis and Lung Disease*, *20*(4), 430-434. https://doi.org/org/10.5588/ijtld.15.0360.

Osborne, J. W., & Costello, A. B. (2004). Sample size and subject to item ratio in principal components analysis. *Practical assessment, research & evaluation*, *9*(11), 8. https://doi.org/10.7275/ktzq-jq66.

Osterberg L & Blaschke T. (2005). Adherence to Medication. *N Eng J Med* 353: 487 – 97. https://doi.org/10.1056/NEJMra050100.

Pachi, A., Bratis, D., Moussas, G., & Tselebis, A. (2013). Psychiatric morbidity and other factors affecting treatment adherence in pulmonary tuberculosis patients. *Tuberculosis research and treatment*, *2013*. https://doi.org/10.1155/2013/489865

Park, S. P., & Lee, E. Y. J. (2019). How should medical researchers respond to false copyright infringement claims?. *Science Editing*, *6*(2), 137-141. https://doi.org/org/10.6087/kcse.174

Stellenbosch University https://scholar.sun.ac.za

Peltzer, K. (2004). Health beliefs and prescription medication compliance among diagnosed hypertension clinic attenders in a rural South African Hospital. *Curationis*, *27*(3), 15-23. https://doi.org/10.4102/curationis.v27i3.994

Peltzer, K., Louw, J., Mchunu, G., Naidoo, P., Matseke, G., & Tutshana, B. (2012). Hazardous and harmful alcohol use and associated factors in tuberculosis public primary care patients in South Africa. *International journal of environmental research and public health*, *9*(9), 3245-3257. https://doi.org/ 10.3390/ijerph9093245

Peltzer, K., Onya, H., Seoka, P., & Tladi, F. M. (2002). Factors at first diagnosis of tuberculosis associated with compliance with the Directly Observed Therapy (DOT) in the Limpopo Province, South Africa. *Curationis*, *25*(3), 55-67. https://doi.org/10.4102/curationis.v25i3.788

Peltzer, K., & Pengpid, S. (2020). Social determinants of depression among adults in South Africa. *Journal of Human Behaviour in the Social Environment*, *30*(5), 525-532. https://doi.org/10.1080/10911359.2019.1703236

Peltzer, K., Naidoo, P., Matseke, G., Louw, J., Mchunu, G., & Tutshana, B. (2012). Prevalence of psychological distress and associated factors in tuberculosis patients in public primary care clinics in South Africa. *BMC psychiatry*, *12*(1), 1-9. https://doi.org/ 10.1186/1471-244X-12-89.

Pelissari, D. M., & Diaz-Quijano, F. A. (2018). Impact of alcohol disorder and the use of illicit drugs on tuberculosis treatment outcomes: a retrospective cohort study. *Archives of Public Health*, *76*(1), 45. https://doi.org/ 10.1186/s13690-018-0287-z

Pengpid, S., & Peltzer, K. (2018). Depression symptoms: their association with socio-demographic factors and health among adults in South Africa. *Journal of Psychology in Africa*, *28*(1), 62-65. https://doi.org/10.1080/14330237.2017.1375212

Stellenbosch University https://scholar.sun.ac.za

Peltzer, K., & Pengpid, S. (2020). Social determinants of depression among adults in South Africa. *Journal of Human Behaviour in the Social Environment*, *30*(5), 525-532. https://doi.org/10.1080/10911359.2019.1703236

Pietersen, E., Ignatius, E., Streicher., E, Mastrapa., B, Padanilam., X, Pooran., A, Badri., M, Lesosky, M., Van Helden, P., Sirgel, F., Warren, R., & Dheda, K. (2014) Long-term outcomes of patients with extensively drug-resistant tuberculosis in South Africa: a cohort study. *Lancet* 383: 1230-39. https://doi.org/ 10.1016/S0140-6736(13)62675-6.

Poss, J. E. (2001). Developing a new model for cross-cultural research: synthesizing the health belief model and the theory of reasoned action. *Advances in Nursing Science*, *23*(4), 1-15. https://doi.org/ 10.1097/00012272-200106000-00002.

Pourghaznein, T., Ghaffari, F., Hasanzadeh, F., & Chamanzari, H. (2013). The relationship between health beliefs and medication adherence in patients with type 2 diabetes: A correlation-cross sectional study. *Life Science Journal*, *10*(4), 38-46. http://www.lifesciencesite.com/lsj/life1004s/006_13765life1004s_38_46.pdf.

Pradipta, I. S., Forsman, L. D., Bruchfeld, J., Hak, E. & Alffenaar, J. W. (2018).Risk factors of multidrug-resistant tuberculosis: a global systematic review and meta-analysis. *J. Infect.* **77**, 469–478. https://doi.org/10.1016/j.jinf.2018.10.004.

Pradipta, I. S., Houtsma, D., van Boven, J. F., Alffenaar, J. W. C., & Hak, E. (2020). Interventions to improve medication adherence in tuberculosis patients: a systematic review of randomized controlled studies. *NPJ primary care respiratory medicine*, *30*(1), 1-10. https://doi.org/10.1038/S41533-020-0179-X.

Prasetya, H., Murti, B., Anantanyu, S., & Syamsulhadi, M. (2018). The Effect of Hypnosis on Adherence to Antituberculosis Drugs Using the Health Belief Model. *International Journal of Clinical and Experimental Hypnosis*, *66*(2), 211-227. https://doi.org/10.1080/00207144.2018.1421361

Stellenbosch University https://scholar.sun.ac.za

Ragan, E. J., Kleinman, M. B., Sweigart, B., Gnatienko, N., Parry, C. D., Horsburgh, C. R., ... & Jacobson, K. R. (2020). The impact of alcohol use on tuberculosis treatment outcomes: a systematic review and meta-analysis. *The International Journal of Tuberculosis and Lung Disease*, *24*(1), 73-82. https://doi.org/10.5588/ijtld.19.0080.

Ramma, L., Cox, H., Wilkinson, L., Foster, N., Cunnama, L., Vassall, A., & Sinanovic, E. (2015). Patients' costs associated with seeking and accessing treatment for drug-resistant tuberculosis in South Africa. *The international journal of tuberculosis and lung disease*, *19*(12), 1513-1519. https://doi.org/10.5588/ijtld.15.0341

Redding, C. A., Rossi, J. S., Rossi, S. R., Velicer, W. F., & Prochaska, J. O. (2000). Health behaviour models. In *International Electronic Journal of Health Education*. https://www.researchgate.net/publication/261773590_Health_Behaviour_Models

Rehm, J., Samokhvalov, A. V., Neuman, M. G., Room, R., Parry, C., Lönnroth, K., ... & Popova, S. (2009). The association between alcohol use, alcohol use disorders and tuberculosis (TB). A systematic review. *BMC public health*, *9*(1), 450. https://doi.org/10.1186/1471-2458-9-450.

Reinert, D. F., & Allen, J. P. (2007). The alcohol use disorders identification test: an update of research findings. *Alcoholism: Clinical and Experimental Research*, *31*(2), 185-199. https://doi.org/10.1111/j.1530-0277.2006.00295.x

Rezaei, M. B. & Feizi, M. (2008). Factors Responsible for Compliance of Medical Treatment among Compliant and Non-Compliant Tuberculosis Patients in Urmia, Iran. *Rawal Medical Journal*, 33 (2):131-133. http://www.scopemed.org/?mno=7404

Rich, A., Brandes, K., Mullan, B., & Hagger, M. S. (2015). Theory of planned behavior and adherence in chronic illness: a meta-analysis. *Journal of behavioral medicine*, *38*(4), 673-688. https://doi.org/10.1007/s10865-015-9644-3

Stellenbosch University https://scholar.sun.ac.za

Rosenstock, I.M. (1974). Historical origins of the health belief model. In Becker MH (Ed.), *The health belief model and personal health behaviour.* Thorofare, New Jersey: Charles B Slack. http://heb.sagepub.com/content/2/4/328

Rosenstock, I.M., Stretcher, V.J. & Becker, M.H. (1988). Social learning theory and the health belief model. *Health Education Behaviour* 15: 175-183. https://doi.org/10.1177/109019818801500203

Ruch, W (2014). Measuring poverty in SA. *Fieldworker* 5 (3). www.statssa.gov.za/wp-content/uploads/2014/07/Fieldworker-Low-Res-June-2014.pdf

Rutstein, S. O., & Staveteig, S. (2014). *Making the demographic and health surveys wealth index comparable*. DHS Methodological Reports No. 9. Rockville, Maryland, USA: ICF International. https://www.dhsprogram.com/pubs/pdf/MR9/MR9.pdf

Ruiz-Grosso, P., Cachay, R., de la Flor, A., Schwalb, A., & Ugarte-Gil, C. (2020). Association between tuberculosis and depression on negative outcomes of tuberculosis treatment: A systematic review and meta-analysis. *PloS one*, *15*(1), e0227472. https://doi.org/10.1371/journal.pone.0227472

Saal, W. L. (2017). *Common mental and substance use disorders among people seeking HIV testing* (Doctoral dissertation, Stellenbosch: Stellenbosch University).

Sabaté, E. (Ed.). (2003). *Adherence to long-term therapies: evidence for action*. World Health Organization. www.who.int/chp/knowledge/publications/adherence_full_report.pdf.

Saunders, J. B., Aasland, O. G., Babor, T. F., De la Fuente, J. R., & Grant, M. (1993). Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. *Addiction*, *88*(6), 791-804. https://doi.org/ 10.1111/j.1360-0443.1993.tb02093.x.

Stellenbosch University https://scholar.sun.ac.za

Saunders, M. J., & Evans, C. A. (2020). COVID-19, tuberculosis and poverty: preventing a perfect storm. https://doi.org/10.1183/13993003.01348-2020

Schuster, R., Bornovalova, M., & Hunt, E. (2012). The influence of depression on the progression of HIV: direct and indirect effects. *Behaviour modification*, *36*(2), 123-145. https://doi.org/10.1177%2F0145445511425231.

Shahin, W., Kennedy, G. A., & Stupans, I. (2020). The Consequences of General Medication Beliefs Measured by the Beliefs about Medicine Questionnaire on Medication Adherence: A Systematic Review. *Pharmacy*, *8*(3), 147. https://doi.org/10.3390/pharmacy8030147

Shean, K., Streicher, E., Pieterson, E., Symons, G., Van Zyl Smit, R., Theron, G., … & van Dheda, K. (2013). Drug-Associated Adverse Events and Their Relationship with Outcomes in Patients Receiving Treatment for Extensively Drug-Resistant Tuberculosis in South Africa. *PLoS ONE* 8(5): e63057. https://doi.org/10.1371/journal.pone.0063057.

Shi, L., Liu, J., Koleva, Y., Fonseca, V., Kalsekar, A., & Pawaskar, M. (2010). Concordance of adherence measurement using self-reported adherence questionnaires and medication monitoring devices. *Pharmacoeconomics*, *28*(12), 1097-1107. https://doi.org/10.2165/11537400-000000000-00000

Shringarpure, K. S., Isaakidis, P., Sagili, K. D., Baxi, R. K., Das, M., & Daftary, A. (2016). "When treatment is more challenging than the disease": a qualitative study of MDR-TB patient retention. *PLoS One*, *11*(3), https://doi.org/10.1371/journal.pone.0150849.

Skinner, D., & Claassens, M. (2016). It's complicated: why do tuberculosis patients not initiate or stay adherent to treatment? A qualitative study from South Africa. *BMC infectious diseases*, *16*(1), 712. https://doi.org/10.1186/s12879-016-2054-5.

Stellenbosch University https://scholar.sun.ac.za

Sohrabi, C., Alsafi, Z., O'neill, N., Khan, M., Kerwan, A., Al-Jabir, A., ... & Agha, R. (2020). World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). *International journal of surgery*, *76*, 71-76. https://doi.org/10.1016/j.ijsu.2020.02.034

South African Department of Health (2000) *The South African Tuberculosis Control Programme Practical Guidelines, 2000,* Department of Health. https://www.westerncape.gov.za/text/2003/tb_guidelines2000.pdf

South African Department of Health (2011). *Management of drug-resistant tuberculosis policy guidelines.* https://www.nicd.ac.za/assets/files/MANAGEMENT%20of%20drug%20resistant%20TB%20guidelines.pdf

South African Department of Health. (2013). *Management of drug-resistant tuberculosis: policy guidelines.* Updated January 2013. https://tbsouthafrica.org.za/resources/ndoh-management-drug-resistant-tuberculosis-policy-guidelines

South African Department of Health. (2014). *National Tuberculosis Management Guidelines 2014*. Department of Health. https://health-e.org.za/2014/06/10/guidelines-national-tuberculosis-management-guidelines/

South African Department of Health. (2016). *Adherence guidelines for HIV, TB and NCDs: Policy and service delivery guidelines for linkage to care, adherence to treatment and retention in care.* https://www.knowledgehub.org.za/elibrary/adherence-guidelines-hiv-tb-and-ncds

South African National AIDS Council. (2012). National strategic plan on HIV, STIs and TB, 2012-2016. South African National AIDS Council. http://www.gov.za/documents/national-strategic-plan-hiv-stis-and-tb-2012-2016

Stellenbosch University https://scholar.sun.ac.za

South African National AIDS Council. (2017). National Strategic Plan on HIV, TB and STIs 2017-2022. http://sanac.org.za/wpcontent/uploads/2017/05/NSP_FullDocument_FINAL.pdf

Stats, SA. (2012). Census 2011 statistical release. *Pretoria, South Africa: Statistics South Africa*. http://www.statssa.gov.za/publications/P03014/P030142011.pdf

Stats, SA. (2018). Provincial profile: Western Cape Community Survey 2016. *Pretoria, South Africa: Statistics South Africa*. http://www.statssa.gov.za/publications/Report%2003-01-07/Report%2003-01-072016.pdf

Stats, SA (2019). General Household Survey 2018. *Pretoria, South Africa: Statistics South Africa*. http://www.statssa.gov.za/publications/P0318/P03182018.pdf

Stop TB Partnership (2020) The potential impact of the COVID-19 response on tuberculosis in high-burden countries: a modeling analysis. http://www.stoptb.org/assets/documents/news/Modeling%20Report_1%20May%202020_FINAL.pdf

Stop TB Partnership (2021). New data shows COVID-19 combined with funding shortfalls are devasating efforts to end TB by 2030. http://www.stoptb.org/news/stories/2021/ns21_035.html

Svarstad, B. L., Chewning, B. A., Sleath, B. L., & Claesson, C. (1999). The Brief Medication Questionnaire: a tool for screening patient adherence and barriers to adherence. *Patient education and counseling*, 37(2), 113-124. https://doi.org/10.1016/S0738-3991(98)00107-4.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). New York: HarperCollins.

Stellenbosch University https://scholar.sun.ac.za

Tarkang, E. E., & Zotor, F. B. (2015). Application of the health belief model (HBM) in HIV prevention: A literature review. *Central African Journal of Public Health*, *1*(1), 1-8. https://doi.org/ 10.11648/j.cajph.20150101.11.

Theron, G., Peter, J., Zijenah, L., Chanda, D., Mangu, C., Clowes, P., ... & Mwaba, P. (2015). Psychological distress and its relationship with non-adherence to TB treatment: a multicentre study. *BMC infectious diseases*, *15*(1), 253. https://doi.org/ 10.1186/s12879-015-0964-2

Thiam, S., LeFevre, A. M., Hane, F., Ndiaye, A., Ba, F., Fielding, K. L., ... & Lienhardt, C. (2007). Effectiveness of a strategy to improve adherence to tuberculosis treatment in a resource-poor setting: a cluster randomized controlled trial. *Jama*, *297*(4), 380-386. https://doi.org/10.1001/jama.297.4.380.

To, Y., & Mandracchia, J. (2019). *Learn About Hierarchical Linear Regression in SPSS With Data From Prison Inmates*. SAGE Publications, Limited. https://methods.sagepub.com/base/download/DatasetStudentGuide/hierarchical-linear-regression-prison-inmates

Tola, H.H., Tol, A., Shojaeizadeh, D., & Garmaroudi, G. (2015). Tuberculosis treatment non-adherence and lost to follow up among TB patients with or without HIV in developing countries: A systematic review. *Iran J Public Health* 44 (1): 1- 11. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4449995/.

Tola, H. H., Shojaeizadeh, D., Tol, A., Garmaroudi, G., Yekaninejad, M. S., Kebede, A., ... & Klinkenberg, E. (2016). Psychological and educational intervention to improve tuberculosis treatment adherence in Ethiopia based on health belief model: a cluster randomized control trial. *PloS one*, *11*(5), e0155147. https://doi.org/10.1371/journal.pone.0155147.

Stellenbosch University https://scholar.sun.ac.za

Uthman, O.A., Magidson, J.F., Safren, S.A. & Nachega, J.B. (2014). Depression and adherence to antiretroviral therapy in low-, middle-and high-income countries: a systematic review and meta-analysis. *Curr HIV/AIDS Rep.* 11 (3): 291-307. https://doi.org/10.1007/s11904-014-02201

Valencia, S., León, M., Losada, I., Sequera, V. G., Fernandez Quevedo, M., & García-Basteiro, A. L. (2017). How do we measure adherence to anti-tuberculosis treatment? *Expert review of anti-infective therapy*, 15(2), 157-165. https://doi.org/10.1080/14787210.2017.1264270.

Van Den Boogaard, J., Boeree, M.J., Kibiki, G.S. & Aarnoutse, R.E. (2011). The complexity of the adherence-response relationship in tuberculosis treatment: why are we still in the dark and how can we get out? *Tropical medicine and International Health.* 16 (6): 693-698. https://doi.org/10.1111/j.1365.2011.02755.x.

van den Hof, S., Najlis, C. A., Bloss, E., & Straetemans, M. (2010). A systematic review on the role of gender in tuberculosis control. *Report prepared for Tuberculosis Control Programme (TB CAP) September*. https://www.kncvtbc.org/uploaded/2015/09/Role_of_Gender_in_TB_Control.pdf

Van der Walt, M., Lancaster, J., Finlay, A., & Holtz, T. (2009). A National Study to Identify Factors Associated with Default from Tuberculosis Treatment, South Africa, 2002: Results from a case-control study in 8 provinces. Pretoria: Tuberculosis Lead Programme, Medical Research Council, South Africa, and US Centers for Disease Control and Prevention. http://www.mrc.ac.za/operationaltb/Defaultstudy.pdf.

Van der Walt M, & Moyo S. (2021) The First National TB Prevalence Survey, South Africa 2018: Short report. 2021 https://www.knowledgehub.org.za/system/files/elibdownloads/2021-02/A4_SA_TPS%20Short%20 Report_10June20_Final_highres.pdf

Stellenbosch University https://scholar.sun.ac.za

Vanleeuw, L., Atkins, S., Zembe-Mkabile, W., & Loveday, M. (2020). Provider perspectives of the introduction and implementation of care for drug-resistant tuberculosis patients in district-level facilities in South Africa: a qualitative study. *BMJ open*, *10*(2), e032591. https://doi.org/10.1136/ bmjopen-2019-032591

Vitalis, D. (2017). Predicting adherence to antiretroviral therapy among pregnant women in Guyana: Utility of the Health Belief Model. *International journal of STD & AIDS*, *28*(8), 756-765. https://doi.org/10.1177%2F0956462416665989

Voils, C. I., Hoyle, R. H., Thorpe, C. T., Maciejewski, M. L., & Yancy Jr, W. S. (2011). Improving the measurement of self-reported medication nonadherence. *Journal of clinical epidemiology*, *64*(3), 250-254. https://doi.org/ 10.1016/j.jclinepi.2010.07.014.

Weimann, A., & Oni, T. (2019). A systematised review of the health impact of urban informal settlements and implications for upgrading interventions in South Africa, a rapidly Urbanising middle-income country. *International journal of environmental research and public health*, *16*(19), 3608. https://doi:10.3390/ijerph16193608

WHO Global Tuberculosis Programme. (1994). TB: a global emergency, WHO report on the TB epidemic. World Health Organization. https://apps.who.int/iris/handle/10665/58749

WHO. (1999). What is DOTS? A Guide to Understanding the WHO-recommended TB Control Strategy Known as DOTS. Geneva: World Health Organization WHO/CDS/CPC/TB/99.270. https://apps.who.int/iris/handle/10665/65979

WHO. (2002). An Expanded DOTS Framework for Effective Tuberculosis Control. Geneva: World Health Organization WHO/CDS/TB/2002.297. https://apps.who.int/iris/bitstream/10665/67232/1/WHO_CDS_TB_2002.297.pdf

Stellenbosch University https://scholar.sun.ac.za

WHO. (2006). The Stop TB Strategy: building on and enhancing DOTS to meet the TB-related Millennium Development Goals. Geneva: World Health Organization; WHO/HTM/TB/2006.368. http://apps.who.int/iris/ bitstream/10665/69241/1/WHO_HTM_STB_2006.368_eng.pdf,

WHO. (2011a). Early detection of tuberculosis: An overview of approaches, guidelines and tools. Geneva: World Health Organization (WHO/HTM/STB/PSI/2011.21 http://apps.who.int/iis/bitstream/10665/70824/1/WHO_HTM_ STB_PSI_2011.21_eng.pdf?ua=1

WHO (2011b). Global Tuberculosis Control Report 2010. WHO Press, Geneva, Switzerland. http://apps.who.int/iris/bitstream/10665/44728/1/9789241564380_eng.pdf

WHO. (2013). Systematic screening for active tuberculosis. Principles and recommendations. Geneva: World Health Organization. (WHO/HTM/TB/2013.04. http://apps.who.int/iris/bitstream/10665/84971/1/9789241548601_eng.pdf?ua=1&ua=1

WHO. (2014a). Global Tuberculosis Report 2013. Geneva: World Health Organization. https://apps.who.int/iris/handle/10665/91355

WHO. (2014b). The End TB Strategy: global strategy and targets for tuberculosis prevention, care and control after 2015. Geneva: World Health Organization. http://www.who.int/tb/strategy/End_TB_Strategy.pdf

WHO. (2014c) Definitions and reporting framework for tuberculosis – 2013 revision. Updated December 2014. Geneva: World Health Organization; WHO/HTM/TB/2013.2. http://apps.who.int/iris/ bitstream/10665/79199/1/9789241505345_eng.pdf,

Stellenbosch University https://scholar.sun.ac.za

WHO. (2014d). Companion handbook to the WHO guidelines for the programmatic management of drug-resistant tuberculosis. Geneva: World Health Organization.WHO/HTM/TB/2014.11. http://apps.who.int/iris/bitstream/10665/130918/1/9789241548809_eng.pdf

WHO. (2015). Implementing The End TB Strategy: the essentials. Geneva: World Health Organization. WHO/HTM/ TB/2015.31. http://www.who.int/tb/publications/2015/end_tb_essential.pdf?ua=1

WHO. (2016a). Global Tuberculosis Report 2015. Geneva: World Health Organization. https://apps.who.int/iris/handle/10665/191102

WHO. (2016b). WHO treatment guidelines for drug-resistant tuberculosis: 2016 update. October 2016 revision. WHO/HTM/TB/2016.04 Geneva: World Health Organization. http://apps.who.int/iris/bitstre am/10665/250125/1/9789241549639-eng.pdf?ua=1.

WHO. (2017a). Global tuberculosis report 2017. Geneva: World Health Organization. WHO/HTM/TB/2017.23. http://www.who.int/tb/publications/global_report/en/

WHO. (2017b). Guidelines for treatment of drug-susceptible tuberculosis and patient care: 2017 update. Geneva: World Health Organization; 2017(WHO/HTM/TB/2017.05. http://apps.who.int/iris/bitstre am/10665/255052/1/9789241550000-eng.pdf?ua=1

WHO, (2017c). Depression and other common mental disorders: global health estimates. WHO/MSD/MER/2017.2). World Health Organization. https://www.who.int/mental_health/management/depression/prevalence_global_health_estimates/en/

WHO. (2018). Latent tuberculosis infection: updated and consolidated guidelines for programmatic management. Geneva: World Health Organization. http://apps.who.int/iris/bitstream/handle/10665/260233/9789241550239-eng.pdf;jsessionid=DEBB365758C4D6960DF59F00B22DE632?sequence=1

Stellenbosch University https://scholar.sun.ac.za

WHO. (2020) Global tuberculosis report 2019. Geneva: World Health Organization. https://www.who.int/tb/publications/global_report/en/

WHO. (2021, January 27) *WHO announces updated definitions of extensively drug-resistant tuberculosis* (departmental news). https://www.who.int/news/item/27-01-2021-who-announces-updated-definitions-of-extensively-drug-resistant-tuberculosis

Worldometer. (n.d.). Coronavirus Worldwide Graphs. Retrieved September 01, 2021, from https://www.worldometers.info/coronavirus/worldwide-graphs

Wise, J. (2006). Southern Africa is moving swiftly to combat the threat of XDR-TB. Bulletin of the World Health Organization, 84, 924-925. https://www.who.int/bulletin/volumes/84/12/06-011206/en/.

Yang, S., He, C., Zhang, X., Sun, K., Wu, S., Sun, X., & Li, Y. (2016). Determinants of antihypertensive adherence among patients in Beijing: application of the health belief model. *Patient Education and Counseling*, *99*(11), 1894-1900. https://doi.org/10.1016/j.pec.2016.06.014

Yin, X., Tu, X., Tong, Y., Yang, R., Wang, Y., Cao, S., ... & Lu, Z. (2012). Development and validation of a tuberculosis medication adherence scale. *PLoS One*, *7*(12), e50328. https://doi.org/ 10.1371/journal.pone.0050328.

Yoshitake, N., Omori, M., Sugawara, M., Akishinonomiya, K., & Shimada, S. (2019). Do health beliefs, personality traits, and interpersonal concerns predict TB prevention behaviour among Japanese adults? *Plos one*, *14*(2), e021172.https://doi.org/10.5061/dryad.3477745

Zagumny, M. & Brady, D. (1998). Development of the AIDS Health Belief Scale (AHBS). *AIDS Educ Prev.* 10(2): 173-179. http://www.ncbi.nlm.nih.gov/pubmed/9573437

Stellenbosch University https://scholar.sun.ac.za

Zegeye, A., Dessie, G., Wagnew, F., Gebrie, A., Islam, S. M. S., Tesfaye, B., & Kiross, D. (2019). Prevalence and determinants of anti-tuberculosis treatment non-adherence in Ethiopia: A systematic review and meta-analysis. *PloS one*, *14*(1), e0210422. https://doi.org/10.1371/journal.pone.0210422

Zentner, I., Schlecht, H. P., Khensouvann, L., Tamuhla, N., Kutzler, M., Ivaturi, V., ... & Vinnard, C. (2016). Urine colorimetry to detect Low rifampin exposure during tuberculosis therapy: a proof-of-concept study. BMC infectious diseases, 16(1), 242. doi.org/10.1186/s12879-016-1576-1

Zhang H, Ehiri J, Yang H, Tang S, Li Y (2016). Impact of Community-Based DOT on Tuberculosis Treatment Outcomes: A Systematic Review and Meta-Analysis. *PLoS ONE* 11(2): e0147744 https://doi.org/10.1371/journal.pone.0147744

Zimmerman, R. S., & Vernberg, D. (1994). Models of preventative health behaviour: Comparison, critique and meta-analysis. In G. Albrecht (Ed.), Advances in medical sociology, health behaviour models: A reformulation (pp. 45-67). Greenwich, CT: JAI Press.

Zolnierek, K. B. H., & DiMatteo, M. R. (2009). Physician communication and patient adherence to treatment: a meta-analysis. Medical care, 47(8), 826. https://doi.org/10.1097/MLR.0b013e31819a5acc

Zorrilla, E. P., Luborsky, L., McKay, J. R., Rosenthal, R., Houldin, A., Tax, A., ... & Schmidt, K. (2001). The relationship of depression and stressors to immunological assays: a meta-analytic review. *Brain, behaviour, and immunity*, *15*(3), 199-226. https://doi.org/10.1006/brbi.2000.0597

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APPENDICES

Appendix A: *Health Research Ethics Committee Approval*

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Approval Notice
Response to Modifications- (New Application)

14-Mar-2017
Rynhoud, Leigh L

Ethics Reference #: S16/10/206
Title: Predictors of medication adherence in people hospitalized with Tuberculosis: Utility of the Health Belief Model.

Dear Ms Leigh Rynhoud,

The **Response to Modifications** - ***(New Application)*** received on **03-Mar-2017**, was reviewed by members of **Health Research Ethics Committee 2** via Expedited review procedures on **14-Mar-2017** and was approved.
Please note the following information about your approved research protocol:

Protocol Approval Period: **14-Mar-2017 -13-Mar-2018**

Please remember to use your **protocol number** (**S16/10/206**) on any documents or correspondence with the HREC concerning your research protocol.

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

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

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005239

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

Provincial and City of Cape Town Approval

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

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Appendix B: *Western Cape Department of Health Permission to conduct research*

Western Cape Government
Health

METRO DISTRICT HEALTH SERVICES
Metro TB Hospital Centre
Dr P Spiller
Manager: Medical Services
E-Mail: Paul.Spiller@westerncape.gov.za
Stanberry street, Ysterplaat 7425
Tel: 021-508- 7403
Fax: 0865236549 Cell: 072-115-2289

Josh Lee Kroukamp
Intern: Health Research
Directorate: Health Impact Assessment
Western Cape Government: Health

Your Ref: WC_2017RP32_950

Principal investigators: Leigh Rynhoud Address:	Research Title: Predictors of medication adherence in people hospitalized with Tuberculosis: Utility of the Health Belief Model

Dear Leigh

Thank you for your request. Permission is hereby granted for you to conduct the research at Brooklyn Chest Hospital and D P Marais Hospital.

Kindly note the following:

1. All individual patient information obtained must be kept confidential.
2. Access to the hospital must be arranged with the Manager so that normal activities are not disrupted
3. No original documents or files must leave the hospital premises.
4. A copy of the final report must be sent to the Manager: Medical Services, Metro TB Hospital Complex, within 3 months of its completion.
5. Feedback must be given to the role players at the respective hospitals.

We would value any research recommendations which would help to improve our services.
Thank you for your co-operation and please feel free to contact me should you require further information or assistance.

Yours

Manager: Medical Services
Metro TB Hospital Complex
Date: 13 April 2017

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Western Cape Government
Health

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REFERENCE: WC_2017RP32_950
ENQUIRIES: Ms Charlene Roderick

Stellenbosch University

Matieland

Private Bag x1

Cape Town

7535

For attention: Ms Leigh Rynhoud

Re: **Predictors of medication adherence in people hospitalized with Tuberculosis: Utility of the Health Belief Model.**

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.

Please contact following people to assist you with any further enquiries in accessing the following sites:

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted.
2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final feedback (**annexure 9**) within six months of

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Appendix C: *Participant leaflet and consent form*

TITLE OF THE RESEARCH PROJECT: Predictors of medication adherence in people hospitalised with Tuberculosis: Utility of the Health Belief Model

REFERENCE NUMBER: S16/10/206

PRINCIPAL INVESTIGATOR: Leigh Rynhoud

ADDRESS:

CONTACT NUMBER: 021

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

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good

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Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

This project helps to improve our understanding of the many different things that can make adhering to treatment for tuberculosis (TB) difficult for some people. We want to understand some of what people feel is good, as well as what they feel is bad, about taking TB medication daily.

You will be asked to complete a set of questionnaires about you and your thoughts, feelings and experiences regarding TB treatment. Some questions are about your feelings in general, some questions relate specifically to drug and alcohol use and some questions ask you about your adherence to TB treatment.

Patients that are admitted to Brooklyn Chest Hospital and DP Marais Hospital that fit the inclusion criteria will be requested to participate in this study. The total number of participants is 200.

Why have you been invited to participate?

You have been asked to participate in this study because you have been hospitalised with TB and started on the TB treatment programme at least sixty days ago.

You are also considered to be healthy enough to be able to complete the questionnaires.

You have indicated that you are able to understand written English or Afrikaans.

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What will your responsibilities be?

You need to complete all the questions as honestly as you can in the test booklet. This should take you no more than one hour to complete. You will be asked to sit in a suitable venue and read each question yourself and indicate your answer. You may ask questions if you are unsure. You will not need to write any sentences; all questions need you to pick one answer that you feel is correct and mark it.

Will you benefit from taking part in this research?

You will be helping us to better understand some of the challenges that people face when taking their TB treatment. This information will be able to be used to plan better ways to help people to adhere to treatment so that less people default, and more people can be cured.

You may identify some personal difficulties or things that worry you as you answer some of the questions. You can request that your doctor refers you to an appropriate health care provider if you would like help.

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

There are no risks posed to you by taking part in this research. All information is confidential and will not be shared with anyone else without your consent.

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

There is no harm to you if you chose not to participate in this study and you will continue to receive all treatment and interventions that you require.

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Who will have access to your medical records?

All information collected will be treated as confidential. If it is used in a publication or thesis, your identity will remain anonymous.

Only the principal investigator is allowed to read any of your answers.

You may hand your test booklet directly to her in the clinical psychology department if you wish. You may also return it to the research assistant who has been instructed not to read any answers, however s/he shall scan the document to check for completeness and then return it directly to the principal investigator.

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

No, you will not be paid to take part in the study. There will be no costs involved for you if you do take part.

Is there anything else that you should know or do?

You can contact Leigh Rynhoud at 021 0000000 if you have any further queries or encounter any problems. You can contact the Health Research Ethics Committee at 021-938 9207 if you have any concerns or complaints that have not been adequately addressed by the researcher or her research assistants.

You can request a copy of this information and consent form for your own records.

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Declaration by participant

By signing below, I ……..…… agree to take part in a research study entitled: Predictors of medication adherence in people hospitalised with Tuberculosis: Utility of the Health Belief Model

I declare that:

I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.

I have had a chance to ask questions and all my questions have been adequately answered.

I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.

I may choose to leave the study at any time and will not be penalised or prejudiced in any way.

I may be asked to leave the study before it has finished, if the study doctor or researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

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

Signature of participant Signature of witness

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Declaration by investigator/ research assistant

I *(name)* ……..…… declare that:

I explained the information in this document to ……..

I encouraged him/her to ask questions and took adequate time to answer them.

I am satisfied that he/she adequately understands all aspects of the research, as discussed above.

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

Signature of investigator/assistant Signature of witness

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DEELNEMERINLIGTINGSBLAD EN -TOESTEMMINGSVORM

TITEL VAN DIE NAVORSINGSPROJEK: Voorspellers van behandelingsgetrouheid by persone wat met tuberkulose gehospitaliseer is: Nut van die gesondheidsoortuigingsmodel

VERWYSINGSNOMMER: S16/10/206

HOOFNAVORSER: Leigh Rynhoud

ADRES:

KONTAKNOMMER:

U word genooi om deel te neem aan ’n navorsingsprojek. Lees asseblief hierdie inligtingsblad op u tyd deur aangesien die detail van die navorsingsprojek daarin verduidelik word. Indien daar enige deel van die navorsingsprojek is wat u nie ten volle verstaan nie, is u welkom om die navorsingspersoneel of dokter daaroor uit te vra. Dit is baie belangrik dat u ten volle moet verstaan wat die navorsingsprojek behels en hoe u daarby betrokke kan wees. U deelname is ook **volkome vrywillig** en dit staan u vry om deelname te weier. U sal op geen wyse hoegenaamd negatief beïnvloed word indien u sou weier om deel te neem nie. U mag ook te eniger tyd aan die navorsingsprojek onttrek, selfs al het u ingestem om deel te neem.

Hierdie navorsingsprojek is deur die Gesondheidsnavorsingsetiekkomitee (GNEK) van die Universiteit Stellenbosch goedgekeur en sal uitgevoer word volgens die

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etiese riglyne en beginsels van die Internasionale Verklaring van Helsinki en die Etiese Riglyne vir Navorsing van die Mediese Navorsingsraad (MNR).

Wat behels hierdie navorsingsprojek?

- Hierdie projek help ons beter verstaan waarom party mense sukkel om hulle tuberkulose- (TB-)medisyne getrou te drink. Ons wil graag hoor wat mense dink is goed en ook wat is sleg daaraan om elke dag TB-medisyne te moet drink.
- U sal gevra word om ’n paar vraelyste oor uself en u gedagtes, gevoelens en ervarings in verband met TB-behandeling te voltooi. Party vrae gaan oor u gevoelens in die algemeen, sommige vrae gaan spesifiek oor middel- en alkoholgebruik, en ander gaan weer oor hoe getrou u u TB-medisyne gebruik.
- Pasiënte wat in Brooklyn-borshospitaal en DP Marais-hospitaal opgeneem is en aan die studiekriteria voldoen, sal gevra word om aan hierdie studie deel te neem. Daar sal altesaam 200 deelnemers wees.

Waarom is u genooi om deel te neem?

- Ons nooi u om aan hierdie studie deel te neem omdat u met TB in die hospitaal opgeneem is en ten minste drie (3) maande gelede met die TB-behandelingsprogram begin het.
- U word ook as gesond genoeg beskou om die vraelyste te kan voltooi.

  U het aangedui dat u geskrewe Engels of Afrikaans verstaan.

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Wat sal u verantwoordelikhede wees?

- U moet ál die vrae so eerlik moontlik in die toetsboekie beantwoord. Dit behoort nie langer as ’n uur te duur nie.
- Ons sal u vra om in ’n geskikte vertrek te sit en self elke vraag te lees en dan u antwoord aan te dui. U kan vrae vra as u oor enigiets onseker is.
- U sal nie enige sinne hoef neer te skryf nie. Op al die vrae sal u net een antwoord hoef te merk wat u dink reg is.

Sal u voordeel trek deur deel te neem aan hierdie navorsingsprojek?

- U sal ons help verstaan met watter uitdagings mense te doen het wat TB-medisyne moet drink. Met hierdie inligting sal ons beter maniere kan beplan om mense hulle medisyne getrou te help drink sodat minder mense hulle medisyne los en ons meer mense kan gesond maak.
- Terwyl u die vrae beantwoord, kan u moontlik bewus word van persoonlike probleme of dinge wat u bekommer. As u hulp nodig het, kan u dan u dokter vra om u na ’n toepaslike gesondheidsorgverskaffer te verwys.

Is daar enige risiko's verbonde aan u deelname aan hierdie navorsingsprojek?

- U deelname aan hierdie navorsing hou geen gevare in nie. Alle inligting is vertroulik (geheim), en niks sal sonder u toestemming aan enigiemand anders bekend gemaak word nie.

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Watter alternatiewe is daar indien u nie instem om deel te neem nie?

- Niks slegs sal met u gebeur indien u kies om nié aan hierdie studie deel te neem nie. U sal steeds alle nodige behandeling en intervensies ontvang.

Wie sal toegang hê tot u mediese rekords?

- Alle inligting wat ons insamel, sal as vertroulik hanteer word. Indien dit in ’n publikasie of tesis gebruik word, sal u identiteit nêrens bekend gemaak word nie.
- Slegs die hoofnavorser mag lees wat u geantwoord het.
- As u wil, kan u die toetsboekie met u antwoorde direk by die hoofnavorser in die departement kliniese sielkunde gaan aflewer. So nie, kan u dit ook aan die navorsingsassistent gee, wat opdrag het om geen antwoorde te lees nie, maar dit net so aan die hoofnavorser te oorhandig.

Sal u betaal word vir deelname aan die navorsingsprojek en is daar enige koste verbonde aan deelname?

- Nee, u sal nie betaal word om aan die studie deel te neem nie. Deelname sal u ook niks kos nie.

Is daar enigiets anders wat u moet weet of doen?

- Vir enige verdere vrae of indien u enige probleme ondervind, bel Leigh Rynhoud by 021 508 7476. Indien die navorser of haar navorsingsassistente nie u klagtes of kwessies goed genoeg hanteer nie, kan u ook die Gesondheidsnavorsingsetiekkomitee by 021 938 9207 bel.
- U kan ’n afskrif van hierdie inligting- en toestemmingsvorm vra vir u eie gebruik.

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Verklaring deur deelnemer

Met die ondertekening van hierdie dokument onderneem ek, …….....……..……..……., om deel te neem aan ’n navorsingsprojek getiteld Voorspellers van behandelingsgetrouheid by persone wat met tuberkulose gehospitaliseer is: Nut van die gesondheidsoortuigingsmodel

Ek verklaar dat:

- Ek hierdie inligtings- en toestemmingsvorm gelees het of aan my laat voorlees het en dat dit in ’n taal geskryf is waarin ek vaardig en gemaklik mee is.
- Ek geleentheid gehad het om vrae te stel en dat al my vrae bevredigend beantwoord is.
- Ek verstaan dat deelname aan hierdie navorsingsprojek **vrywillig** is en dat daar geen druk op my geplaas is om deel te neem nie.
- Ek te eniger tyd aan die navorsingsprojek mag onttrek en dat ek nie op enige wyse daardeur benadeel sal word nie.
- Ek gevra mag word om van die navorsingsprojek te onttrek voordat dit afgehandel is indien die studiedokter of navorser van oordeel is dat dit in my beste belang is, of indien ek nie die ooreengekome navorsingsplan volg nie.

Geteken te *(plek)* .....……. op *(datum)* ……...…….. .

....

Handtekening van deelnemer Handtekening van getuie

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Verklaring deur navorser

Ek *(naam)* ……..…… verklaar dat:

- Ek die inligting in hierdie dokument verduidelik het aan …….……..
- Ek hom/haar aangemoedig het om vrae te vra en voldoende tyd gebruik het om dit te beantwoord.
- Ek tevrede is dat hy/sy al die aspekte van die navorsingsprojek soos hierbo bespreek, voldoende verstaan.
- Ek ’n tolk gebruik het/nie ’n tolk gebruik het nie. (*Indien ’n tolk gebruik is, moet die tolk die onderstaande verklaring teken.)*

Geteken te *(plek*) .....…….. op *(datum*) ……...…….. .

....

Handtekening van navorder Handtekening van getuie

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Verklaring deur tolk

Ek *(naam)* ……..…… verklaar dat:

- Ek die navorser *(naam*) …….....……. bygestaan het om die inligting in hierdie dokument in Afrikaans/Xhosa aan *(naam van deelnemer)* ……..... te verduidelik.
- Ons hom/haar aangemoedig het om vrae te vra en voldoende tyd gebruik het om dit te beantwoord.
- Ek ’n feitelik korrekte weergawe oorgedra het van wat aan my vertel is.
- Ek tevrede is dat die deelnemer die inhoud van hierdie dokument ten volle verstaan en dat al sy/haar vrae bevredigend beantwoord is.

Geteken te *(plek*) .....…….. op *(datum*) ……...…….. .

....

Handtekening van tolk Handtekening van getuie

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Appendix D *Demographic Information*

INSTRUCTIONS

Thank you for participating in this study and taking the time to answer these questions. Your answers are very important, and you will be helping us to understand the factors that impact on adherence to tuberculosis (TB) treatment.

This booklet contains several questions relating to your thoughts and feelings about TB and your treatment. Some questions are quite personal and there are questions relating to drug and alcohol use. Please answer every question by indicating the answer that best describes your personal experiences.

If you require any help or more explanation about any questions, please ask the research assistant who gave you this booklet.

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PERSONAL INFORMATION

1. Age: _____

2. Date of birth: _____

3. Gender: _____

4. What is your relationship status?

☐ Single	☐ Separated	☐ Widowed
☐ Divorced	☐ Married or living with a significant other as if married	

5. What is the highest level of education that you have completed?

☐ None	☐ Attended primary but never completed	☐ Completed primary
☐ Attended high school but never completed		☐ Completed grade 12
☐ Attended a tertiary institution but not completed		
☐ Graduated from a tertiary institution		

6. In the previous 6 months, what has been your main work situation?

☐ Full time employed	☐ Part time employed	☐ Unemployed
☐ Student/scholar	☐ Retired	☐ Disabled

7. Which hospital are you currently admitted to?

☐ ☐

8. What type of TB do you have now?

☐ Drug sensitive (normal)TB	☐ MDR TB	☐ Pre XDR TB	☐ XDR TB

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INSTRUKSIES

Dankie vir jou deelname aan hierdie studie en die tyd wat jy spandeer om die vrae te beantwoord. Jou antwoorde is baie belangrik en gaan ons help om beter te verstaan waarom mense sukkel om hulle tuberkulose (TB) medisyne getrou te drink.

Hierdie boekie bevat verskeie vrae ten opsigte van jou gedagtes en gevoelens teenoor TB en jou TB behandeling. Van die vrae is persoonlik van aard, en van die vrae gaan oor die gebruik van dwelms en alcohol. Beantwoord asseblief elke vraag met ’n antwoord wat jou persoonlike ervanwys die beste beskryf.

Indien jy enige hulp of verdere verduideliking oor van die vrae benodig het, vrae asseblief die hulp van die navorsing assistant wat vir jou die boekie gegee het.

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PERSONLIKE INLIGTING

1. Ouderdom: _____

2. Gebortedatum: _____

3. Geslag: _____

4. Wat is u huwelikstatus?

☐ Nie in n verhouding nie	☐ Enkellopend	☐ Weduwee/Wewenaar
☐ Geskei	☐ Getroud/bly saam as of getroud	

5. Wat is die hoogste vlak van opvoeding wat u al voltooi het?

☐ Geen formele opvoeding	☐ Laerskool - onvoltooid	☐Laerskool - voltooid
☐ Hoërskool - onvoltooid		☐ Graad 12- voltooid
☐ Universiteit, kollege of tegnikon bygewoon, maar nie 'n graad/diploma behaal nie		
☐ Graad/diploma aan universiteit, kollege of tegnikon behaal		

6. Wat is u werk status die afgelope 6 maande?

☐ Werk voltyds	☐ Werk deeltyds	☐ Werkloos
☐ Student	☐ Afgetree	☐ Gestremd

7. Wat is die naam van die hospital waarin jy opgeneem is?

☐ ☐

8. Watter tipe TB het u nou?

☐ Drug sensitive (gewone)TB	☐ MDR TB	☐ Pre XDR TB	☐ XDR TB

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Appendix E: *Socio-economic information*

These questions are related to where you have been living for <u>most of the time</u> in the last 6 months. Please can you place a cross (x) next to the most correct answer. There should be only one answer (x) for each question.

1. **What is your main source of <u>drinking water</u> where you live:**

Piped tap water in the house		Water tanker	
Piped tap water in the yard		Well, stream or river	
Community tap		Other	

2. What is your main source of <u>cooking energy</u>?

Electricity		Coal	
Wood		Gas	
Paraffin		Other	

3. **What type of <u>toilet facility</u> do you usually use at home?**

Flush toilet		Pit toilet	
Chemical or bucket toilet		Other type of toilet	
No toilet			

4. Where you have been living for most of the time in the last 6 months?

Homeless or have no fixed place to live	
Staying in a shelter	
Living with friends or family in their home	
Rent or own home	
Other (specify)	

5. Please answer each of the questions by indicating if you have the following items where you live:

	YES	NO
5.1 Access to electricity		
5.2 Working refrigerator		
5.3 Working radio		
5.4 Working TV		
5.5 Working telephone (including cell phone)		

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Die onderstaande vrae het te doen met waar jy die afgelope 6 maande meeste van die tyd gewoon het.
Maak asseblief 'n kruisie (x) by die mees toegepaste/korrekte antwoord.
Daar moet net een antwoord (x) per vraag wees.

1. Daar waar jy woon, toon asseblief aan waar jy, jou drink water vandaan kry:

Gepypte water in die huis		Water tenk	
Gepypte water in die jaart		Put, stroompie of rivier	
Gemeenskaplike kraan		Ander	

2. Wat gebruik jy om mee te kook?

Elektrisiteit		Kool	
Hout		Gas	
Parafien		Ander	

3. **Wat se tipe toilet geriewe gebruik jy gewoonlik by die huis?**

Spoel toilet		Put toilet	
Sanitere of emmer toilet		Ander tipe van toilet	
Geen toilet			

4**. Waar het jy die afgelope 6 maande meeste van die tyd gewoon?**

Haweloos of geen permanente woning/verblyf	
Bly in 'n nagskuiling	
Bly saam met vriende of familie in hulle huis	
Bly in u eie woonplek of woonplek wat jy huur	
Anders	

5. **In die lys hieronder, toon asseblief aan watter van die items jy in jou woonplek het. Gee asseblief 'n antwoord vir elke vraag.**

	JA	NEE
5.1 Toegang tot elektrisiteit		
5.2 Werkende yskas		
5.3 Werkende radio		
5.4 Werkende televisie		
5.5 Werkende telefoon (insluitende selfoon)		

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Appendix F: *Tuberculosis Health Belief Scale*

Think about how you have felt and thought about TB and your treatment in the last month. Please show how much you agree or disagree with these statements. Please place a cross (x) in only one box per question to show your answer.

		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
1	TB can be a serious disease if you do not treat it.	5	4	3	2	1
2	TB causes death.	5	4	3	2	1
3	The thought of TB scares me.	5	4	3	2	1
4	I would rather have any other illness than TB.	5	4	3	2	1
5	Taking my treatment properly will help prevent complications related to TB.	5	4	3	2	1
6	My TB would be worse if I did not take any treatment for it.	5	4	3	2	1
7	I am afraid that I might contract a more resistant type of TB (such as MDR, XDR or worse).	5	4	3	2	1
8	I would rather die from a violent death (e.g., gunshot, car accident etc.) than from TB.	5	4	3	2	1
9	When I think about drug resistant TB (such as MDR, XDR or worse), my heart beats faster.	5	4	3	2	1
10	If I had a more drug resistant type of TB (such as MDR or XDR or worse) my whole life would change.	5	4	3	2	1
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
11	I am afraid to think about drug resistant TB (such as MDR or XDR or worse).	5	4	3	2	1

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12	Taking TB treatment will decrease my chances of dying from TB.	5	4	3	2	1
13	It is important for me to take TB treatment regularly.	5	4	3	2	1
14	Taking my TB treatment can protect others in my household from getting TB.	5	4	3	2	1
15	I believe that my TB treatment(s) will cure me from TB.	5	4	3	2	1
16	I cannot afford the cost to travel to the clinic.	5	4	3	2	1
17	Before I was admitted to hospital, I did not like to the clinic to get my TB treatment because it took too long to get there.	5	4	3	2	1
18	Before I was admitted to hospital, I did not like to go to the clinic to get treatment because the queues were too long.	5	4	3	2	1
19	Before I was admitted to hospital, I did not like to go to the clinic because the staff members did not treat me with respect.	5	4	3	2	1
20	I would have to change too many things in my life to follow my TB treatment plan.	5	4	3	2	1
21	Taking my TB treatment interferes with my normal daily activities.	5	4	3	2	1
22	It has been difficult for me to take all the treatment that has been prescribed to me.	5	4	3	2	1
23	I do not understand what the doctor told me about my TB treatment.	5	4	3	2	1
		Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
24	The tablets make me feel ill and I sometimes vomit.	5	4	3	2	1
25	I experienced side effects from taking my TB treatment.	5	4	3	2	1
26	I have read an article on the importance of taking TB treatment.	5	4	3	2	1

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27	I am aware of advertisements about the importance of taking TB treatment.	5	4	3	2	1
28	I have seen a poster encouraging people with TB to stay on their treatment.	5	4	3	2	1
29	I know someone who has been successfully cured from TB.	5	4	3	2	1
30	I can stick to my treatment plan even when side effects begin to interfere with daily activities.	5	4	3	2	1
31	I can manage to make the time to take my treatment and do my usual daily activities.	5	4	3	2	1
32	I can take my treatment if it means taking medication in front of people who don't know I have TB.	5	4	3	2	1
33	I believe that I can stick to my treatment plan even when my daily routine is disrupted.	5	4	3	2	1
34	I know that I will stick to my treatment plan even when I am not feeling well.	5	4	3	2	1
35	I can stick to my treatment plan even if it means changing my eating habits.	5	4	3	2	1
36	I can continue with my treatment even if doing so interferes with my daily activities.	5	4	3	2	1
37	I feel confident that I will continue with my treatment even if there is no improvement in my health.	5	4	3	2	1
38	I will take my treatment even on the days when I feel that treatment is not working.	5	4	3	2	1
39	I know I will continue with my treatment even when getting to my clinic appointments are a major hassle.	5	4	3	2	1
40	I will continue with my treatment even when people tell me that they don't think that it is doing any good.	5	4	3	2	1
41	I believe that I will get something positive out of my participation in treatment, even if the medication does not improve my health.	5	4	3	2	1

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Dink aan hoe jy oor TB en jou behandeling die afgelope maand gevoel en gedink het. Maak asseblief ’n kruisie (x) in elke blokkie om jou antwoord aan te dui. Sorg asseblief dat jy net een blokkie vir elke vraag merk.

		Stem heeltemal saam	Stem saam	Nie seker nie	Stem nie saam nie	Stem glad nie saam nie
1	TB kan ’n ernstige siekte wees as jy nie behandeling daarvoor kry nie.	5	4	3	2	1
2	Jy kan doodgaan van TB.	5	4	3	2	1
3	As ek net dink aan TB, dan raak ek bang.	5	4	3	2	1
4	Ek sou eerder enige ander siekte wil hê, net nie TB nie.	5	4	3	2	1
5	As ek my behandeling reg neem, sal dit help om komplikasies te keer wat verwant is aan TB.	5	4	3	2	1
6	My TB sou erger wees as ek nie enige behandeling daarvoor geneem het nie.	5	4	3	2	1
7	Ek is bang ek kry dalk ’n meer weerstandige (soos MDR, XDR of erger) soort TB.	5	4	3	2	1
8	Ek sou eerder gewelddadig wil doodgaan (bv. skietwond, motorongeluk ens.) as van TB.	5	4	3	2	1
9	Wanneer ek aan weerstandige TB dink (soos MDR, XDR of erger), klop my hart sommer vinniger.	5	4	3	2	1
		Stem heeltemal saam	Stem saam	Nie seker nie	Stem nie saam nie	Stem glad nie saam nie
10	As ek ’n meer weerstandige soort TB gehad het(soos MDR, XDR of erger), sou my hele lewe verander.	5	4	3	2	1
11	Ek is bang om aan middelweerstandige TB(soos MDR, XDR of erger) te dink.	5	4	3	2	1
12	As ek my TB-behandeling neem, sal dit die kanse verminder dat ek van TB doodgaan.	5	4	3	2	1

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13	Dit is belangrik dat ek gereeld TB-behandeling neem.	5	4	3	2	1
14	As ek my TB-behandeling neem, kan dit keer dat ander mense in die huis TB kry.	5	4	3	2	1
15	Ek glo dat my TB-behandeling(s) my TB gesond sal maak.	5	4	3	2	1
16	Ek kan nie vervoer tot by die kliniek bekostig nie.	5	4	3	2	1
17	Voor ek opgeneem is in die hospitaal, het ek nie kliniek toe om my TB-behandeling te gaan haal nie, want dit het te lank gevat om daar uit te kom.	5	4	3	2	1
18	Voor ek opgeneem is in die hospitaal, het ek nie daarvan gehou om kliniek toe te gaan om behandeling te kry nie, want die rye was te lank.	5	4	3	2	1
19	Voor ek opgeneem is in die hospitaal het ek nie daarvan gehou om kliniek toe te gaan nie, want die personeellede het my nie met respek behandel nie.	5	4	3	2	1
20	Ek sal te veel dinge in my lewe moet verander om my TB-behandelingsplan te volg.	5	4	3	2	1
21	As ek my TB-behandeling neem, meng dit in met my normale dagtake.	5	4	3	2	1
		Stem heeltemal saam	Stem saam	Nie seker nie	Stem nie saam nie	Stem glad nie saam nie
22	Dit is moeilik vir my om al die behandeling te neem wat vir my voorgeskryf is.	5	4	3	2	1
23	Ek verstaan nie wat die dokter vir my gesê het oor my TB-behandeling nie.	5	4	3	2	1
24	Ek voel siek van die pille en partykeer gooi ek op.	5	4	3	2	1
25	Ek het newe-effekte gekry van my TB-behandeling neem.	5	4	3	2	1
26	Ek het ’n artikel gelees oor hoe belangrik dit is om TB-behandeling te neem.	5	4	3	2	1

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27	Ek is bewus van advertensies oor hoe belangrik dit is om TB-behandeling te neem.	5	4	3	2	1
28	Ek het ’n plakkaat gesien wat mense aanmoedig om op hul TB-behandeling te bly.	5	4	3	2	1
29	Ek ken iemand wat TB gehad het en heeltemal gesond geraak het.	5	4	3	2	1
30	Ek is seker ek kan by my behandelingsplan hou selfs wanneer die newe-effekte met dagtake begin inmeng.	5	4	3	2	1
31	Ek kan dit regkry om tyd te maak om my behandeling te neem en my gewone dagtake te doen.	5	4	3	2	1
32	Ek kan my behandeling neem as dit beteken ek moet medikasie neem voor mense wat nie weet ek het TB nie.	5	4	3	2	1
33	Ek glo ek kan by my behandelingsplan hou selfs wanneer my daaglikse roetine onderbreek word.	5	4	3	2	1
34	Ek weet ek sal by my behandelingsplan hou selfs as ek nie lekker voel nie.	5	4	3	2	1
35	Ek kan by my behandelingsplan hou selfs as dit beteken ek moet my eetgewoontes verander.	5	4	3	2	1
36	Ek kan met my behandeling aanhou selfs al meng dit in met my dagtake.	5	4	3	2	1
37	Ek is vol vertroue dat ek sal aanhou met my behandeling selfs al raak my gesondheid nie beter nie.	5	4	3	2	1
38	Ek sal my behandeling neem selfs op die dae wat ek voel my behandeling help my nie.	5	4	3	2	1
39	Ek weet ek sal aanhou met my behandeling selfs al is dit ’n groot gesukkel om by my kliniekafsprake uit te kom.	5	4	3	2	1
40	Ek sal aanhou met my behandeling selfs al sê mense vir my hulle dink dit help glad nie.	5	4	3	2	1
41	Ek glo ek sal iets positief kry uit my deelname aan behandeling selfs al maak die medikasie nie my gesondheid beter nie.	5	4	3	2	1

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Appendix G: *Beliefs about Medicine Questionnaire*

Below are some statements that some people have made about how they think or feel <u>specifically about their TB treatment</u>. Please show how much you agree or disagree with these statements. Please place a cross (x) in only one box per question to show your answer.

		Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1	My health at present depends on my TB medicines.	5	4	3	2	1
2	Having to take TB medication worries me.	5	4	3	2	1
3	My life would be impossible without my TB medication.	5	4	3	2	1
4	Without my TB medication I would be very ill.	5	4	3	2	1
5	I sometimes worry about the long-term effects of my TB medication.	5	4	3	2	1
6	My TB medication is mystery to me. (I do not understand my medication)	5	4	3	2	1
	My health in the future will depend on my TB medication.	5	4	3	2	1
8	My TB medication disrupts my life.	5	4	3	2	1
9	I sometimes worry about becoming too dependent on my TB medication.	5	4	3	2	1
10	My TB medication protects me from becoming worse.	5	4	3	2	1

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These next few statements other people have made about medicines <u>in general</u>. Please indicate your personal views by placing a cross (x) in one box per question

		Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1	Doctors use too many medicines.	5	4	3	2	1
2	People who take medicines should stop their treatment for a while every now and again.	5	4	3	2	1
3	Most medicines are addictive.	5	4	3	2	1
4	Natural remedies (such as herbal treatment) are safer than medicines.	5	4	3	2	1
5	Medicines do more harm than good.	5	4	3	2	1
6	All medicines are poisons.	5	4	3	2	1
7	Doctors place too much trust on medicines.	5	4	3	2	1
8	If doctors had more time with patients, they would prescribe fewer medicines.	5	4	3	2	1

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Hieronder is enkele stellings wat sommige mense gemaak het oor hoe hulle <u>spesifiek oor hul TB-behandeling</u> dink of voel. Dui asseblief aan tot watter mate jy met hierdie stellings saamstem of nie saamstem nie. Maak asseblief net ’n kruisie (x) in net een blokkie by elke vraag om jou antwoord aan te dui.

		Stem heeltemal saam	Stem saam	Onseker	Stem nie saam nie	Stem glad nie saam nie
1	Op hierdie oomblik hang my gesondheid af van my TB-medisyne.	5	4	3	2	1
2	Dit maak my bekommerd om TB-medikasie te neem.	5	4	3	2	1
3	Sonder my TB-medikasie sou my lewe nie moontlik wees nie.	5	4	3	2	1
4	Ek sou baie siek wees sonder my TB-medikasie.	5	4	3	2	1
5	Soms raak ek bekommerd oor die langtermynuitwerkings van my TB-medikasie.	5	4	3	2	1
6	My TB-medikasie is ’n raaisel vir my. (Ek verstaan nie my TB-medikasie nie)	5	4	3	2	1
7	My gesondheid in die toekoms sal afhang van my TB-medikasie.	5	4	3	2	1
8	My TB-medikasie ontwrig my lewe.	5	4	3	2	1
9	Soms raak ek bekommerd dat ek te afhanklik kan raak van my TB-medikasie.	5	4	3	2	1
10	My TB-medikasie beskerm dat ek erger raak.	5	4	3	2	1

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Die volgende paar stellings is deur ander mense gemaak oor medisyne <u>oor die algemeen</u>. Dui asseblief jou persoonlike mening aan deur ’n kruisie (x) te trek in een blokkie by elke vraag.

		Stem heeltemal saam	Stem saam	Onseker	Stem nie saam nie	Stem glad nie saam nie
1	Dokters gebruik te veel medisyne.	5	4	3	2	1
2	Mense wat medisyne neem, moet elke nou en dan vir ’n tyd met hul behandeling ophou.	5	4	3	2	1
3	Die meeste medisyne is verslawend.	5	4	3	2	1
4	Natuurlike geneesmiddels (byvoorbeeld kruiemiddles) is veiliger as medisyne.	5	4	3	2	1
5	Medisyne verrig meer skade as goed.	5	4	3	2	1
6	Alle medisyne is giftig.	5	4	3	2	1
7	Dokters vertrou te veel op medisyne.	5	4	3	2	1
8	As dokters meer tyd met pasiënte gehad het,sou hulle minder medisyne voorgeskryf het.	5	4	3	2	1

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Appendix H: *Alcohol Use Disorder Identification Test (AUDIT)*

The following questions relate to how much alcohol you normally use. Please indicate your answer by placing a cross (X) in the box which best describes your own behaviour.

Questions	0	1	2	3	4
1. How often do you have a drink containing alcohol?	Never	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week
2. How many drinks containing alcohol do you have on a typical day when you are drinking?	1 or 2	3 or 4	5 or 6	7 to 9	10 or more
3. How often do you have six or more drinks on one occasion?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily
4. How often during the last year have you found that you were not able to stop once you had started?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily
5. How often during the last year have you failed to do what was normally expected of you because of drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily
6. How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily
7. How often during the last year have you had a feeling of guilt or remorse after drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily
8. How often during the last year have you been unable to remember what happened the night before because of your drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily
9. Have you or someone else been injured because of your drinking?	No		Yes, not in the last year		Yes, during the last year
10. Has a relative, friend, doctor, or other health care worker been concerned about your drinking or suggested you cut down?	No		Yes, but not in the last year		Yes, during the last year

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Die volgende vrae handel oor jou gebruik van alkohol. Beantwoord asseblief eerlik deur 'n (X) te maak in die boks wat waar is vir jou.

	0	1	2	3	4
1. Hoe gereeld neem jy 'n drankie wat alkohol bevat?	Nooit	Elke maand of minder	2-4 keer per maand	2-3 keer per week	4 of meer keer per week
2. Hoe baie drankies wat alkohol bevat neem jy op 'n tipiese dag wat jy drink?	1 of 2	3 of 4	5 of 6	7 tot 9	10 of meer
3. Hoe gereeld het jy ses of meer drankies op een geleentheid?	Nooit	Minder as elke maand	Elke maand	Elke week	Elke dag of amper elke dag
4. Hoe gereeld gedurende die laaste jaar het jy gevind dat jy nie kon ophou met drink as jy eers begin het nie?	Nooit	Minder as elke maand	Elke maand	Elke week	Elke dag of amper elke dag
5. Hoe gereeld gedurende die laaste jaar kon jy nie iets doen wat normaalweg van jou verwag was nie as gevolg van drinkery?	Nooit	Minder as elke maand	Elke maand	Elke week	Elke dag of amper elke dag
6. Hoe gereeld gedurende die laaste jaar het jy 'n drankie in die oggend nodig gehad om jouself aan die gang te kry na 'n groot drink sessie?	Nooit	Minder as elke maand	Elke maand	Elke week	Elke dag of amper elke dag
7. Hoe gereeld gedurende die laaste jaar het jy skuldig of jammer gevoel na jy gedrink het?	Nooit	Minder as elke maand	Elke maand	Elke week	Elke dag of amper elke dag
8. Hoe gereeld gedurende die laaste jaar kon jy nie onthou wat gebeur het die aand voor jy gedrink het nie?	Nooit	Minder as elke maand	Elke maand	Elke week	Elke dag of amper elke dag
9. Was jy of iemand anders al beseer as gevolg van jou drinkery?	Nee		Ja, maar nie in die laaste jaar nie		Ja, gedurende die laaste jaar
10. Het 'n familielid, friend, dokter, of ander gesondheidswerker al n voorstel gemaak dat jy 'n bietjie minder moet drink of bekommer uitgespreek oor jou drinkery?	Nee		Ja, maar nie in die laaste jaar nie		Ja, gedurende die laaste jaar

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Appendix I: *Drug Use Disorders Identification Test (DUDIT)*

Here are a few questions about drugs. Please place a cross (X) in the block that describes your drug use Please answer as correctly and honestly as possible.

Questions	0	1	2	3	4
1. How often do you use drugs other than alcohol?	Never	Once or twice or less	2 – 4 times a month	2-3 times a week	4 times a week or more
2. Do you use more than one type of drug on the same occasion?	Never	Once or twice or less	2 – 4 times a month	2-3 times a week	4 times a week or more
3. How many times do you take drugs on a typical day that you use drugs?	0	1-2	3-4	5-7	7 or more
4. How often are you heavily influenced by drugs?	Never	Less than once a month	Every month	Every week	Daily or almost daily
5. Over the past year, have you felt that your longing for drugs was so strong that you could not resist it?	Never	Less than once a month	Every month	Every week	Daily or almost daily
6. Has it happened, over the past year, that you have not been able to stop taking drugs once you have started.	Never	Less than once a month	Every month	Every week	Daily or almost daily
7. How often over the past year have you taken drugs and then neglected to do something that you should have done?	Never	Less than once a month	Every month	Every week	Daily or almost daily
8. How often over the past year have you needed to use a drug the morning after a night of heavy use?	Never	Less than once a month	Every month	Every week	Daily or almost daily
9. How often over the past year have you had guilt feelings or a bad conscience because you used drugs?	Never	Less than once a month	Every month	Every week	Daily or almost daily
10. Have you or anyone else been hurt (mentally or physically) because you used drugs	No		Yes, but not over the past year		Yes, within the past year
11. Has a relative, a friend, a doctor, a nurse or anyone else been worried about your drug use or said you should stop using drugs?	No		Yes, but not over the past year		Yes, within the past year.

Cannabis	Amphetamines	Cocaine	Opiates	Hallucinogens	Solvents/inhalants	GHB and others
Marijuana	Methamphetamine	Crack	Smoked heroin	Ecstasy	Thinner	GHB
Hash	Phenmetraline	Freebase	Heroin	LSD (Lisergic acid)	Trichlorethylene	Anabolic steroids
Hash oil	Khat	Coca	Opium	Mescaline, Peyote	Gasoline/petrol	Laughing gas
	Betel nut	leaves		PCP, angel dust	Gas	(Halothane)
	Ritaline			Phencyclidine	Solution	Amyl nitrate (poppers)
	(Methylphenidate)			Psilocybin	Glue	Anticholergic

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Die volgende vrae handel oor jou gebruik van dwelms. Beantwoord asseblief eerlik deur 'n (X) te maak in die boks wat waar is vir jou.

	0	1	2	3	4
1. Hoe gereeld gebruik jy dwelms anders as alkohol?	Nooit	Een keer per maand of minder	2-4 keer per maand	2-3 keer per week	4 keer per week of meer
2. Gebruik jy meer as een tiepe dwelm op dieselfde geleentheid?	Nooit	Een keer per maand of minder	2-4 keer per maand	2-3 keer per week	4 keer per week of meer
3. Hoeveel keer gebruik jy dwelms op 'n tipiese dag wat jy dwelms gebruik?	0	1-2	3-4	5-6	7 of meer
4. Hoe gereeld word jy ernstig beinvloed deur dwelms?	Nooit	Minder as een keer per maand	Elke maand	Elke week	Daagliks of amper elke dag
5. Oor die afgelope jaar, het jy gevoel dat jou behoefte aan dwelms so sterk was dat jy dit nie kon weerstaan nie?	Nooit	Minder as een keer per maand	Elke maand	Elke week	Daagliks of amper elke dag
6. Het dit oor die afgelope jaar gebeur dat jy nie kon ophou dwelms neem as jy eers begin het nie?	Nooit	Minder as een keer per maand	Elke maand	Elke week	Daagliks of amper elke dag
7. Hoe gereeld oor die afgelope jaar het jy dwelms geneem en nagelaat om iets te doen wat jy moes doen?	Nooit	Minder as een keer per maand	Elke maand	Elke week	Daagliks of amper elke dag
8. Hoe gereeld oor die afgelope jaar het jy nodig gehad om 'n dwelm te neem die oggend na swaar dwelm gebruik die vorige dag?	Nooit	Minder as een keer per maand	Elke maand	Elke week	Daagliks of amper elke dag
9. Hoe gereeld oor die afgelope jaar het jy skuld gevoelens of 'n skuldige gewete gehad omdat jy dwelms gebruik het?	Nooit	Minder as een keer per maand	Elke maand	Elke week	Daagliks of amper elke dag
10. Het jy of iemand anders al seergekry (verstandelik of fisies) omdat jy dwelms gebruik het?	Nee	Ja, maar nie gedurende die afgelope jaar nie		Ja, gedurende die afgelope jaar	
11. Het 'n familielid of 'n friend, dokter of verpleegster, of enige iemand anders al vir jou gesê dat jy moet ophou dwelms gebruik, of bekommer getoon oor jou dwelm gebruik?	Nee	Ja, maar nie gedurende die afgelope jaar nie		Ja, gedurende die afgelope jaar	

Cannabis	Amphetamines	Cocaine	Opiates	Hallucinogens	Solvents/inhalants	GHB and others
Marijuana Hash Hash oil	Methamphetamine Phenmetraline Khat Betel nut Ritaline	Crack Freebase Coca leaves	Smoked heroin Heroin Opium	Ecstasy LSD (Lisergic acid) Mescaline Peyote PCP, angel dust (Phencyclidine)	Thinner Trichlorethylene Gasoline/petrol Gas Solution Glue	GHB Anabolic steroids Laughing gas(Halothane) Amyl nitrate (poppers) Anticholinergic compounds

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Appendix J: *Beck Depression Inventory (BDI)*

On this questionnaire are groups of statements. Please read each group of statements carefully. Then pick the one statement in each group that best describes the way you have been feeling during the last two weeks, including today. Circle the number beside the statement you picked. Be sure to read all the statements in each group before making your choice.

1.	0	I do not feel sad.
	1	I feel sad.
	2	I am sad all the time and I can't snap out of it.
	3	I am so sad or unhappy that I can't stand it.
2.	0	I am not particularly discouraged about the future.
	1	I feel discouraged about the future.
	2	I feel I have nothing to look forward to.
	3	I feel that the future is hopeless and that things cannot improve.
3.	0	I do not feel like a failure.
	1	I feel I have failed more than the average person.
	2	As I look back on my life, all I can see is a lot of failures.
	3	I feel I am a complete failure as a person.
4.	0	I get as much satisfaction out of things as I used to.
	1	I don't enjoy things the way I used to.
	2	I don't get real satisfaction out of anything anymore.
	3	I am dissatisfied or bored with everything.
5	0	I don't feel particularly guilty.
	1	I feel guilty a good part of the time.
	2	I feel guilty most of the time.
	3	I feel guilty all of the time.
6.	0	I don't feel I am being punished.
	1	I feel I may be punished.
	2	I expect to be punished.
	3	I feel I am being punished.
7.	0	I don't feel disappointed in myself.
	1	I am disappointed in myself.
	2	I am disgusted in myself.
	3	I hate myself.
8.	0	I don't feel I am any worse than anybody else.
	1	I am critical of myself for my weakness or mistakes.

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	2	I blame myself all the time for my faults.
	3	I blame myself for everything bad that happens.
9.	0	I don't have any thoughts of killing myself.
	1	I have thoughts of killing myself, but I would not carry them out.
	2	I would like to kill myself.
	3	I would kill myself if I had the chance.
10.	0	I don't cry any more than usual.
	1	I cry now more than I used to.
	2	I cry all the time now.
	3	I used to be able to cry, but now I can't cry even though I want to.
11.	0	I am no more irritated than I ever was.
	1	I am slightly more irritated now than usual.
	2	I am quite annoyed or irritated a good deal of the time.
	3	I feel irritated all the time.
12.	0	I have not lost interest in other people.
	1	I am less interested in other people than I used to be.
	2	I have lost most of interest in other people.
	3	I have lost all of my interest in other people.
13.	0	I make decisions about as well as I ever could.
	1	I put off making decisions more than I used to.
	2	I have greater difficulty in making decisions than before.
	3	I can't make decisions at all anymore.
14.	0	I don't feel that I look any worse than I used to.
	1	I am worried that I am looking old or unattractive.
	2	I feel that there are permanent changes in my appearance that make me look unattractive.
	3	I believe I look ugly.
15.	0	I can work as well as before.
	1	It takes extra effort to get started at doing something.
	2	I have to push myself very hard to do anything.
	3	I can't do any work at all.
16.	0	I can sleep as well as usual.
	1	I don't sleep as well as I used to.
	2	I wake up one or two hours earlier than usual and find it hard to get back to sleep.
	3	I wake up several hours earlier than I used to and cannot get back to sleep.
17.	0	I don't get any more tired than usual.
	1	I get tired more easily than I used to.

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	2	I get tired from doing almost anything.
	3	I am too tired to do anything.
18.	0	My appetite is no worse than usual.
	1	My appetite is not as good as it used to be
	2	My appetite is much worse now.
	3	I have no appetite at all anymore.
19.	0	I haven't lost much weight, if any, lately.
	1	I have lost more than 5 pounds. (about 2kg's)
	2	I have lost more than 10 pounds. (about 4.5 kgs)
	3	I have lost more than 15 pounds. (nearly 7 kgs)
20.	0	I am no more worried about my health than usual.
	1	I am worried about physical problems such as aches and pains, or upset stomach, or constipation.
	2	I am very worried about physical problems and it is hard to think of much else.
	3	I am so worried about my physical problems that I cannot think about anything else.
21.	0	I have not noticed any recent change in my interest in sex.
	1	I am less interested in sex than I used to be.
	2	I am much less interested in sex now.
	3	I have lost interest in sex completely.

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Hierdie afdeling bestaan uit 21 groepe stellings. Lees asseblief elke groep stellings noukerig deur, en kies dan EEN STELLING uit elke groep wat die beste beskryf hoe jy gedurende die AFGELOPE TWEE WEKE, INSLUITENDE VANDAG gevoel het. Sirkel die nommer langsaan die stelling wat jy gekies het.

1.	0 Ek voel nie hartseer nie 1 Ek voel meeste van die tyd hartseer 2 Ek is heeltyd hartseer 3 Ek is so ongelukkig dat ek dit nie kan verdra nie
2.	0 Ek is nie juis mismoedig oor die toekoms nie 1 Ek voel meer mismoedig oor die toekoms as wat ek voorheen was 2 Ek verwag nie dat dinge van my gaan uitwerk nie 3 Ek voel dat die toekoms hopeloos is en dat sake nie kan verbeter nie
3.	0 Ek voel nie soos ‘n mislukkings nie 1 Ek het meer misluk as wat ek moes 2 As ek op my lewe terugkyk, sien ek ‘n klomp mislukkings 3 Ek voel dat ek ‘n totale mislukking as persoon is
4.	0 Ek kry net so veel plesier as wat ek altyd het uit dinge wat ek geniet 1 Ek geniet dinge nie meer soos voorheen nie 2 Ek kry minder plesier uit die dinge wat ek gewoontlik geniet het 3 Ek kry glad nie meer plesier uit die dinge wat ek gewoontlik geniet het nie
5.	0 Ek voel nie juis skuldig nie 1 Ek voel gereeld skuldig oor dinge wat ek gedoen het of moes gedoen het 2 Ek voel meeste van die tyd skuldig 3 Ek voel die heeltyd skuldig
6.	0 Ek voel nie asof ek gestraf word nie 1 Ek voel ek mag gestraf word 2 Ek verwag om gestraf te word 3 Ek voel dat ek gestraf word
7.	0 Ek voel dieselfde oor myself as altyd 1 Ek het vertroue in myself verloor 2 Ek is terleurgesteld met myself 3 Ek hou nie van myself nie
8.	0 Ek kritiseer of blameer myself nie meer as gewoontlik nie 1 Ek is meer krities teenoor myself as wat ek was 2 Ek blameer myself vir al my foute 3 Ek blameer myself vir alle slegte dinge wat gebeur

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9.	0 Ek dink nie daaraan om selfmoord te pleeg nie 1 Ek dink aan selfmoord, maar sal dit nooit doen nie 2 Ek wil selfmoord pleeg 3 Ek sou selfmoord pleeg indien ek die kans gehad het
10.	0 Ek huil nie meer as gewoontlik nie 1 Ek huil nou meer as voorheen 2 Ek huil deesdae oor elke liewe ding 3 Ek wil huil, maar kan nie
11.	0 Ek is nie meer onrustig of geirriteerd as gewoonlik nie 1 Ek voel meer onrustig of geirriteerd as gewoonlik 2 Ek voel meeste van die tyd onrustig of geirriteerd 3 Ek voel heeltyd onrustig of geirriteerd
12.	0 Ek het nie belangstelling in ander mense of aktiwiteite verloor nie 1 Ek stel minder in ander mense of dinge belang as voorheen 2 Ek het meeste van my belangstelling in ander mense of dinge verloor 3 Dis moeilik om belangstelling in iets te vind
13	0 Ek neem ontrent besluite so goed soos voorheen 1 Ek vind dit moeiliker om besluite te neem as voorheen 2 Ek vind dit baie moeiliker om besluite te neem as voorheen 3 Ek vind dit moeilik om enige besluite te neem
14	0 Ek voel nie dat ek slegte lyk as tevore nie 1 Ek is bekommered dat ek oud of onaantreklik lyk 2 Ek voel dat daar permanente veranderinge in my voorkoms wat my onaantreklik laat lyk 3 Ek glo ek lyk lelik
15.	0 Ek werk so goed soos voorheen 1 Dit verg ekstra moeitie om the begin om iets te doen 2 Ek moet myself baie hard druk om iets te doen 3 Ek het nie genoeg energie om enigeiets te doen nie
16.	0 Ek slaap so goed soos gewoonlik 1 Ek slaap nie meer so goed soos waarvan ek gewoond is nie 2 Ek word wakker een of twee ure vroeër as gewoonlik en vind did moelik om weer aan die slaap te raak 3 Ek word wakker n paar ure vroeër as waarvan ek gewoond is en kan nie weer aan die slaap raak nie

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17.	0 Ek word nie moeër as gewoonlik nie 1 Ek word makliker en meer moeg as gewoonlik 2 Ek is te moeg om baie van die dinge te doen wat ek gewoonlik gedoen het 3 Ek is te moeg om die meeste van die dinge te doen wat ek altyd gedoen het
18.	0 Ek het nie enige veranderinge in my eetlus ervaar nie 1 My eetlus is effens minder as gewoonlik 2 My eetlus is baie minder as voorheen 3 Ek het glad nie ‘n eetlus nie
19.	0 Indien ek gevig verloor het, is dit nie baie nie 1 Ek het meer as 5 pond (omtrent 2kgs) verloor 2 Ek het meer as 10 pond (omtrent 4.5kgs) verloor 3 Ek het meer as 15 pond (omtrent 7kgs) verloor
20.	0 Ek is nie meer bekommerd oor my gesondheid as gewoonlik nie 1 Ek is bekommered oor fisiese probleme soos pyne en skete of omgekrapte maag of hardlywigheid 2 Ek is baie bekommered oor fisiese probleme en dit is moelik om oor enige iets anders te dink 3 Ek is so bekommered oor my fisiese probleme dat ek aan niks anders kan dink nie
21.	0 Ek het nie enige onlangse veranderinge in my belangstelling in seks opgemerk nie 1 Ek is minder geinteresseerd in seks as wat ek gewoonlik was 2 Ek is huidiglike baie minder geintereseerd in seks 3 Ek het heeltemal my belangstelling in seks verloor

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Appendix K: *Tuberculosis Adherence Scale (TB – AS)*

Below is a list of questions relating to medication taking behaviour. Please place a cross (x) in the box that matches your personal experience with your TB medication. There is no right or wrong answer.

1. Have you ever skipped/missed your TB treatment?	YES ☐ NO ☐
2. Have you ever hidden your TB medication?	YES ☐ NO ☐
3. Have you ever skipped your TB treatment for two (or more) consecutive months?	YES ☐ NO ☐
4. How often have you skipped your TB treatment for any reason? Never ☐ Almost never ☐ Sometimes ☐ Frequently ☐ Always ☐	

You DO NOT need to fill in this section, to be completed by investigator	
File Review	YES ☐ NO ☐

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Hieronder is ’n lys stellings wat verband hou met jou TB-behandeling. Maak ’n kruisie (x) in die blokkie wat pas by wat jy dink.

1. Het jy al ooit jou TB -medikasie nie geneem nie?	JA ❑ NEE ❑
2. Het jy al ooit jou TB -medikasie weggesteek?	JA ❑ NEE ❑
3. Het jy al ooit jou TB – medikasie vir 2 (of meer) aaneenlopende maande nie geneem nie?	JA ❑ NEE ❑
4. Hoe gereeld, vir enege rede, drink jy nie jou TB – medikasie nie? Nooit ❑ Amper nooit nie ❑ Soms ❑ Gereeld ❑ Altyd ❑	

Jy hof nie hierdie deel te voltooi nie.
File Review YES ☐ NO ☐

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Appendix L: *Information to access additional support services.*

Dear Participant

Thank you very much for your assistance in this study. If you have any concerns or feel distressed in any way, please consult your ward doctor.

As a patient admitted to either XX XXX or XXX Hospital you can be referred to:

➢ Audiologist ➢ Dietician ➢ Occupational therapist	➢ Physiotherapist ➢ Psychologist ➢ Social worker

The team is here to help you. Please ask your ward doctor if you feel concerned and s/he will make sure you can get the right support.

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Geagte Deelnemer

Baie dankie vir jou deelname aan die studie. Indien jy enige verdere navrae het of angstig voel, kontak asb die dokter in jou saal.

As n pasient by XXX of XXX kan jy na die volgende proffesionele persone verwys word:

➢ **Oudioloog**	➢ **Fisioterapeut**
➢ **Dieetkundige**	➢ **Sielkundige**
➢ **Arbeidsterapeut**	➢ **Maatskaplike werker**

Die mediese span is hier om jou te help.

As jy bekommerd voel, gesels met jou dokter en hy/sy sal sorg dat jy die regte ondersteuning kry.