Association between community knowledge and stigmatising attitudes towards tuberculosis across five provinces in Zimbabwe

By

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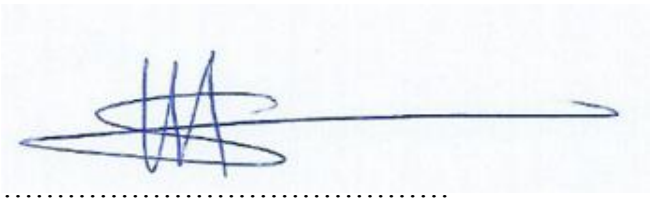
Dedication

I dedicate this project to my beautiful wife and best friend Rudo, my two sons Mufudzi and Matifadza. Thank you all for loving me and giving me the strength to get up every day.

Declaration

I declare that except where specific reference is made to the work of others, the contents of this research report are original. This report has never been submitted for consideration for any other degree or qualification in this, or any other University. I take full ownership of this research report as my work, and it does not include any outcome of work done in collaboration, except where specifically indicated in the text.



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Dr Machekera Shepherd M **18 November 2017**

Acknowledgements

Firstly, I would like to thank God almighty whose grace and provisions have enabled me to walk through and finish this journey. I am eternally grateful to some individuals whose outstanding contributions made this project a success. Special mention goes to my wife Rudo and two sons for their unwavering love and support. I am eternally grateful to my supervisor Associate Professor Eustasius Musenge who guided me and ensured I would have a sound research project. His knowledge, experience, as well as positive criticism, inspired me to improve on and complete this report. I thank my country director Dr Christopher Zishiri and the team from The International Union against Tuberculosis and Lung Disease (The Union) who collected the data and granted me the opportunity to use it for this study. My friends and classmates at Wits University deserve recognition for sharing good and hard moments with me throughout this course. Last but not least, I thank all staff from the Department of Epidemiology and Biostatistics at the School of Public Health for your many contributions to make this research report a success.

Abstract

Background: People with tuberculosis (TB) often get stigmatised in the communities they live. High stigma contributes to delays in seeking care, poor adherence, and adverse treatment outcomes. Most public health interventions that address stigma focus only on increasing community knowledge and awareness on TB. There is however limited local evidence to support this practice. This study was carried out to determine the association between community knowledge and stigmatising attitudes towards TB in five provinces in Zimbabwe. I also wanted to determine the factors associated with good knowledge of TB and stigma towards it.

Methods: I conducted a cross-sectional study using secondary data collected in 2016 from a Knowledge Attitudes and Practices (KAP) survey. The primary study was carried out in five provinces in Zimbabwe by The International Union against Tuberculosis and Lung Disease (The Union). A total of 634 adults from randomly selected households were interviewed using a pre-validated structured questionnaire. The participants' knowledge was determined based on their total score on simple questions around TB. Logistic regression was used to identify factors associated with community knowledge of TB. An ordinal logistic regression was fitted to determine the association between knowledge of TB and stigmatising attitudes. Also, confirmatory factor analysis (CFA) using generalised structural equation model (GSEM) was done to demonstrate the factors directly and indirectly associated with stigmatising attitudes.

Results: More than half of my participants had sound knowledge of TB. Participants who had attained a tertiary level of education (AOR 6.86; 95% CI 1.82 – 25.9) and those who knew of someone who has/had TB (AOR 2.67; 95% CI 1.71 – 4.17) were more likely to have good knowledge of TB. The majority of my participants (54%) had some form of stigma towards TB. Surprisingly, there was no association between community knowledge of TB and stigmatising attitudes towards it (AOR 1.03; 95% CI 0.75 – 1.43). However, participants from other smaller religious groups (AOR 2.01; 95% CI 1.03 – 3.91) had higher levels of stigma. The likelihood of having higher levels of stigma decreased with advancing age (AOR 0.99; 95% CI 0.97 – 1.00). Religious groups (traditional churches and apostolic sects), age and socioeconomic status were all directly and indirectly associated with stigmatising attitudes. Their total effect was to increase the likelihood of having higher levels of stigmatising attitudes.

Conclusion: Most individuals in the five provinces are aware of TB and have received information on TB however high levels of stigma exist. There is no association between community knowledge and stigma towards TB. There is need to take into consideration the demographic, religious and socioeconomic factors in the design and implementation of public health interventions aimed at improving community knowledge and reducing stigma on TB

Keywords: Tuberculosis, stigma, "community knowledge", generalised structural equation model (GSEM), principal component analysis (PCA)

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Nomenclature

Knowledge:	Information or facts gained through practical experience or education that has resulted in the understanding of a subject (1).
Community knowledge	Information or facts that are understood and agreed by individuals in the defined group to be correct about a subject
Stigma	A label of degradation and disgrace associated with a particular person because of their circumstance or character (1)
Attitude	A settled way of thinking or feeling about something.(1)
Latent tuberculosis	This is when a person has persistent immune response to the bacteria *Mycobacterium tuberculosis'* antigens without evidence of any symptoms and signs of TB disease (2)
Active tuberculosis	This is a condition in which an individual's immune system is unable to fight off the *Mycobacterium tuberculosis* in the lungs or other parts of the body. As such they develop clinical signs and symptoms of the disease. These may include a chronic cough, fever, night sweats, loss of weight, chest pain or other symptoms related to the affected body part (2).
Multi-drug resistant tuberculosis	This as a form of tuberculosis in which the type of *Mycobacterium tuberculosis* that is causing the disease has is resistance to one or more of the first line TB medicines and in particular rifampicin and isoniazid (3).

Abbreviations

AOR	Adjusted odds ratio
ART	Anti-Retroviral Therapy
CI	Confidence Interval
CFA	Confirmatory Factor Analysis
CKS	Composite Knowledge Score
DOTS	Directly Observed Therapy, Short-course
HCWs	Health Care Workers
HIV	Human Immunodeficiency Virus
HREC	Human Research Ethics Committee
KAP	Knowledge Attitudes Practices
LR	Logistic regression
MDR-TB	Multi-Drug Resistant Tuberculosis
MOHCC	Ministry of Health and Child Care
MRCZ	Medical Research Council of Zimbabwe
NTP	National Tuberculosis Programme
OLR	Ordinal logistic regression
OR	Odds Ratio
PCA	Principal component analysis
PLHIV	People Living with HIV
REDCap	Research Electronic Data Capture
SES	Socioeconomic status
TB	Tuberculosis
The Union	The International Union against Tuberculosis and Lung Disease

Chapter 1: INTRODUCTION

This chapter provides the background information regarding community knowledge of TB and stigmatising attitudes towards those affected. It also includes a description of the problem that was investigated as well as justification for carrying out the study. I also highlight the research question, study aim, objectives and conceptual framework for this study. The last section of the chapter is an in-depth discussion of the current evidence on knowledge and stigmatising attitudes.

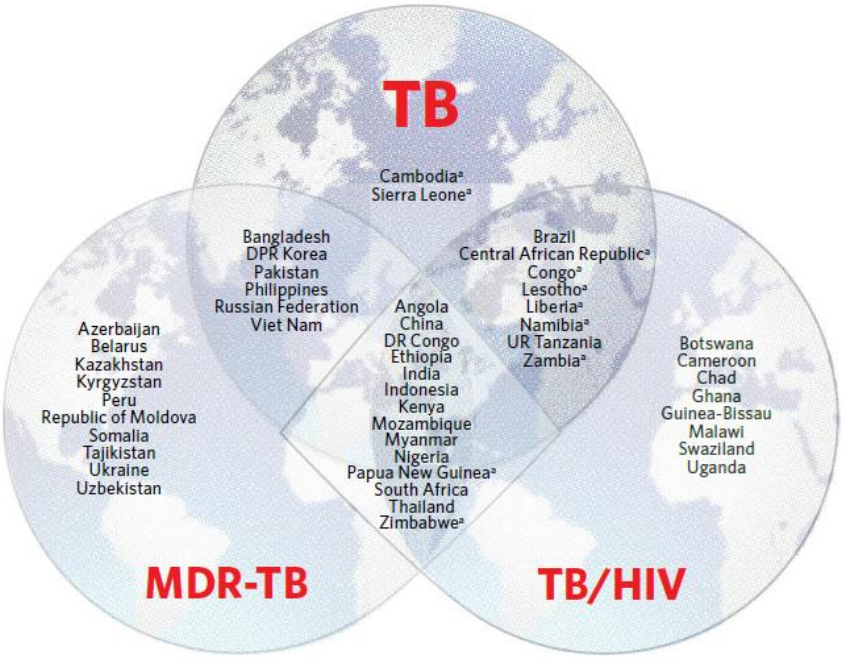
1.1 Background

1.1.1 Global epidemiology of TB

Tuberculosis (TB) is an ancient disease that has been around human communities for over 40,000 years (4). Around a third of the world's population is infected with *Mycobacterium Tuberculosis* (5) the bacterium that causes TB. Many people however remain asymptomatic. Transmission is through aerosols when someone with active disease coughs or sneezes (6). In 2015, over 10.4 million people developed active TB disease, of whom 1.4 million died from it (7). These deaths were more than what was reported for any other infectious disease including malaria and HIV.

In Africa, TB remains a major challenge because of poverty (8, 9), poor living conditions (6), and a high HIV burden (10). In 2015, over 31% of all TB cases notified in the region were co-infected with HIV (7). Eight countries in Africa appear on the World Health Organisation

(WHO) list of 30 high burden countries for TB, TB-HIV and drug-resistant TB (DR-TB) and Zimbabwe is one of them (see figure 1) (11). These high burden countries together contribute between 80 – 85% of the global burden of TB.



DPR Korea, Democratic People's Republic of Korea; DR Congo, Democratic Republic of the Congo; HIV, human immunodeficiency virus; MDR, multidrug resistant; TB, tuberculosis; UR Tanzania, United Republic of Tanzania; WHO, World Health Organization

[a] Indicates countries that are included in the list of 30 high-burden countries for TB on the basis of the severity of their TB burden (i.e. TB incidence per 100 000 population), as opposed to the top 20, which are included on the basis of their absolute number of incident cases per year.

Figure 1: WHO lists of 30 countries with a high burden of TB, TB-HIV and DR- TB (11)

1.1.2 Tuberculosis in Zimbabwe

TB is a big public health problem in the country. In 2014, TB was responsible for 13% of all deaths reported (see figure 2) (12). In 2015, the prevalence rate of TB in Zimbabwe was 292 per 100 000 population (7). In the same year, 28 225 people were diagnosed and started on treatment. The epidemic of TB in Zimbabwe is mainly due to a high prevalence of HIV, and in 2015, 70% of all cases notified were co-infected (7). Although notifications are coming down annually, nearly 11 000 (28%) active TB cases were not diagnosed and started on treatment in

2015 alone (7). These missed cases act as reservoirs that continue driving transmission within communities and hamper efforts to end TB in Zimbabwe.

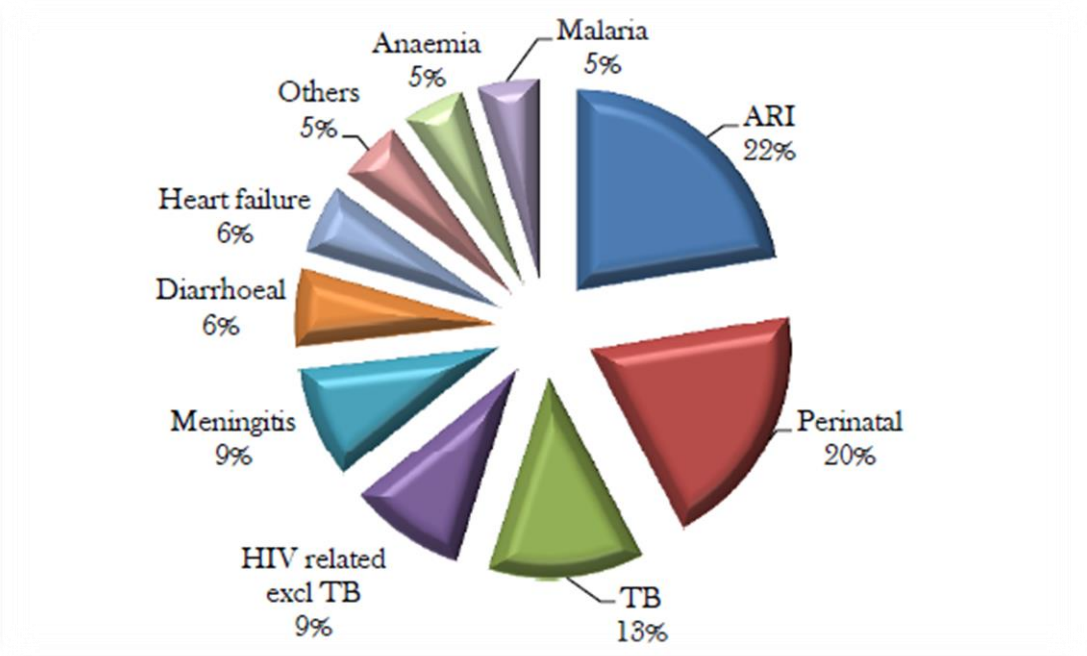


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Figure 2: Top ten causes of death in Zimbabwe in 2014 (13)

1.1.3 Care and treatment for active TB

Early diagnosis and rapid initiation of appropriate treatment are central to TB control efforts (7). In Zimbabwe, patients diagnosed with TB access treatment for free at any public health institution. However, they pay for medical consultation and some initial investigations before a diagnosis is made. Despite the fact that TB is curable, in some provinces in the southern part of Zimbabwe districts report death rates as high as 27%. Figure 3 shows districts death rates for TB in 2015. Seven of the ten districts with the highest death rates are from the five provinces that were included in this study. Delays in seeking care (14) and poor adherence (15, 16) among other health system related challenges contribute to these adverse treatment outcomes.

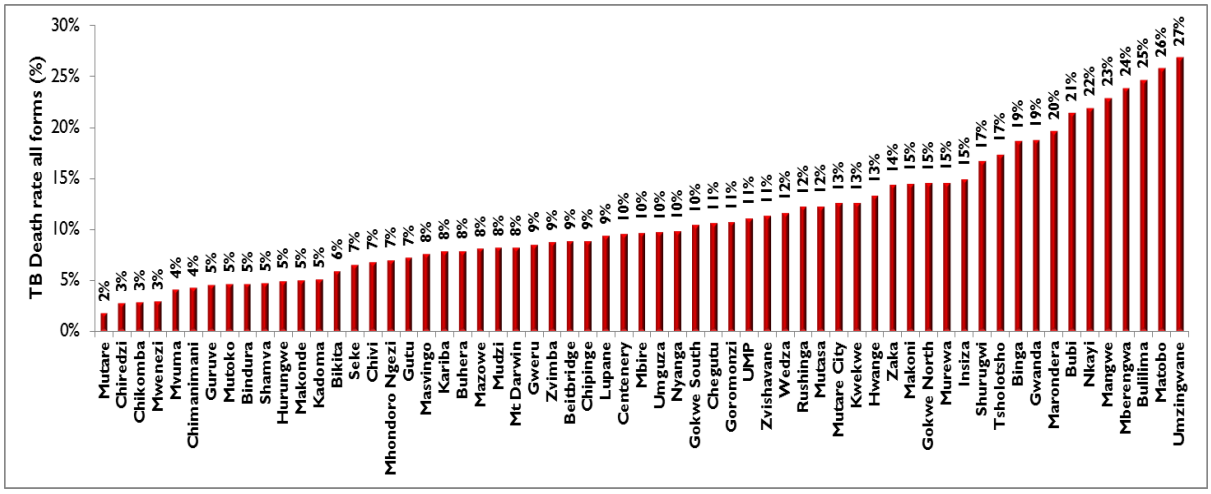

Figure 3: TB death rates for districts in Zimbabwe: 2015 ***(Source: National TB Program data)***

People who are not aware of the signs and symptoms of active TB will be more likely to delay in seeking care. Others may know that they probably have TB but cannot afford the user fees required for consultation at public health institutions. As such, they resort to other cheaper alternatives which include consulting traditional or spiritual healers (17-19). In addition to the individual factors, health system related factors like poor access to quality health services particularly in the rural areas also contribute towards delays (14, 20, 21). Adverse outcomes like death, treatment failure and development of DR-TB are also prevalent among people with poor adherence (22-24). Patients may also lack adequate knowledge of the fact that TB is curable and thus lack the motivation to complete the entire treatment course. Some may be too poor to afford the costs for the repeated visits to health facilities where directly observed therapy, short-course (DOTS) is administered (25). Some patients may also lack psychosocial support and get stigmatised within communities. Such individuals fail to freely disclose that they are sick and on treatment leading to poor adherence (26-28). Improving community

knowledge of TB and reducing stigmatising attitudes towards it are essential in improving adherence and reducing the occurrence of adverse outcomes (29).

1.1.4 Community TB interventions

TB is a social disease (30), and the public health response to it does not only focus on addressing the biomedical aspects alone. That is why addressing the social determinants of health is a fundamental component of the End TB Strategy (31). There is a high recognition of the current global efforts to end TB by 2035 that harnessing community involvement can improve early case detection, access to appropriate treatment and adherence (32, 33). In particular, public health interventions are now also focusing on improving community knowledge of TB and reducing stigma towards it.

Community interventions are context-specific and should be mindful of the religious, demographic and socioeconomic factors associated with knowledge and stigma towards TB (34). Even within the same country, these factors may vary between rural and urban communities. There is however limited literature on the factors associated with knowledge and stigma towards TB in Zimbabwe.

1.2 Literature review

1.2.1 Knowledge of TB

Knowledge of TB is a subjective measure of how well informed an individual is about the disease (35). Specifically, it is an assessment of what an individual knows regarding the cause of TB, how it is transmitted, treated, at what cost, whether it can be cured and other related

factors (36). A set of questions are often used by researchers to quantify a participants' knowledge of TB. Points are awarded for correct responses (37-39).

1.2.1.1 Individual factors associated with knowledge of TB

Persons who would have been treated for TB are bound to know more about the disease than those who may not have been close to a TB patient before. In Ethiopia TB patients were organised into clubs that assisted in raising awareness, finding TB cases and supporting those on treatment by sharing their own experiences with much success (40). Authors seem to agree that gender differences in knowledge of TB exist (41, 42). In Vietnam, for example, men are more informed about the disease than women (43). Individuals with higher level of education are more knowledgeable about TB than the illiterate (38, 44). However, in one study from Bangladesh, there was no association between level of education and knowledge about TB (42). Older people, particularly those not well educated, have been shown to have poor knowledge of TB (37, 45). Individuals from the upper class, with a better socioeconomic status (SES), have been reported to be more informed about TB that the poor (44). I did not find any study has been done to document individual factors associated with knowledge of TB and stigmatising attitudes in Zimbabwe.

1.2.1.2 Community factors related to knowledge of TB

A systematic review by Chang *et al.* showed how communities have different views regarding the causes of TB and how it is transmitted (46). The varying opinions were reported to be influenced by religion (47), cultural beliefs and norms within communities. Even within the same country, knowledge of TB varies across regions. For example, in Pakistan urban dwellers

were reported to have better knowledge of TB than their rural counterparts (48). The source of TB information is also associated with their knowledge of TB (44). However, I did not find any literature on the community factors associated with good knowledge of TB within my study population.

1.2.2 Stigma towards TB

Stigma is when a level of degradation and disgrace is associated with a particular person because of their condition. It is commonly experienced by patients with TB because their situation is viewed as being shameful and embarrassing in many countries (46).

Stigma exists on two levels. Internal or self-stigmatisation is when one has negative public stereotypes and translating those opinions onto oneself (49). External/felt stigma is when one gets stigmatised by the community (50, 51). Any of these two levels of stigma towards TB have been associated with delays in seeking care (52), poor adherence (53) which leads to adverse treatment outcomes (54). To address internal stigma interventions should target patients diagnosed with the TB disease. However, interventions should focus on the community's perceptions towards people with TB when addressing external stigma.

1.2.2.1 Measurement of stigma towards TB

Qualitative instruments have been used by researchers to measure the levels of stigmatising attitudes among study participants (54-56). There is, however, no agreed standard way of objectively measuring stigma. Macq *et al.* proposed four broad dimensions that can be used to determine stigma (57). Their tool had questions that determined if the TB patients felt alienated,

were being discriminated, had withdrawn from society and if they had been associated with specific stereotypes. In a study done in Ethiopia, binary responses (stigmatising or non-stigmatising) on these four broad areas were used to determine the level of stigma towards TB (58). Another study from India also used similar binary responses and the level of stigma for a participant was determined by the number of stigmatising responses they had given (45).Some have also used total sum to scores to responses on questions assessing stigma on a Likert scale to reflect an individual's level of stigma (26). A higher score would indicate a increased level of stigma. Although authors have used different methods to measure the level of stigma, all of them had good reliability. The choice of which method to use in mostly influenced by how the primary data was collected.

1.2.2.2 Factors associated with stigma towards TB

TB disproportionately affects the poor and most vulnerable people in communities in most countries (8, 9, 59). It is thus not surprising that stigma towards TB is higher towards individuals with a low socioeconomic status (SES) and who are uneducated (60, 61). In Zambia, women were reported to experience higher levels of stigma than their male counterparts (28). Likewise in India, women with TB are more likely to lose their families and livelihoods because of stigma compared to men (62). Opposing views exist on how age is associated with stigma towards TB. For example, a study from India failed to demonstrate any relationship between age and experiencing stigma (45). While in Nigeria individuals of the working age group of 20 – 50 years experience more stigma than others (60). Stigma also varies across geographic locations. In Bangladesh for example, levels of stigma were much higher among participants from the villages as compared to those from urban areas (58).

In most Sub-Saharan countries TB is closely linked with HIV. As such, most TB related stigma is linked to HIV infection (28, 34, 62). Patients with the disease are often perceived to be promiscuous and social misfits (56). Some people also stigmatise individuals with TB because of a fear of getting infected (59, 63) particularly in this era of multi-drug resistant TB (MDR-TB). For this reason, healthcare workers (HCWs) have also been reported to have high levels of stigma towards patients with TB. In Thailand, religion influences levels of stigmatising attitudes and Muslims were reported to have higher levels (61).

1.2.3 Knowledge of TB and stigmatising attitudes towards it

Primary health approaches to address stigma mainly focus on increasing community knowledge of the causes of TB, how it is transmitted, treated and that it is curable. Communities with the correct knowledge of TB thus are thought to have less stigmatising attitudes towards those affected (36). Very few if any public health programs try to address some of the religious, demographic and sociocultural factors that may drive stigma against TB in communities.

1.3 Conceptual Framework

Knowledge of TB and level of stigmatising attitudes are all subjectively measured variables. Their relationship is a complex one and can directly or indirectly be as a result of individual or community-related factors. Some of these factors can be objectively measured while others need to be constructed as latent variables. I hypothesised that a person's level of stigmatising attitude is a direct result of their knowledge of TB. Both poor knowledge and high levels of stigmatising attitudes can lead to practices which result in reduced adherence, treatment failure, death and continued spread of TB infection within communities. Some of these practices

include delay in seeking care, poor infection control practices when coughing, defaulting treatment or even refusing to take medication. However, outsomes or their relationship with knowledge and stigmatising attitudes were outside the scope of this study. Figure 4 is an illustration of my conceptual framework for this study. The literature review section discusses in detail the components of the conceptual framework.

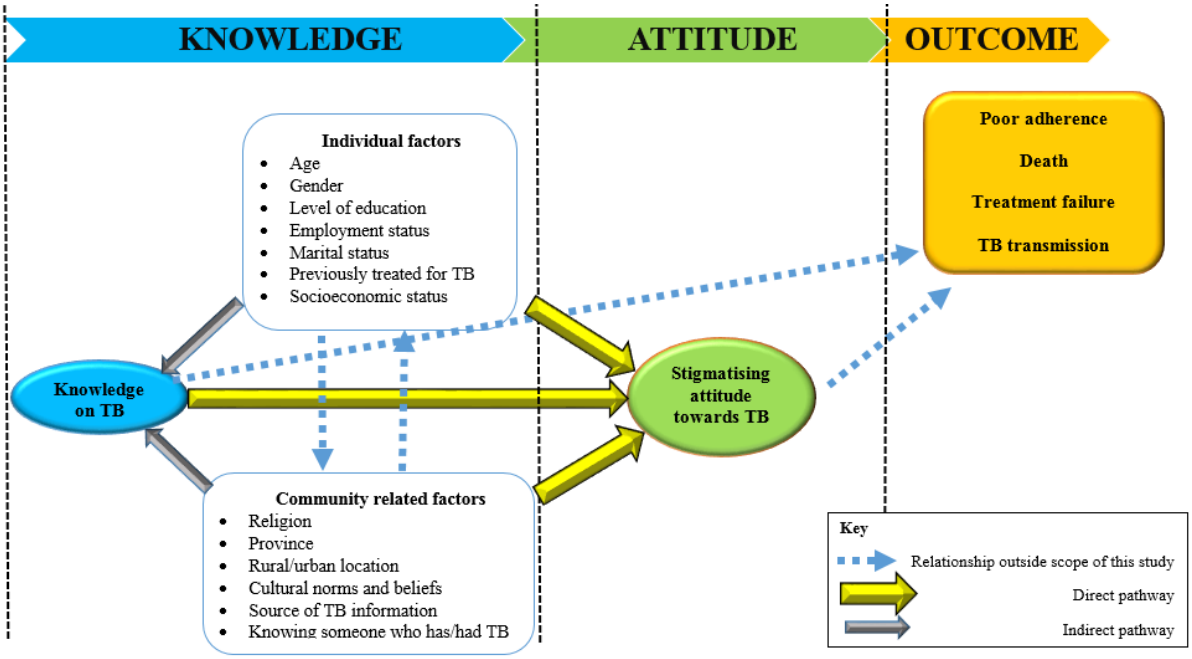

Figure 4: Conceptual framework on the association between knowledge of TB and stigmatising attitudes

1.4 Problem statement

Poor community knowledge of TB contributes to adverse treatment outcomes. Several socioeconomic, religious, and demographic factors have been documented to influence community knowledge of TB. Increasing community awareness on TB has been widely used by public health programs to address stigma. In addition to addressing knowledge of TB, other demographic, religious and socioeconomic issues may also need attention in order to reduce

stigma efficiently. The demographic, religious and sociocultural factors that influence knowledge and stigma towards TB differ among countries and context specific.

To the best of my knowledge, only one study from India has looked at the relationship between knowledge and stigmatising attitudes towards TB (45). This study had a selection bias and deliberately excluded individuals who had someone in their household with TB while only those who had heard of TB or knew of TB were included. The study also did not carry out a confirmatory factor analysis to identify the direct or indirect factors that affect the association between knowledge and stigmatising attitudes. Findings from this study from India may not be representative of what exists among communities in Zimbabwean communities.

There is need to generate local evidence that can be used to tailor-make public health responses to the local context. There is, however, a paucity of information in Zimbabwe on whether improved knowledge of TB among communities translates to reduced stigma towards those affected. As such, I set out to document this relationship in five provinces across Zimbabwe. I also wanted to identify the socioeconomic, religious and demographic factors associated with knowledge and stigma on TB in Zimbabwe.

1.5 Justification

My findings will augment the body of knowledge that would be used in the design of public health interventions that improve awareness and reduce stigma towards TB within communities. Unlike findings from other studies, my results are specific to the Zimbabwean

context. In addition, I have used generalised structural equation models (GSEM) to bring out the direct and indirect factors that influence the relationship between knowledge and stigmatising attitudes towards TB. These findings could also provide evidence that might help in the design of tailor-made community interventions to improve TB case finding, adherence to treatment and reducing the occurrence of adverse treatment outcomes in Zimbabwe. Literature from other countries has demonstrated that understanding these factors is a critical step that guides the design and implementation of community TB interventions (30, 46, 64). Studies of this association are however scarce in Zimbabwe where TB is a major public health problem.

1.6 Research question, aim, and objectives

1.6.1 Research question

Among adults in five provinces in Zimbabwe in 2016, does knowledge have an association with stigmatising attitudes towards tuberculosis?

1.6.2 Study aim

I wanted to determine the association between knowledge and stigmatising attitudes towards TB in adults from communities across five provinces in Zimbabwe in 2016.

1.6.3 Objectives

The specific objectives of this study were;

1. to describe the religious, socioeconomic and demographic characteristics of rural and urban communities across the five provinces in Zimbabwe in 2016;

2. to identify the factors associated with knowledge of TB in adults from communities across five provinces in Zimbabwe in 2016;
3. to determine how knowledge is associated with stigmatising attitudes towards TB across five provinces in Zimbabwe in 2016.

Chapter 2: METHODS

This chapter describes the method used in carrying out this study. It highlights the study design, population, and how sampling was done. In this section, I also provide information on data collection, including generation of variables that were used in the analysis. I will also discuss some of the sources of bias and how I controlled for potential confounders.

2.1 Study design

This was a cross-sectional study using data collected from Knowledge, Attitudes, and Practices (KAP) study conducted by The Union in April 2016.

2.2 Study sites

The primary KAP study was carried out in five of the ten provinces in Zimbabwe namely Masvingo, Bulawayo, Matabeleland South, Manicaland, and Midlands (see Figure 5). These provinces have the highest TB notifications and death rates in Zimbabwe. They are also part of the six that are supported by The Union in Zimbabwe.

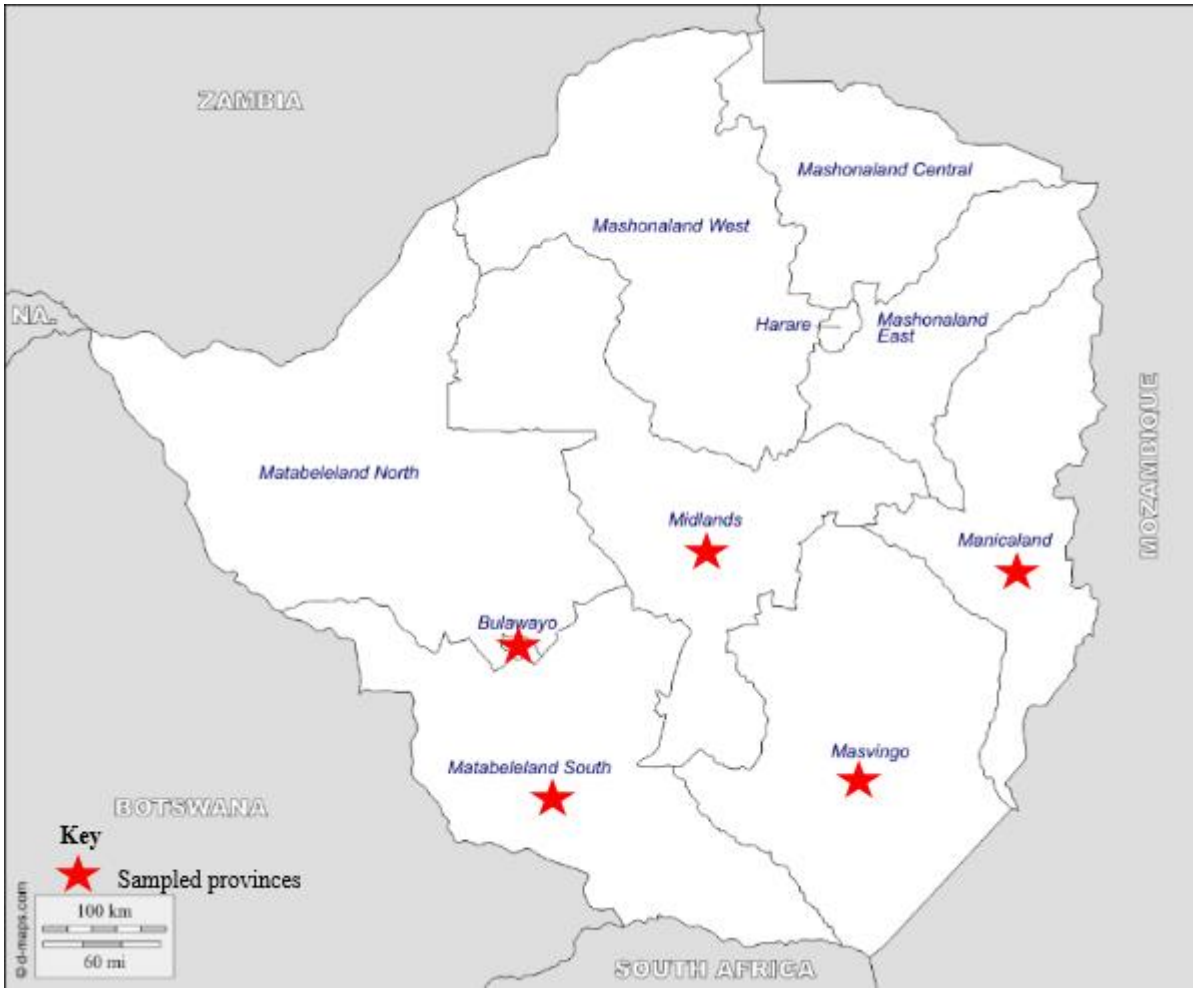

Figure 5: Map showing the ten provinces in Zimbabwe

2.3 Study population and sampling

The study population was adults, 18 years and older, from the randomly sampled households that participated in the primary KAP study. I included all the 634 participants that took part in the KAP study for this secondary data analysis. For this study, the sample size had sufficient power (greater than 80%) at 5% significance level. Results from a similar study done in India showed that 29% of participants that had good knowledge of TB did not have stigmatising attitudes towards it (45). As such, in my power computation, I used an effect size of 42% which

is the measured difference between the proportion which we assumed to have had good knowledge and poor knowledge. Appendix A shows the syntax and outputs for power calculation from STATA.

The primary study used multistage sampling (see figure 6). They randomly chose five provinces from the six that are supported by The Union in Zimbabwe. Two districts with the highest TB notifications were then purposively sampled from each of these five provinces. In each districts, two wards were chosen using simple randomisation from a sampling frame that included all the wards. Systematic sampling was then done to select households in each ward. They would then recruit one adult 18 years or older from each home for interview using a pre-validated structured questionnaire. The questions were all administered by a trained field officer. If there were more than one eligible adult available at the house, the Kish grid method was used to select the participant (65). In cases where no people were available or suitable in the selected household, then substitution was done with the next home. If the selected respondent was not willing to participate, he or she would be substituted by another.

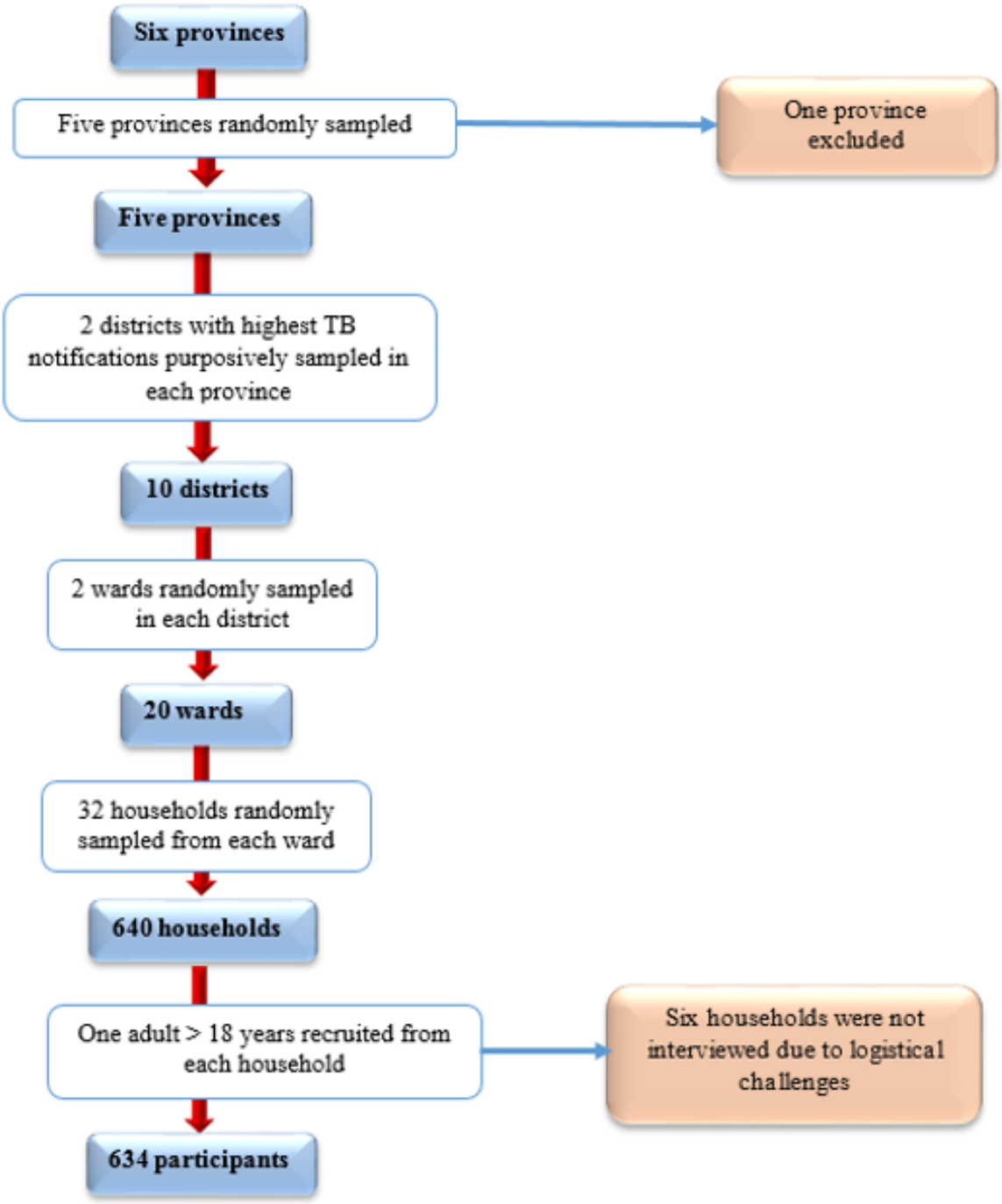

Figure 6: Multistage sampling done in the primary study

2.4 Data collection

This study was a secondary data analysis, and no additional field work was carried out. Pre-validated structured questionnaires developed for the KAP were used to collect data from the participants in the primary study. All the questionnaires from the KAP were then recaptured using Research Electronic Data Capture (REDCap) (66) hosted at the University of the Witwatersrand by a trained data capture. The tool in REDCap was programmed to automatically generate the composite knowledge scores for the participants (see Appendix B). The knowledge scores were not available in the original dataset hence the decision to recapture the questionnaire using REDCap.

2.5 Data Management

The data captured using REDCap was exported onto STATA version 13.0 (StataCorp LP college station, TX) for management and analysis. The data were inspected for inconsistencies as well as missing values. A logic check was used to look for possible errors made during data entry. Verification with the original questionnaire would be done and where appropriate corrections made if errors were detected. Recoding and transformation of variables from continuous to categorical variables and vice versa were performed where necessary.

2.6 Generation of new latent variables

New variables were generated from the original data and used in my analysis to answer the research question. These include;

2.6.1 Composite knowledge score (CKS)

The CKS was a continuous variable used to measure the participant's knowledge of TB. In the primary study, an inquiry on what the participants knew regarding how TB is transmitted, common symptoms, prevention, the seriousness of the disease, whether it can be cured and treated was carried out. Also, they were asked if they knew of MDR-TB as well as the cost of diagnosis and treatment of TB in Zimbabwe. These variables collected in the primary study were then used to generate scores of correct responses in REDCap. A single point was given for each correct answer. The maximum score that any participant could get was 13. The CKS was a proportion of the total points accumulated by the individual over the maximum possible score. Table 1 shows the questions used to generate the CKS and the correct responses expected.

Table 1: Variables used to generate composite knowledge score

Variable description	Correct response(s)	Score
How can a person get TB?	Through the air when a person with TB coughs or sneezes	1
What are the signs and symptoms of TB?	Cough A cough longer than 2 weeks Coughing up blood Weight loss Fever Fever without clear cause that lasts more than 7 days	6
How can a person prevent getting TB?	Covering mouth and nose when coughing or sneezing	1
In your opinion, how serious is TB?	Very serious	1
Can TB be cured?	Yes	1
If yes, how can someone with TB get cured	Specific drugs that are given at the health centre	1
Have you ever heard of MDR-TB	Yes	1
How expensive do you think TB diagnosis and treatment is in this country?	It is free of charge	1
Total score		13

2.6.2 Good knowledge of TB

The CKS was used to generate a binary variable on whether or not a participant had good knowledge of TB. I used the mean CKS as the cut-off point. Individuals who had scored below it had poor knowledge of TB.

2.6.3 Stigmatising attitudes

I measured stigmatising attitudes on an ordinal scale with three levels (none, some and high stigma) using participants' responses to three questions. The questions from the questionnaire that I used to generate the level of stigmatising attitude are; (1) What would be your reaction if

you find out that you had TB? (2) What is your feeling about people with TB? (3) In your community, how is a person with TB usually regarded/treated? For each of these questions, I created binary variables from these questions in STATA based on whether their response was stigmatising or not.

A participant's level of stigmatising attitude was dependent on the number of stigmatising response they gave on these three questions. If the responses to all the three questions were stigmatising the participant was classified as having a high stigma. To the contrary, participants that did not give stigmatising responses had no stigma. Participants that had at least one stigmatising response on the three questions got classified as having some stigma.

2.6.4 Socioeconomic status (SES)

Principal component analysis (PCA) was used to generate the SES for the study participants (67). This includes ownership of some durable household assets (radio, scotch cart, cell phone, etc.) and domestic animals (cattle, goats/sheep) that have some economic value among communities in Zimbabwe were included in the PCA. Also, whether or not the participant had any means of earning an income (formal employment or self-employed) as well as having access to modern amenities (electricity, piped water and flush toilets) were included in the PCA.

The first step was to recode all the variables that were to be included in my PCA into a binary form. This was made to reflect whether or not the participant possessed that particular durable household asset or quality. The first step was to carry out descriptive statistical analysis and

variables in which less than 10% of the participants had them were excluded in the analysis. Eventually, I used 21 variables from the questionnaire to come up with the PCA score, and this was important to avoid truncation and clumping. To ensure that all the data had an equal weight, my analysis was carried out using a correlation matrix. I then run the PCA in STATA and generated eigenvalues for some principal components. Figure 7 is a scree-plot of the principal components and their corresponding eigenvalues.

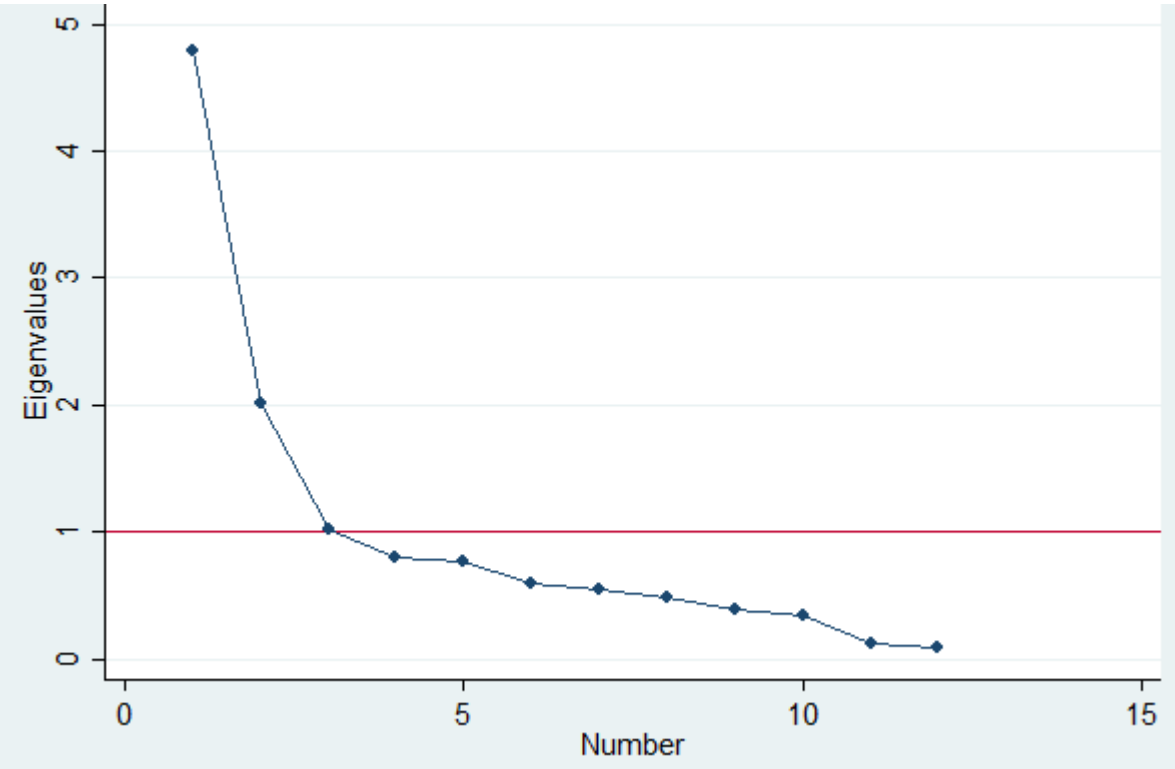

Figure 7: Scree-plot of eigenvalues after PCA

I used Keiser's rule to retain the first two components which had eigenvalues greater than one as shown in figure 7(68). In order to get a better understanding of these two principal components, the factor scores for each of the 21 variables included in the PCA were plotted against each other as shown in figure 8. The figure shows that items or variables of items that

are commonly found in urban areas had higher loadings on component 1. In other words, having access to piped water, electricity and ownership of household items like a fridge, TV and DStv was associated represented higher SES on component 1. Likewise, ownership of things like a bicycle, cattle or a solar panel represented a low SES on the same component.

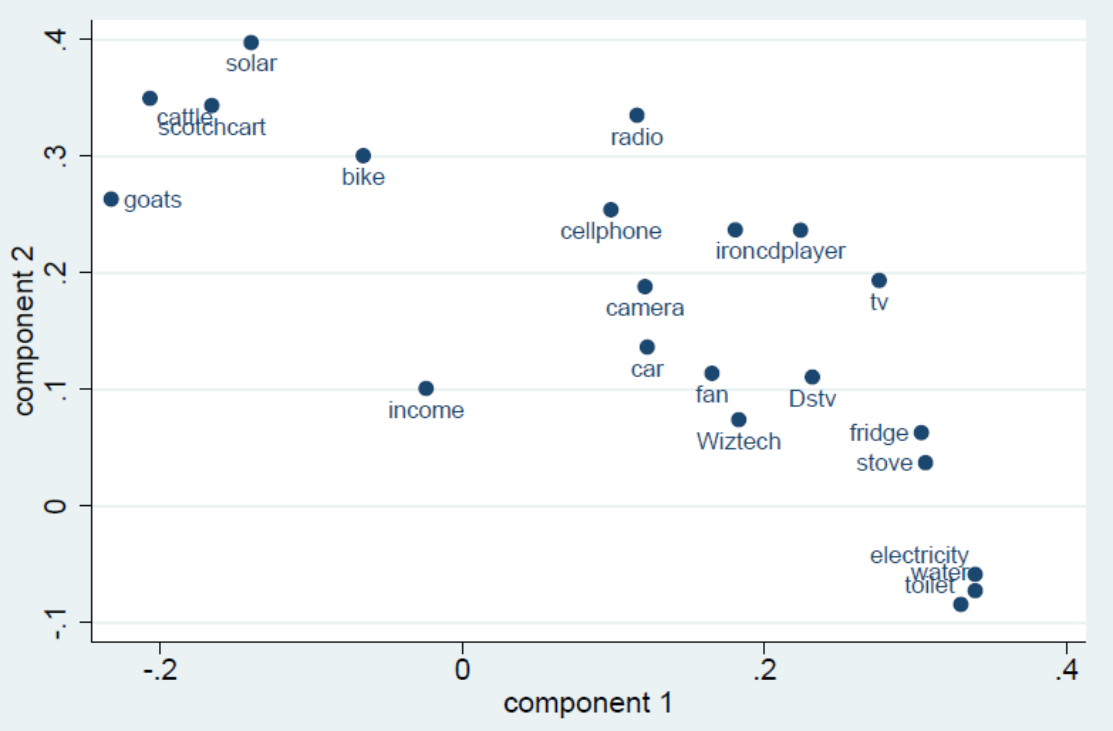

Figure 8: Loadings plot of component 1 and 2 from PCA

I then used the component 1 to generate a new variable of SES scores for each participant. This was done using the *predict* command in STATA. I then ranked the participants from the lowest to the highest based on their SES scores and divided them into three groups of equal size. Participants that had the lowest SES scores were classified as belonging to poorest SES group. Those that had the highest SES were categorised as belonging to the upper class and likewise

the those in the middle group the middle class. And this is how I generated the SES class for each participant.

2.7 Data analysis

2.7.1 Religious, demographic and socioeconomic characteristics of communities

My first objective was to describe the religious, demographic and socioeconomic characteristics of participants from the rural and urban communities within the five provinces. I used different tests to analyse continuous and categorical variables

2.7.1.1 Analysis for continuous variables

Continous variables like the participants' CKS were described using means and their 95% confidence interval (CI) (see table 2). I inspected all the continuous variables to determine if they were normally distributed using both graphical and numerical methods. Graphically this was done by plotting histograms using the syntax *histogram var, normal* in STATA. Numerical methods were also used to test for skewness and kurtosis using the *sktest var* syntax. For continuous variables that were normally distributed I used a t-test to determine if there were significant differences between rural and urban communities at 5% significance level.

2.7.1.2 Analysis for categorical variables

Chi-square test was used to determine differences in the characteristics of rural and urban participants for categorical variables at 5% significance level. A Fisher's exact test was used instead in cases where there was a count of less than five.

2.7.2 Factors associated with good knowledge of TB

Both univariate and multivariable logistic regression models were fitted to determine the factors related to good knowledge of TB. Whether or not a participant had good knowledge of TB was the dependent variable in the model. Independent variables were the ones identified from the literature and included in my conceptual framework.

2.7.2.1 Univariate analysis

I conducted univariate logistic regression to determine the factors in my conceptual framework that were associated with having good knowledge of TB. For all categorical variables, one of the levels was used as a reference. Only the statistically significant variables (see table 2) were all included in the multivariable analysis.

2.7.2.2 Multivariable analysis

I conducted multivariable logistic regression to identify factors associated with good knowledge of TB while controlling for potential confounders. I initially fitted a full model that included variables which were statistically significant in the univariate analysis including interaction terms. I made use of the likelihood ratio test to remove unnecessary variables and generate a parsimonious model (see Appendix C). The final model was statistically significant (p-value <0.001). The final model was tested to see if it met the assumptions for logistic regression. Graphical and numerical methods were used to check for any influential values that would affect the model. The link test was used to check for any misspecification errors. I used

the Hosmer-Lemeshow post-estimation to test for goodness-of-fit of the final model (69). I used tolerance and variance inflation factor to check for multicollinearity among the variables included in the final model.

2.7.3 Association between knowledge and stigmatising attitudes on TB

I used ordinal logistic regression (OLR) to determine the relationship between good knowledge of TB and stigmatising attitudes towards it. A confirmatory factor analysis (CFA) was then done using generalised structural equation modelling (GSEM) was then done to identify factors that are directly and indirectly associated with stigmatising attitudes towards TB.

2.7.3.1 Ordinal logistic regression

I initially carried out univariate OLR to identify the association between good knowledge of TB and stigmatising attitudes towards it. The analysis was also extended to include identification of individual and community-related factors from my conceptual framework that is associated with stigmatising attitudes. All the statistically significant variables were then included in the multivariate analysis.

I carried out a multivariable OLR to determine the association between good knowledge of TB and stigmatising attitudes towards it while controlling for potential confounders (see Appendix D). The final parsimonious model was statistically significant (p-value <0.001). The *brant, detail* command in STATA was done and confirmed that my last model did not violate the proportional odds assumptions (70).

2.7.3.2 Confirmatory factor analysis

Confirmatory factor analysis using GSEM was carried out after the OLR. I did this to identify the individual and community factors that were directly and indirectly associated with stigmatising attitudes from my conceptual framework. The categorical variables were all converted into binary form. If a participant had a particular characteristic they were coded as 1 and if not 0. I included all the variables that were significant in the univariate OLR in the initial model. I then sequentially excluded all pathways that were not significant (p-value > 0.10) from the model (see figure 11).

From the final fitted GSEM, I was able to identify statistically significant direct pathways of factors associated with stigmatising attitudes. Direct pathways meant that factors have a significant association with stigmatising attitudes while controlling for other confounders (71). There were also a few factors that had significant indirect pathways with stigmatising attitudes with good knowledge of TB being a mediator (71). I used the *nlcom _b[gdknow: var]* command in STATA to generate the coefficients and p-values for these pathways. For each of the individual and community-related factors that were associated with stigmatising attitudes towards TB, I also calculated their total effects. This was the total of both the direct and indirect pathways (71, 72). This would be particularly important in telling us the overall effect of each variable on stigmatising attitudes.

2.8 Ethics

Ethical clearance was granted by the University of the Witwatersrand Human Research Ethics Committee (HREC) (Certificate Number M170240) (see Appendix E). The primary KAP study

had also received ethical clearance from the Medical Research Council of Zimbabwe on 4 April 2016 (Reference number MRCZ/A/2055). The Union also granted me permission to carry out secondary data analysis for this study. In the KAP, all participants were older than 18 years, and informed consent was sought and granted. The data used did not have any names or personal identifiers. This research report will be shared with The Union and also published in a peer-reviewed journal. The findings will add on to the existing body of evidence used in the development of country targeted interventions to prevent and control TB among the communities that participated in the primary study.

Chapter 3: RESULTS

This chapter will present the results of this study. I start with a description of the characteristics of the study participants. I then give my findings on the factors that associated with knowledge of TB. I then go on to report my results on the demographic, religious and socioeconomic factors associated with stigmatising attitudes towards TB. The last section will highlight my findings on the association between knowledge of TB and stigmatising attitudes.

3.1 Characteristics of the study participants

I carried out my study in five provinces namely Bulawayo, Matabeleland South, Manicaland, Midlands, and Masvingo. Table 2 shows the characteristics of the participants recruited in this study in both the rural and urban communities. The majority of the study participants (67%) were from the rural communities. Similarly, the last national census showed that 67% of the country's population is in the countryside (73). The participants were mostly adults with an average age of 40.7 years (95% CI 39.5 – 42.0), and most of them were women (72%). There was no significant age differences among individuals from rural and urban communities. However, as expected participants from the countryside were more likely to be female (p-value 0.005).

Participants from urban areas had higher levels of education (p-value <0.001). They were also more likely to be formally employed compared to their rural counterparts who reported being unemployed or self-employed (p-value 0.001). Most of the participants (69%) were married.

Nonetheless, there was a significant difference in marital status between urban and rural areas (p-value <0.001) with higher divorce rates observed among the urban dwellers. As expected participants from the urban areas where more likely to have a better socioeconomic status (p-value <0.001).

Significant differences between religious affiliations were noted in these two communities (p-value <0.001). Most participants that belonged to Apostolic sects were from rural areas (72%). Manicaland (27%) and Bulawayo (23%) provinces combined contributed half of the participants. Unlike in Bulawayo, the majority of participants from each of the other provinces were predominantly from rural communities (p-value <0.001).

Over 90% (570/631) of the people I recruited had heard of TB before. Participants from urban communities were more likely to have heard of TB compared to those from rural areas (p-value < 0.05). In total, 80% (497/623) of the participants knew of someone who had been treated for TB, and this was more common among participants from rural than urban communities (OR 1.60; 95% CI 1.01 - 2.57). There was no significant difference in the proportion of people who had received information on TB between rural and urban communities. Table 2 summarises my findings on the demographic, religious and socioeconomic characteristics of the participants.

Table 2: Characteristics of study participants

Variable	Rural N=419 (67%)	Urban N = 210 (33%)
Age (years)*	41.7 (40.2 – 43.2)	39.0 (37.0 – 41.1)
Gender *		
Female	287 (63)	116 (37)
Male	132 (75)	44 (25)
Level of education**		
None	30 (91)	3(9)
Primary	154 (70)	65 (30)
Secondary	223 (66)	115 (34)
Tertiary	9 (28)	23 (72)
Employment status*		
Domestic worker	14 (61)	9 (39)
Self employed	190 (73)	70 (27)
Formally employed	15 (42)	21 (58)
Unemployed	193 (65)	102 (35)
Student	7 (47)	8 (53)
Marital Status**		
Divorced	18 (45)	22 (55)
Married	312 (71)	125 (29)
Single	41 (55)	34 (45)
Widowed	47 (63)	28 (37)
Socio-economic status**		
Poorest	208 (99)	2 (1)
Middle class	172 (83)	36 (17)
Richest	39 (18)	172 (82)
Religion**		
Apostolic sects	150 (75)	49 (25)
Pentecostal churches	112 (60)	74 (40)
Traditional churches	95 (58)	70 (42)
Other groups	33 (85)	6 (15)
None	28 (72)	11 (28)
Province**		
Bulawayo	1 (1)	143 (99)
Manicaland	129 (75)	42 (25)
Masvingo	141 (99)	1 (1)
Matabeleland South	65 (100)	0 (0)
Midlands	83 (78)	24 (22)
Proportion that know someone who had TB*	0.78 (0.74 – 0.82)	0.85 (0.80 – 0.90)
Proportion who heard of TB before*	0.88 (0.85 – 0.92)	0.94 (0.91 – 0.97)
Knowledge of TB**		
Poor	220 (76)	69 (24)
Good	199 (59)	141 (41)
Composite knowledge score on TB**	0.39 (0.37 – 0.41)	0.46 (0.44 – 0.48)

**p-value <0.05; **p-value <0.001*

3.2 Knowledge of TB

The mean composite knowledge score was 0.41 ± 0.20, and it varied significantly across the five provinces (p-value <0.001). Bulawayo (0.47 ± 0.16) had the highest while Masvingo (0.31 ± 0.20) the lowest knowledge of TB. Figure 9 shows the knowledge scores across the five provinces.

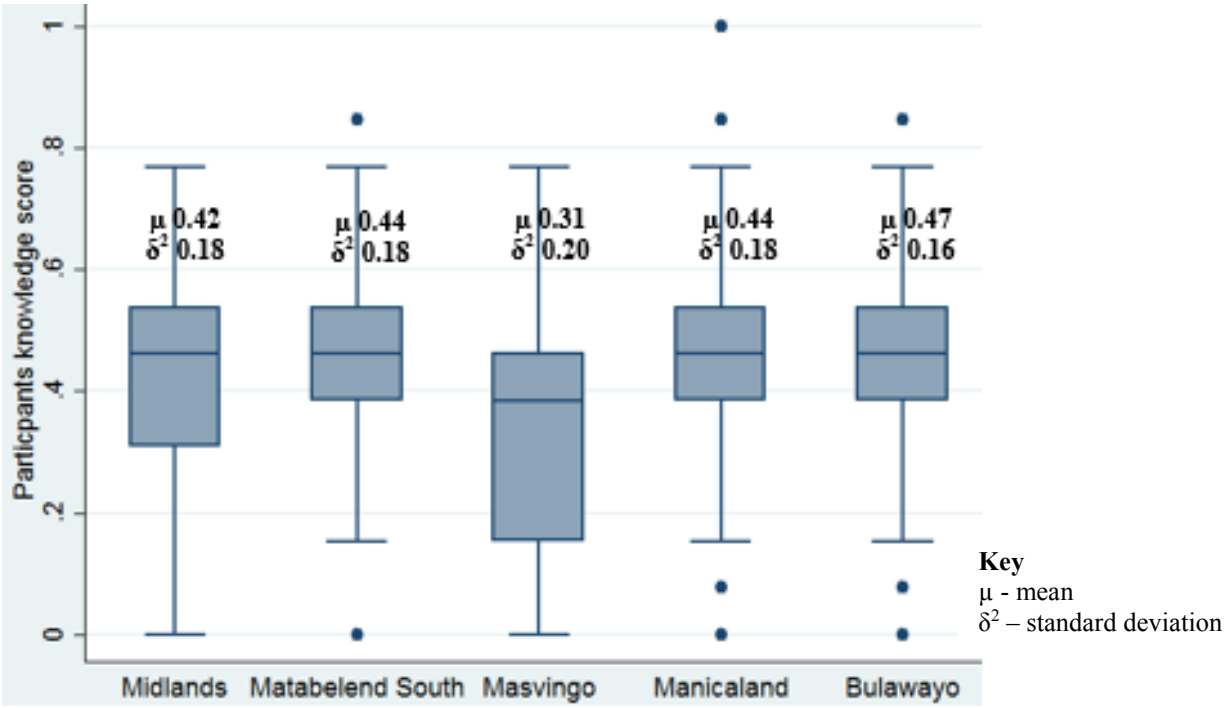

Figure 9: Knowledge scores across the five provinces

3.2.1 Results from the univariate and multivariable logistic regression

On univariate analysis knowledge of TB was much higher among those with a higher socioeconomic status compared to the poorest (OR 3.94; 95% CI 1.66 – 9.31). Similarly, participants from urban areas were more likely to have good knowledge of TB than individuals from the rural communities (OR 2.96; 95% CI 1.60 – 3.19), but this was not significant after

controlling for other factors. The likelihood of having good knowledge of TB also varied among provinces on univariate analysis. Specifically, participants from Masvingo province were less likely to have good knowledge of TB compared to those from Bulawayo (OR 0.23: 95% CI 0.14 - 0.38). Individuals who reported attending Pentecostal churches were more likely to have good knowledge of TB compared to those from the Apostolic sects (OR 1.53; 95% CI 1.02 – 2.92) nevertheless this association was also not significant in the final adjusted model. Age, Gender, marital status, employment status and source of TB were all not significantly associated with good knowledge of TB on univariate analysis. Table 3 shows only the factors that are significantly associated with good knowledge of TB in either the univariate or multivariate analysis.

Knowledge of TB was higher among the educated participants compared to the illiterate. More specifically, individuals that had attained a tertiary level education were six times more likely to have good knowledge of TB than the uneducated (AOR 6.86; 95% CI 1.82 – 25.9). Individuals who knew of someone who has/had TB were more than twice as likely to have good knowledge of TB than those who did not (AOR 2.67; 95% CI 1.71 – 4.17).

Table 3: Factors significantly associated with good knowledge of TB

Variable	Unadjusted	Adjusted
	OR (95% CI)	**AOR (95% CI)**
Level of education		
None	1.00	1.00
Primary	3.68 (1.53 – 8.83)*	2.22 (0.85 – 5.77)
Secondary	4.84 (2.04 – 11.5)**	2.51 (0.97 – 6.47)
Tertiary	16.1 (4.76 – 54.4)**	6.86 (1.82 – 25.9)*
Socio-economic status		
Poor	1.00	1.00
Middle class	1.38 (0.66 – 2.25)	1.05 (0.66 – 1.67)
Upper class	3.94 (1.66 – 9.31)**	1.34 (0.67 – 2.67)
Religion		
Apostolic sects	1.00	1.00
Pentecostal churches	1.53 (1.02 – 2.92)*	1.34 (0.86 – 2.10)
Traditional Christian churches	1.43 (0.94 – 2.16)	1.39 (0.88 – 2.20)
Other religious groups	0.53 (0.26 – 1.07)	0.61 (0.28 – 1.34)
None	0.49 (0.24 – 1.01)	0.55 (0.25 – 1.20)
Province		
Bulawayo	1.00	1.00
Manicaland	0.80 (0.50 – 1.27)	1.10 (0.55 – 2.19)
Masvingo	0.23 (0.14 - 0.38) **	0.56 (0.24 – 1.31)
Matabeleland South	0.64 (0.35 – 1.16)	1.31 (0.53 – 3.27)
Midlands	0.68 (0.41 – 1.14)	1.08 (0.51 – 2.31)
Rural/Urban location		
Rural	1.00	1.00
Urban	2.56 (1.60 – 3.19)**	1.30 (0.66 – 2.54)
Know someone who has/had TB		
No	1.00	1.00
Yes	2.99 (1.98 – 4.52)**	2.67 (1.71 – 4.17)**

**p-value < 0.05; **p-value < 0.001*

3.2.2 Results of logistic regression diagnostics

I used graphical methods identify any influential observations that would affect my model (see figure 9). There were no significant outliers that would affect the interpretation of my regression coefficients in my data. I also tested the final model for any misspecification error using the *linktest* command after fitting the model in STATA. The test was insignificant (p-

value 0.317) indicating that I did not leave out or include relevant variables in the final model. The Hosmer-Lemeshow post-estimation test for goodness-of-fit of the final model was carried out (69), and I did not see any evidence of a lack of fit (p-value 0.2884). The variables included in the final model did not have any multicollinearity as shown by the absence of very high standard errors. I confirmed this finding by looking at the tolerance and variance inflation factor (VIF) for the variables using the *collin* command in STATA (see Appendix F).

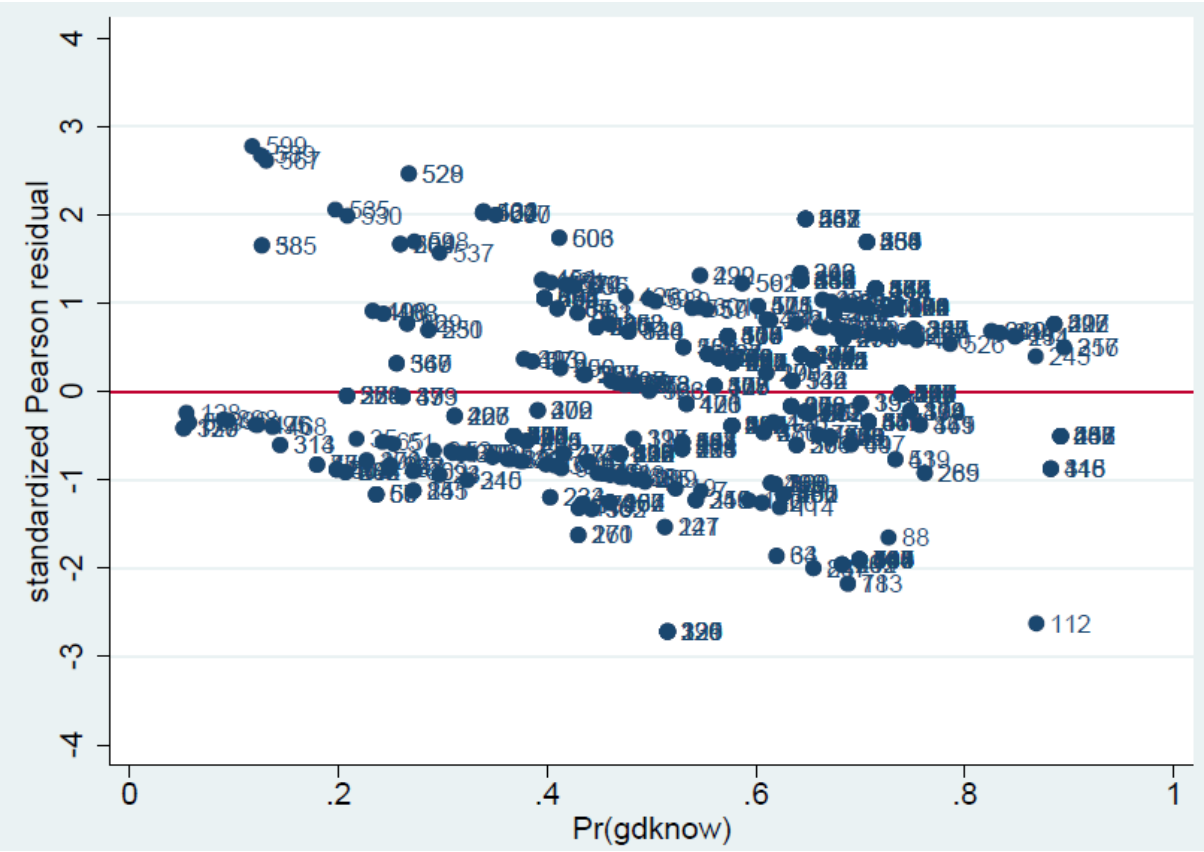

Figure 10: Scatter plot of standardised Pearson residuals and good knowledge of TB

3.3 Knowledge and stigmatising attitudes towards TB

3.3.1 Results from the univariate and multivariable ordinal logistic regression

There were some individual and community-related factors that had statistically significant associations with stigmatising attitudes after doing univariate OLR. However, this association was not significant after adjusting for other variables. In particular, participants from urban areas had greater odds of having higher levels of stigmatising attitudes than those from rural areas (OR 1.86; 95% CI 1.39 – 2.60). Levels of stigmatising attitudes also varied significantly across provinces after doing univariate OLR. In particular, individuals from Masvingo (OR 0.47; 95% CI 0.29 – 0.75) and Matabeleland South (OR 0.46; 95% CI 0.26 – 0.83) provinces were more likely to have lower levels of stigmatising attitudes than those from Bulawayo. Similarly, participants who reported attending Pentecostal churches (OR 1.56; 95% CI 1.04 – 2.33) were more likely to have higher levels of stigmatising attitudes compared to the ones those from apostolic sects. The likelihood of having higher levels of stigmatising attitudes was also greater in participants from the upper socioeconomic class (OR 1.86; OR 1.39 – 2.60) than the poorest.

More than half of my study participants (53%) had some level of stigma toward TB. There was no association between knowledge of TB and stigmatising attitudes (AOR 1.03; 95% CI 0.75 – 1.43). The likelihood of having higher levels of stigma was significantly lower with advancing age (AOR 0.99; 95% CI 0.98 – 0.99). When compared to individuals from apostolic sects, those who belonged to other smaller religious groups (Muslim, African tradition, etc.) were more likely to have higher levels of stigmatising attitudes (AOR 2.29; 95% CI 1.12 –

4.69). Table 4 summarises my finding from OLR on the factors associated with stigmatising attitudes.

Table 4: Factors associated with stigmatising attitudes

Variable	Unadjusted	Adjusted
	OR (95% CI)	**AOR (95% CI)**
Knowledge of TB		
Poor	1.00	1.00
Good	1.13 (0.83 – 1.54)	1.05 (0.75 – 1.46)
Age	0.99 (0.98 – 0.99)*	0.99 (0.98 – 0.99)*
Religion		
Apostolic sects	1.00	1.00
Pentecostal churches	1.56 (1.04 – 2.33)*	1.33 (0.87 – 2.01)
Traditional churches	1.04 (0.69 – 1.57)	0.93 (0.60 – 1.43)
Other groups	1.81 (0.92 – 3.57)	2.29 (1.12 – 4.69)*
None	1.13 (0.57 – 2.23)	1.19 (0.59 – 2.41)
Province		
Bulawayo	1.00	1.00
Manicaland	0.69 (0.44 – 1.08)	0.98 (0.53 – 1.83)
Masvingo	0.47 (0.29 – 0.75)*	0.79 (0.34 – 1.72)
Matabeleland South	0.46 (0.26 – 0.83)*	0.87 (0.37 – 2.04)
Midlands	0.63 (0.38 – 1.04)	0.99 (0.49 – 2.01)
Location		
Rural	1.00	1.00
Urban	1.86 (1.39 – 2.60)**	1.17 (0.63 – 2.17)
Socioeconomic status		
Poorest	1.00	1.00
Middle third	1.42 (0.97 – 2.08)	1.26 (0.82 – 1.94)
Upper class	2.39 (1.63 – 3.53)**	1.78 (0.93 – 3.41)

**p-value <0.05; p-value<0.001*

3.3.2 Results from the generalised structural equation model

I used GSEM to identify the individual and community-related factors, directly and indirectly, associated with stigmatising attitudes toward TB (see figure 11). There was no statistically significant direct relationship between having good knowledge in TB and level of stigmatising attitudes (p-value 0.820).

Advancing age directly resulted in a reduction in the likelihood of having higher levels of stigma (p-value 0.025). However, inderectly individuals with adancing age who had good knowledge of TB were more likely to have higher levels of stigma (p-value 0.034). In total, advancing age would increase the likelihood of having higher levels of stigma.

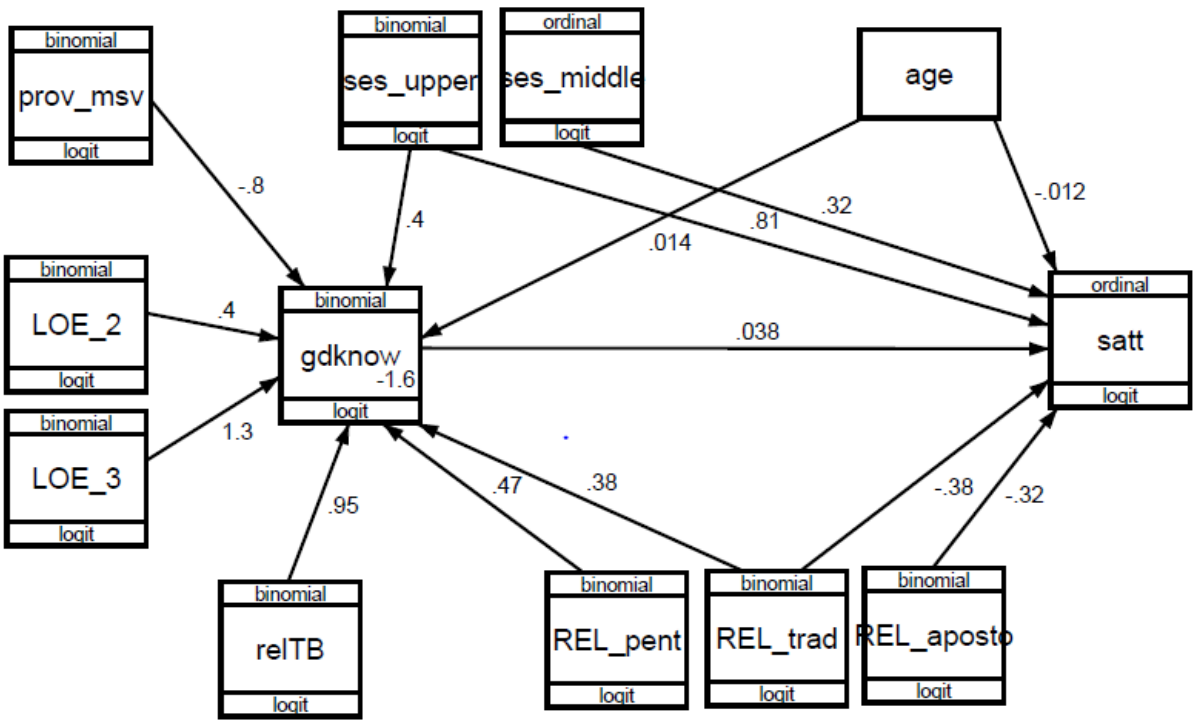

Figure 11: GSEM on the association between good knowledge and stigmatising attitudes towards TB

Key of variables

Prov_msv – Masvingo province; **LOE_2** – Secondary level of education; **LOE_3** – Tertiary level of education; r**elTB** – know someone who has/had TB; **gdknow** – good knowledge of TB; **ses_upper** – Upper SES class; **ses_middle** – Middle SES class; **satt** – stigmatising attitudes; **REL_pent** – Pentecostal churches**; REL_trad** – Traditional churches; **REL_aposto** – Apostolic sects

Table 5: Factors directly and indirectly associated with stigmatising attitudes from GSEM

Variable	Direct effects on stigmatising attitudes	Indirect effects mediated by good knowledge of TB	Total effects[§]
	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)
Good knowledge of TB	0.038 (0.1654889)	-	0.038 (0.1654889)
Age	-0.012 (0.0052877)**	0.014 (0.0065016)*	0.002 (0.0117893)
Socioeconomic status			
Poorest	-		-
Middle third	0.037 (0.1987424)	-	0.037 (0.1987424)
Upper class	0.807 (0. 2078371)***	0.403 (0. 2058116)*	1.21 (0.4136487)
Religion			
Apostolic sects	-0.319 (0.1913671)*	-	-0.319 (0.1913671)
Pentecostal churches	-	-	-
Traditional churches	-0.377 (0. 2030051)*	0.382 (0.2211904)*	0.005 (0.4241955)
Others	-		-
None	-		-

**p-value <0.100; **p-value <0.050; p-value < 0.001*

[§]Total effects calculated as (indirect + direct pathway)

Participants with an upper SES class were more likely to have higher levels of stigmatising attitudes (p-value <0.001). Similarly, indirectly people from the upper SES class were associated with higher levels of stigma towards TB (p-value 0.050). In total, participants from the upper SES were associated with higher levels of stigmatising attitudes towards TB.

Certain religious groups, in particular, apostolic sects (p-value 0.096) and traditional churches (p-value 0.063) were directly associated with lower levels of stigmatising attitudes. However, indirectly participants from traditional churches with good knowledge on TB were more likely

to have higher levels of stigma (p-value 0.084). The total effect of being affiliated to traditional churches would increase the likelihood of having higher levels of stigmatising attitudes.

Chapter 4: DISCUSSION AND CONCLUSION

This chapter will be a review of my most significant findings and what is in existing literature. I will also highlight some of the limitations of my study. In the last section, I will also state my conclusion on the association between knowledge and stigmatising attitudes towards TB as well as put forward recommendations for consideration in public health practice.

4.1 Community knowledge of TB

Most of the participants had heard of TB before, but sadly 12% and 6% of the rural and urban participants respectively had not heard of TB before. These high rates are particularly worrying for the National TB Program (NTP) and expose the inefficiencies or lack thereof in information dissemination on TB mainly to people from the rural areas. However, 80% of the participants knew of someone who has/had it. Such findings reflect how common TB is among Zimbabwean communities. It is thus not surprising that more than half of the participants had good knowledge of TB. Similar findings have been documented in studies carried out in other high burden African countries like Ethiopia (38, 74).

There was significant variation in community knowledge of TB across the five provinces. In particular, participants from Bulawayo province (0.47 ± 0.16) were more informed about TB than those from Masvingo (0.31 ± 0.20). Information from the NTP shows that Bulawayo also has significantly higher provincial notifications than Masvingo. And from my analysis, knowing someone who has/had TB meant that someone was more likely to have good

knowledge of TB. The provincial variation could be a result of the better quality of TB services accessed in the city compared to rural areas as observed in studies conducted in Nigeria (75) and South Africa (76). Most participants from Bulawayo were from urban settings while those from Masvingo were from rural communities.

From my univariate analysis, individuals from urban areas had better knowledge of TB. These findings are consistent with results from a study carried out in Pakistan (48). Differences in sociocultural beliefs and access to care between rural and urban communities may in part explain these findings. In addition, participants from the urban areas had a higher SES and were more educated than the rural fork. My univariate analysis showed that participants with a higher SES have better knowledge of TB than the poorest. These findings are also quite consistent with has been reported in other settings (43). Also, participants from the urban areas were more educated than their counterparts. Having attained higher levels of education in particular university degree was associated with a more than six times better knowledge of TB when compared to the uneducated. The differences could be attributed to the increased level of awareness and understanding that is typical of educated individuals. These findings are also similar to what has been reported in studies from Pakistan (44, 48).

Some sociocultural factors have been reported to affect community knowledge of TB. A systematic review carried out by *Chang et al.* (46) highlighted how religious and cultural beliefs influence how individuals perceive TB. Similarly, my findings show that having good knowledge of TB varied across religious affiliations. In particular, participants that confess to

attending Pentecostal churches were better informed than those who belonged to apostolic sects. Some studies from Zimbabwe have also shown that the apostolic sects have low uptake and/or high levels of misinformation around conditions that are of public health importance in the country (77-79). Most of these studies, however, focused on HIV, maternal and child health issues but none of them had explored their involvement in TB. Our findings are unique in that they also show how ignorant individuals who confess being affiliated to apostolic sects are regarding TB.

Surprisingly, some individual and community-related factors that were investigated were not associated with good knowledge of TB. My study showed that gender was not associated with good knowledge on TB in our setting. This is in contrast to what was reported in Ethiopia (38) and India (47). Similarly, other factors like age, marital status, employment status or source of TB information were not associated with good knowledge of TB. In contrast, one study from India reported that individuals who got their TB information from radios had better knowledge on TB (47).

4.2 Stigmatising attitudes towards TB

More than half of my study participants had some form of stigmatising attitudes towards TB. The results are very consistent with observations made in in some countries as well (28, 56). My initial hypothesis was that individuals who are well informed about TB would have lower levels of stigmatising attitudes towards it. Surprisingly, my results show no association between knowledge of TB and stigmatising attitudes towards it. Put simply, stigma towards

people affected by TB is not a result of a lack of knowledge by communities on what causes TB, how it is transmitted, prevented, treated or cured. Similar observations were reported in a study conducted in India with more than 4,500 participants from mostly rural communities (45). As such, current approaches to reducing stigma towards individuals affected by TB through various community awareness interventions may not be sufficient. A comprehensive package that considers several sociocultural factors closely linked with stigma also needs to be considered.

TB is a social disease (30), and addressing stigma requires a deeper understanding of the religious, demographic and socioeconomic factors associated with it. This study showed that people from urban settings were more likely to have higher levels of stigma than those from the rural areas. This is in contrast to findings from a study done in India where stigmatising attitudes were more common among rural participants (45). To add to this, provinces that were predominantly rural like Masvingo and Matabeleland South had lower levels of stigma compared to Bulawayo which is mostly urban. Participants from the upper class, with a better socioeconomic status, were associated with higher levels of stigma in my study. Evidence has shown that TB affects mostly the poor and underprivileged communities (8, 80). This close linkage between TB and poverty may be the reason why individuals from the upper class stigmatise those affected by it. However, one study from Zimbabwe had contrasting results on stigma towards HIV which was reported to be higher among the poorest (81).

The likelihood of having higher levels of stigmatising attitudes towards TB decreased with advancing age among my study participants. These findings are in contrast to what was observed in a study carried out in Sudan were older people had more stigma (82). Also, there seemed to be some association between stigma and religion. Religion has been well documented to closely influence stigma for other disease related to TB like HIV in Zimbabwe (83, 84).

Findings from my study also allowed us to interrogate further the direct and indirect factors that are associated with stigmatising attitudes using GSEM. As shown in the OLR, advancing age had a direct associated with lower levels of stigmatising attitudes. What was however interesting was that advancing age even in individuals with good knowledge of TB (indirect effect) was associated with higher levels of stigma ($p < 0.05$). In contrast, SES specifically the upper class had a direct and indirect association with higher levels of stigmatising attitudes. In other words, those form the upper SES class had higher levels of stigma regardless of their knowledge of TB. In addition, religious affiliations had a direct and indirect relationship with stigmatising attitudes. In particular, participants who confessed belonging to apostolic sects and traditional churches have lower levels of stigma. Surprisingly, participants from traditional churches with good knowledge on TB also had higher levels of stigma.

Literature that has used structural equation models to determine the direct and indirect factors associated with good knowledge of TB and stigmatising attitudes is currently scarce. However, findings from both OLR and GSEM agree in that there is no association between good

knowledge on TB and stigmatising attitudes towards it. These findings are in stark contrast to results that used a similar approach to determine direct and indirect factors associated to the knowledge of HIV and stigma (85). However, a study which was done in India also showed no association between knowledge of TB and stigmatising attitudes (45). In addition to what we already know from India, our study clearly showed that other demographic, socioeconomic and religious factors also, directly and indirectly, influence an individual's level of stigmatising attitude towards TB. Further to that, good knowledge on TB among people with advancing age, from the upper SES class and those who confess to affiliating to traditional churches are associated with higher levels of stigmatising attitudes. A few authors concur with this significant finding and as such addressing community knowledge alone does not sufficiently address the high stigma towards people affected by TB (27, 45, 59, 61, 63, 86). More studies that explore in greater detail some of the other sociocultural factors that drive community stigma towards people affected by TB in Zimbabwe will need to be carried out. Such information is useful in the planning and implementation of public health interventions that address knowledge of TB and stigmatising attitudes towards it.

4.3 Strengths and Limitations

I used secondary data that was collected only from participants that had been at home during the time interviewers conducted the home visits. This limited my choice of the variables I had in particular for determining participant's level of stigmatising attitudes. More variables than what I used for my study have been used in similar by other authors (45) but were not collected in the primary study. The study also had selection bias as there were opinions from people

engaged in other activities away from home during the time of the interviews. As such, the views from the participants of this study may not represent the opinions of those not interviewed. Fortunately, the recruitment of the participants was however randomised, and this would reduce the likelihood of bias. The primary study also did not collect qualitative information from community leaders who are key opinion makers in most communities. A mixed methods study would have been very beneficial and help unpack some of our findings. Such data could have been collected through focus group discussions or other means and could have helped to explain my findings better.

The study findings are generalizable to all the communities in Zimbabwe. I sampled from five of the ten provinces in the country. Both rural and urban communities were also represented among the study participants. Furthermore, the study had a statistically significant power. Also, in addition to regression models I used GSEM to thoroughly interrogate both the direct and indirect factors associated with stigmatising attitudes. I was also able to generate latent variables on aspects that are difficult to objectively measure through statistically significant methods.

To the best of my knowledge, it is the only study that has been done thus far to document the association of knowledge of TB and stigmatising attitudes among communities in Zimbabwe. This is particularly important because there is scarce literature on this matter in the country.

4.4 Conclusion

High stigma and poor knowledge of TB are some of the major reasons for delays in seeking care for TB services as well as poor treatment outcomes for those affected. As such addressing these challenges is very crucial for a high burden country like Zimbabwe. I did not find any association between good knowledge of TB and stigmatising attitudes towards it. However, some demographic and sociocultural factors like age, religion and socioeconomic status are directly and indirectly associated with stigmatising attitudes towards TB. Although the greater majority of people in communities from the five provinces had a good knowledge of TB, sadly high levels of stigmatising attitudes also exist.

4.5 Recommendations

I propose the following recommendations for consideration based on my findings;

- Some religious, socioeconomic and demographic factors were demonstrated to influence the likelihood of having good knowledge of TB and high levels of stigmatising attitudes. Primary health interventions to address community's knowledge of TB and reduce stigma towards those affected should consider their target audience's age, education, SES, religion in their design and implementation approach. Masvingo province with the lowest knowledge of TB should be a top priority for such interventions
- My findings did not show any association between knowledge of TB and stigma towards those affected by it. However, I did not collect any qualitative information that

could help better explain these findings. More studies are needed to assess this in greater detail.

REFERENCES

1. Oxford Dictionaries. Oxford living dictionary 2017. Available online from: ` https://en.oxforddictionaries.com/definition. Accessed 05.06.16
2. World Health Organisation. Guidelines on the management of latent tuberculosis infection. Geneva: : World Health Organization; 2015.Available online from http://apps.who.int/iris/bitstream/10665/136471/1/9789241548908_eng.pdf?ua=1&ua=1. Accessed 08.06.16
3. Organization WH. Definitions and reporting framework for tuberculosis–2013 revision. 2013. Available online from http://apps.who.int/iris/bitstream/10665/79199/1/9789241505345_eng.pdf . Accessed 08.06.16
4. T Wirth, F Hildebrand, C Allix-BeKremer, D van Soolingen, S Ru Philip Supply, Niemann S. Origin, Spread and Demography of the Mycobacterium Tuberculosis Complex. PLoS Pathogens. 2008;4(9):e1000160.
5. Dye C, Scheele S, Dolin P, Pathania V, Raviglione MC. Consensus statement. Global burden of tuberculosis: estimated incidence, prevalence, and mortality by country. WHO Global Surveillance and Monitoring Project. JAMA. 1999;282(7):677-86.
6. Beggs CB, Noakes CJ, Sleigh PA, Fletcher LA, Siddiqi K. The transmission of tuberculosis in confined spaces: an analytical review of alternative epidemiological models. The International Journal of Tuberculosis and Lung Disease. 2003;7(11):1015-26.
7. World Health Organisation (WHO). Global Tuberculosus Report 2016. 20th ed2016. Available online at http://www.who.int/tb/publications/global_report/gtbr2016_executive_summary.pdf?ua=1.Accessed 09.06.16
8. Boccia D, Hargreaves J, De Stavola BL, Fielding K, Schaap A, Godfrey-Faussett P, et al. The association between household socioeconomic position and prevalent tuberculosis in Zambia: a case-control study. PloS one. 2011;6(6):e20824.
9. Siroka A, Law I, Macinko J, Floyd K, Banda R, Hoa N, et al. The effect of household poverty on tuberculosis. The International Journal of Tuberculosis and Lung Disease. 2016;20(12):1603-8.
10. Davies PD. The world-wide increase in tuberculosis: how demographic changes, HIV infection and increasing numbers in poverty are increasing tuberculosis. Annals of medicine. 2003;35(4):235-43.
11. World Health Organisation. Use of high burden country lists for TB by WHO in the post-2015 era. 2015. Available online at http://www.who.int/tb/publications/global_report/high_tb_burdencountrylists2016-2020summary.pdf?ua=1. Accessed 09.06.16

12. Ministry of Health abd Child Care. National Health Strategy for Zimbabwe: 2016 - 2020. Harare2016. Available online at https://www.unicef.org/zimbabwe/National_Health_Strategy_for_Zimbabwe_2016-2020_FINAL.pdf. Accessed 04.02.2017

13. Ministry of Health abd Child Care. National Health Strategy for Zimbabwe: 2016 - 2020. Harare2016. Available online at https://www.unicef.org/zimbabwe/National_Health_Strategy_for_Zimbabwe_2016-2020_FINAL.pdf. Accessed 04.02.2017

14. Takarinda KC, Harries AD, Nyathi B, Ngwenya M, Mutasa-Apollo T, Sandy C. Tuberculosis treatment delays and associated factors within the Zimbabwe national tuberculosis programme. BMC public health. 2015;15(1):29.

15. Nájera-Ortiz J, Sánchez-Pérez H, Ochoa-Díaz H, Arana-Cedeño M, Lezama MS, Mateo MM. Demographic, health services and socio-economic factors associated with pulmonary tuberculosis mortality in Los Altos Region of Chiapas, Mexico. International Journal of Epidemiology. 2008;37(4):786-95.

16. Bustamante-Montes LP, Escobar-Mesa A, Borja-Aburto VH, Gómez-Muñoz A, Becerra-Posada F. Predictors of death from pulmonary tuberculosis: the case of Veracruz, Mexico. The International Journal of Tuberculosis and Lung Disease. 2000;4(3):208-15.

17. Asch S, Leake B, Anderson R, Gelberg L. Why Do Symptomatic Patients Delay Obtaining Care for Tuberculosis? American Journal of Respiratory and Critical Care Medicine. 1998;157(4):1244-8.

18. Laokri S, Drabo MK, Weil O, Kafando B, Dembele SM, Dujardin B. Patients are paying too much for tuberculosis: a direct cost-burden evaluation in Burkina Faso. PloS one. 2013;8(2):e56752.

19. Viney KA, Johnson P, Tagaro M, Fanai S, Linh NN, Kelly P, et al. Tuberculosis patients' knowledge and beliefs about tuberculosis: a mixed methods study from the Pacific Island nation of Vanuatu. BMC public health. 2014;14(1):1.

20. Cheng G, Tolhurst R, Li RZ, Meng QY, Tang S. Factors affecting delays in tuberculosis diagnosis in rural China: a case study in four counties in Shandong Province. Transactions of The Royal Society of Tropical Medicine and Hygiene. 2005;99(5):355-62.

21. Storla DG, Yimer S, Bjune GA. A systematic review of delay in the diagnosis and treatment of tuberculosis. BMC public health. 2008;8(1):1.

22. Kayigamba FR, Bakker MI, Mugisha V, De Naeyer L, Gasana M, Cobelens F, et al. Adherence to tuberculosis treatment, sputum smear conversion and mortality: a retrospective cohort study in 48 Rwandan clinics. PloS one. 2013;8(9):e73501.

23. Eshetie S, Gizachew M, Dagnew M, Kumera G, Woldie H, Ambaw F, et al. Multidrug resistant tuberculosis in Ethiopian settings and its association with previous history of anti-tuberculosis treatment: a systematic review and meta-analysis. BMC infectious diseases. 2017;17(1):219.

24. Sawadogo B, Tint KS, Tshimanga M, Kuonza L, Ouedraogo L. Risk factors for tuberculosis treatment failure among pulmonary tuberculosis patients in four health regions of Burkina Faso, 2009: case control study. Pan African medical journal. 2015;21(1).

25. Gebremariam MK, Bjune GA, Frich JC. Barriers and facilitators of adherence to TB treatment in patients on concomitant TB and HIV treatment: a qualitative study. BMC public health. 2010;10(1):1.

26. Kipp AM, Pungrassami P, Stewart PW, Chongsuvivatwong V, Strauss RP, Van Rie A. Study of tuberculosis and AIDS stigma as barriers to tuberculosis treatment adherence using validated stigma scales. The International Journal of Tuberculosis and Lung Disease. 2011;15(11):1540-6.

27. Amo-Adjei J. Individual, household and community level factors associated with keeping tuberculosis status secret in Ghana. BMC public health. 2016;16(1):1196.

28. Cremers AL, de Laat MM, Kapata N, Gerrets R, Klipstein-Grobusch K, Grobusch MP. Assessing the consequences of stigma for tuberculosis patients in urban Zambia. PloS one. 2015;10(3):e0119861.

29. Cramm JM, Finkenflügel HJ, Møller V, Nieboer AP. TB treatment initiation and adherence in a South African community influenced more by perceptions than by knowledge of tuberculosis. BMC public health. 2010;10(1):1-8.

30. Ali M. Treating tuberculosis as a social disease. The Lancet. 2014;383:2195.

31. World Health Organisation. Gear up to end TB: introducing the end TB strategy. 2015. Available online at http://www.who.int/tb/End_TB_brochure.pdf?ua=1. Accessed 02.07.16

32. Hadley M, Maher D. Community involvement in tuberculosis control: lessons from other health care programmes. The International Journal of Tuberculosis and Lung Disease. 2000;4(5):401-8.

33. Maher D, Hausler H, Raviglione M, Kaleeba N, Aisu T, Fourie B, et al. Tuberculosis care in community care organizations in sub-Saharan Africa: practice and potential [Planning and Practice]. The International Journal of Tuberculosis and Lung Disease. 1997;1(3):276-83.

34. Murray EJ, Bond VA, Marais BJ, Godfrey-Faussett P, Ayles HM, Beyers N. High levels of vulnerability and anticipated stigma reduce the impetus for tuberculosis diagnosis in Cape Town, South Africa. Health policy and planning. 2012;28(4):410-8.

35. Gumucio S, Merica M, Luhmann N, Fauvel G, Zompi S, Ronsse A, et al. Data Collection Quantitative Methods, the KAP Survey Model (Knowledge, Attitude and Practices). IGC communigraphie: Saint Etienne France. 2011:4-7.

36. World Health Organisation and Stop TB partnership. Advocacy, Communication and Social Mobilisation for Tuberculosis Control: A handbook for country programmes. 2007. Available online at

http://www.stoptb.org/assets/documents/resources/publications/acsm/ACSM_Handbook.pdf. Accessed 23.10.16

37. Westerlund EE, Tovar MA, Lönnermark E, Montoya R, Evans CA. Tuberculosis-related knowledge is associated with patient outcomes in shantytown residents; results from a cohort study, Peru. Journal of Infection. 2015;71(3):347-57.

38. Tolossa D, Medhin G, Legesse M. Community knowledge, attitude, and practices towards tuberculosis in Shinile town, Somali regional state, eastern Ethiopia: a cross-sectional study. BMC public health. 2014;14(1):1.

39. Malangu N, Adebanjo OD. Knowledge and practices about multidrug-resistant tuberculosis amongst healthcare workers in Maseru. African journal of primary health care & family medicine. 2015;7(1):1-5.

40. Getahun H, Maher D. Contribution of 'TB clubs' to tuberculosis control in a rural district in Ethiopia [Planning and Practice]. The International Journal of Tuberculosis and Lung Disease. 2000;4(2):174-8.

41. Hoa NP, Thorson AE, Long NH, Diwan VK. Knowledge of tuberculosis and associated health-seeking behaviour among rural Vietnamese adults with a cough for at least three weeks. Scandinavian Journal of Public Health. 2003;31(62 suppl):59-65.

42. Paul S, Akter R, Aftab A, Khan AM, Barua M, Islam S, et al. Knowledge and attitude of key community members towards tuberculosis: mixed method study from BRAC TB control areas in Bangladesh. BMC public health. 2015;15(1):1.

43. Hoa NP, Chuc NTK, Thorson A. Knowledge, attitudes, and practices about tuberculosis and choice of communication channels in a rural community in Vietnam. Health Policy. 2009;90(1):8-12.

44. Mushtaq M, Majrooh M, Ahmad W, Rizwan M, Luqman M, Aslam M, et al. Knowledge, attitudes and practices regarding tuberculosis in two districts of Punjab, Pakistan. The international journal of tuberculosis and lung disease. 2010;14(3):303-10.

45. Sagili KD, Satyanarayana S, Chadha SS. Is Knowledge Regarding Tuberculosis Associated with Stigmatising and Discriminating Attitudes of General Population towards Tuberculosis Patients? Findings from a Community Based Survey in 30 Districts of India. PloS one. 2016;11(2):e0147274.

46. Chang S, Cataldo J. A systematic review of global cultural variations in knowledge, attitudes and health responses to tuberculosis stigma. The International Journal of Tuberculosis and Lung Disease. 2014;18(2):168-73.

47. Sreeramareddy CT, Kumar HH, Arokiasamy JT. Prevalence of self-reported tuberculosis, knowledge about tuberculosis transmission and its determinants among adults in India: results from a nation-wide cross-sectional household survey. BMC infectious diseases. 2013;13(1):1.

48. Mushtaq MU, Shahid U, Abdullah HM, Saeed A, Omer F, Shad MA, et al. Urban-rural inequities in knowledge, attitudes and practices regarding tuberculosis in two

districts of Pakistan's Punjab province. International journal for equity in health. 2011;10(1):1-9.

49. Corrigan PW, Watson AC. The paradox of self-stigma and mental illness. Clinical Psychology: Science and Practice. 2002;9(1):35-53.

50. Earnshaw VA, Quinn DM, Park CL. Anticipated stigma and quality of life among people living with chronic illnesses. Chronic Illness. 2012;8(2):79-88.

51. Link BG. Understanding labeling effects in the area of mental disorders: An assessment of the effects of expectations of rejection. American Sociological Review. 1987:96-112.

52. Adenager GS, Alemseged F, Asefa H, Gebremedhin AT. Factors Associated with Treatment Delay among Pulmonary Tuberculosis Patients in Public and Private Health Facilities in Addis Ababa, Ethiopia. Tuberculosis research and treatment. 2017;2017.

53. Boru CG, Shimels T, Bilal AI. 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. 2017.

54. Craig G, Daftary A, Engel N, O'Driscoll S, Ioannaki A. Tuberculosis stigma as a social determinant of health: a systematic mapping review of research in low incidence countries. International Journal of Infectious Diseases. 2016.

55. Courtwright A, Turner AN. Tuberculosis and stigmatization: pathways and interventions. Public health reports. 2010;125(4_suppl):34-42.

56. Kelly P. Isolation and Stigma: The Experience of Patients With Active Tuberculosis. Journal of Community Health Nursing. 1999;16(4):233-41.

57. Macq J, Solis A, Martinez G. Assessing the stigma of tuberculosis. Psychology, health & medicine. 2006;11(3):346-52.

58. Chowdhury MRK, Rahman MS, Mondal MNI, Sayem A, Billah B. Social impact of stigma regarding tuberculosis hindering adherence to treatment: a cross sectional study involving tuberculosis patients in Rajshahi city, Bangladesh. Japanese journal of infectious diseases. 2015;68(6):461-6.

59. Baral SC, Karki DK, Newell JN. Causes of stigma and discrimination associated with tuberculosis in Nepal: a qualitative study. BMC public health. 2007;7(1):1-10.

60. Abioye I, Omotayo M, Alakija W. Socio-demographic determinants of stigma among patients with pulmonary tuberculosis in Lagos, Nigeria. African health sciences. 2011;11(3):100-4.

61. Kipp AM, Pungrassami P, Nilmanat K, Sengupta S, Poole C, Strauss RP, et al. Socio-demographic and AIDS-related factors associated with tuberculosis stigma in southern Thailand: a quantitative, cross-sectional study of stigma among patients with TB and healthy community members. BMC public health. 2011;11(1):675.

62. Somma D, Thomas B, Karim F, Kemp J, Arias N, Auer C, et al. Gender and socio-cultural determinants of TB-related stigma in Bangladesh, India, Malawi and Colombia [Special section on gender and TB]. The International Journal of Tuberculosis and Lung Disease. 2008;12(7):856-66.

63. Tadesse S. Stigma against Tuberculosis Patients in Addis Ababa, Ethiopia. PloS one. 2016;11(4):e0152900.

64. World Health Organisation and Stop TB Partnership. Advocacy, Communication and Social Mobilisation for Tuberculosis Control: A handbook for country programmes. 2007. Available on http://www.stoptb.org/assets/documents/resources/publications/acsm/ACSM_Handbook.pdf. Accessed 22.10.16

65. Nemeth R, editor Respondent selection within the household-A modification of the Kish grid. Meeting of Young Statisticians; 2002: Citeseer.

66. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. Journal of biomedical informatics. 2009;42(2):377-81.

67. Vyas S, Kumaranayake L. Constructing socio-economic status indices: how to use principal components analysis. Health policy and planning. 2006;21(6):459-68.

68. Kaufman JD, Dunlap WP. Determining the number of factors to retain: Q windows-based FORTRAN-IMSL program for parallel analysis. Behavior Research Methods, Instruments, & Computers. 2000;32(3):389-95.

69. Archer KJ, Lemeshow S, Hosmer DW. Goodness-of-fit tests for logistic regression models when data are collected using a complex sampling design. Computational Statistics & Data Analysis. 2007;51(9):4450-64.

70. Brant R. Assessing proportionality in the proportional odds model for ordinal logistic regression. Biometrics. 1990:1171-8.

71. Gunzler D, Chen T, Wu P, Zhang H. Introduction to mediation analysis with structural equation modeling. Shanghai archives of psychiatry. 2013;25(6):390.

72. Musenge E, Vounatsou P, Collinson M, Tollman S, Kahn K. The contribution of spatial analysis to understanding HIV/TB mortality in children: a structural equation modelling approach. Global health action. 2013;6(1):19266.

73. Zimbabwe National Statistics Agency. Census 2012: National Report. 2013. Available online at http://www.zimstat.co.zw/sites/default/files/img/National_Report.pdf. Accessed 22.06.17

74. Bati J, Legesse M, Medhin G. Community's knowledge, attitudes and practices about tuberculosis in itang special district, gambella region, south western Ethiopia. BMC public health. 2013;13(1):734.

75. Tobin-West CI, Isodje A. Quality and rural-urban comparison of tuberculosis care in Rivers State, Nigeria. Pan African Medical Journal. 2016;24(1).

76. Scott V, Sanders D. Evaluation of how integrated HIV and TB programs are implemented in South Africa and the implications for rural-urban equity. 2013.

77. VanDenHeuvel O, DeMey W, Buddingh H, Bots M. Use ofmaternal care in a rural area of Zimbabwe, a population-based study. Acta obstetricia et gynecologica Scandinavica. 1999;78(10):838-46.

78. Hallfors DD, Iritani BJ, Zhang L, Hartman S, Luseno WK, Mpofu E, et al. 'I thought if I marry the prophet I would not die': The significance of religious affiliation on marriage, HIV testing, and reproductive health practices among young married women in Zimbabwe. SAHARA-J: Journal of Social Aspects of HIV/AIDS. 2016;13(1):178-87.

79. Manzou R, Schumacher C, Gregson S. Temporal dynamics of religion as a determinant of HIV infection in East Zimbabwe: a serial cross-sectional analysis. PloS one. 2014;9(1):e86060.

80. Spence DP, Hotchkiss J, Williams CS, Davies PD. Tuberculosis and poverty. BMJ. 1993;307(6907):759-61.

81. Mateveke K, Singh B, Chingono A, Sibanda E, Machingura I. Is socio-economic status a determinant of HIV-related stigma attitudes in Zimbabwe? Findings from Project Accept. Journal of Public Health in Africa. 2016;7(1).

82. Ahmed Suleiman M, Sahal N, Sodemann M, El Sony A, Aro AR. Tuberculosis stigma in Gezira State, Sudan: a case-control study. The International Journal of Tuberculosis and Lung Disease. 2013;17(3):388-93.

83. Scott K, Campbell C, Madanhire C, Skovdal M, Nyamukapa C, Gregson S. In what ways do communities support optimal antiretroviral treatment in Zimbabwe? Health promotion international. 2013;29(4):645-54.

84. Sambisa W, Curtis S, Mishra V. AIDS stigma as an obstacle to uptake of HIV testing: evidence from a Zimbabwean national population-based survey. AIDS care. 2010;22(2):170-86.

85. Mihan R, Kerr J, Maticka-Tyndale E, Team A. HIV-related stigma among African, Caribbean, and Black youth in Windsor, Ontario. AIDS care. 2016;28(6):758-63.

86. Wynne A, Richter S, Jhangri GS, Alibhai A, Rubaale T, Kipp W. Tuberculosis and human immunodeficiency virus: exploring stigma in a community in western Uganda. AIDS care. 2014;26(8):940-6.

APPENDIX

A. Syntax and output on power computation from STATA

Syntax:

power oneproportion 0.29 0.71, test(wald) n(634) continuity

Output:

Estimated power for a one-sample proportion test
Wald z test
Ho: p = p0 versus Ha: p != p0

Study parameters:

alpha = 0.0500
N = 634
delta = 0.4200
p0 = 0.2900
pa = 0.7100

Estimated power:

power = 1.0000

B. REDCap data collection tool

Confidential

KAP of communties in Zimbabwe towards TB

Please complete the survey below.

Thank you!

1) Questionnaire Number
_____
(please enter the number of the questionnaire)

2) Province
◯ Midlands
◯ Manicaland
◯ Masvingo
◯ Bulawayo
◯ Matabelend South

3) District
_____

4) Rural or Urban location
◯ Rural
◯ Urban

5) How old are you
_____

6) Sex of the respondent
◯ Female
◯ Male

7) What is the highest level of education that you have finished?
◯ Primary
◯ Secondary
◯ Tertiary (Polytechnics, College)
◯ University or higher
◯ None
(enter age at last birthday)

8) What do you do to earn a living?
◯ Unemployed
◯ Student
◯ Miner/Mining industry
◯ Farm-worker
◯ Professional
◯ Police/Military/Security
◯ Domestic worker
◯ Trucker/Transport business
◯ General worker
◯ Self-employed
◯ Vendor
◯ Other

9) In your house, is there:

- ☐ Radio
- ☐ CD player
- ☐ TV
- ☐ Camera
- ☐ Fixed phone
- ☐ Mobile phone
- ☐ Gas/Paraffin cooker
- ☐ Refrigerator
- ☐ Washing machine
- ☐ Air conditioner
- ☐ Fan
- ☐ Iron
- ☐ Bicycle
- ☐ Motorcycle
- ☐ Car
- ☐ Stove
- ☐ Tractor
- ☐ Scotch-cart
- ☐ Cattle
- ☐ Goat/Sheep
- ☐ Solar Panel
- ☐ Free to Air Decoder (e.g. Wiztech)
- ☐ DSTV Decoder
- ☐ Internet Access
- ☐ None of the above

(please select one)

10) Does your house have any of the following

- ☐ Electricity
- ☐ Piped water into household
- ☐ Flush latrine
- ☐ None of the above

11) What is your marital status

- ◯ Married/Co-habiting
- ◯ Never married
- ◯ Widowed
- ◯ Divorced
- ◯ Separated

12) What is your religion?

- ◯ Traditional
- ◯ Roman Catholic/Methodist/SDA or similar traditional churches
- ◯ Pentecostal or any other protestant churches/prophetic ministries
- ◯ Apostolic Sect
- ◯ Muslim
- ◯ None
- ◯ Other

13) How far do you live from the nearest health care facility?

- ◯ 0-10 kilometres
- ◯ 11-20 kilometres
- ◯ 21-30 kilometres
- ◯ More than 30 kilometres

Health-seeking behaviour

Where do you usually go if you are sick, or to treat a general health problem?

- ◯ Private clinic
- ◯ Local Clinic
- ◯ Local Hospital
- ◯ Traditional healer
- ◯ Faith healer
- ◯ Pursue self-treatment options
- ◯ Other

How often do you generally seek health care at a clinic or hospital?

- ◯ Twice or more a year
- ◯ Once per year
- ◯ Less than once a year but at least twice in past 5 years
- ◯ Once in past 5 years
- ◯ Never in past 5 years
- ◯ Other:
- ◯ N/A

TB knowledge and awareness

Have you ever heard of a disease called Tuberculosis or TB?
- ◯ Yes
- ◯ No

Have you ever received any information on TB?
- ◯ Yes
- ◯ No

From where did you receive this information?
- ☐ Radio
- ☐ Television
- ☐ Workplace
- ☐ Newspaper or magazine
- ☐ Poster
- ☐ Billboard
- ☐ Health worker/Clinic/Hospital
- ☐ Counsellor
- ☐ Friends/relatives
- ☐ Leaflet/Brochure
- ☐ Road shows
- ☐ Dramas/Theatre
- ☐ Door to Door
- ☐ Small Group Discussions
- ☐ Individual Discussions
- ☐ Community Health Worker
- ☐ Other

(Please select all that apply)

How can a person get TB?
- ☐ Through handshakes
- ☐ Through the air when a person with TB coughs or sneezes
- ☐ Through sharing dishes
- ☐ Through eating from the same plate
- ☐ Through touching items in public places (doorknobs, handles in transportation, etc.)
- ☐ Do not know
- ☐ Other

q304 score _____

What are the signs and symptoms of TB?
- ☐ Rash
- ☐ Cough
- ☐ Cough longer than 2 weeks
- ☐ Coughing up blood
- ☐ Severe headache
- ☐ Nausea
- ☐ Weight loss
- ☐ Fever
- ☐ Fever without clear cause that lasts more than 7 days
- ☐ Chest pain
- ☐ Shortness of breath
- ☐ Ongoing fatigue
- ☐ Do not know
- ☐ Other

q305 score _____

How can a person prevent getting TB?

- ☐ Avoid shaking hands
- ☐ Covering mouth and nose when coughing or sneezing
- ☐ Avoid sharing dishes
- ☐ Washing hands after touching items in public places
- ☐ Closing windows at home
- ☐ Through good nutrition
- ☐ By praying
- ☐ Do not know
- ☐ Other

q306 score _____

In your opinion, how serious is TB?

- ◯ Very serious
- ◯ Somewhat serious
- ◯ Not very serious

q307 score _____

How serious a problem do you think TB is in Zimbabwe?

- ◯ Very serious
- ◯ Somewhat serious
- ◯ Not very serious

In your opinion, who can be infected with TB?

- ☐ Poor people
- ☐ Homeless people
- ☐ Alcoholics
- ☐ Drug users
- ☐ People living with HIV
- ☐ People who have been in prison
- ☐ Old People
- ☐ Children under five
- ☐ People living in crowded conditions
- ☐ People caring for TB patients
- ☐ Health Care workers
- ☐ Anyone
- ☐ Other

Can TB be cured?

- ◯ Yes
- ◯ No

q310 score _____

If Yes, how can someone with TB be cured?

- ◯ Herbal remedies
- ◯ Home rest without medicine
- ◯ Spiritual healing by Prayer
- ◯ Specific drugs given by health center
- ◯ Do not know
- ◯ Other:

q311 score _____

Have you ever heard about Multi-Drug resistant TB?

- ◯ Yes
- ◯ No

q312 score _____

How expensive do you think TB diagnosis and treatment is in this country?

- ◯ It is free of charge
- ◯ It is reasonably priced
- ◯ It is somewhat/moderately expensive
- ◯ It is very expensive
- ◯ I don't know

q407 score _____

Total knowledge score _____

TB attitudes and Health seeking behaviour

Do you think you can get TB?
- ◯ Yes
- ◯ No

What would be your reaction if you find out that you have TB?
- ◯ Fear
- ◯ Surprise
- ◯ Shame
- ◯ Embarrassment
- ◯ Sadness or hopelessness
- ◯ Other
- ◯ Pain

Who would you talk to about your illness if you had TB?
- ☐ Doctor or other medical worker
- ☐ Spouse
- ☐ Parent
- ☐ Child(ren)
- ☐ Other family member
- ☐ Close friend
- ☐ Pastor/church leader
- ☐ No one
- ☐ Other

What would you do if you thought you had symptoms of TB?
- ◯ Go to health facility
- ◯ Go to pharmacy
- ◯ Go to traditional healer
- ◯ Pursue other self-treatment options (herbs, etc.)
- ◯ Go to church
- ◯ Other

If you had symptoms of TB, at what point would you go to the health facility?
- ◯ When treatment on my own does not work
- ◯ When symptoms that look like TB signs last for 3-4 weeks
- ◯ As soon as I realize that my symptoms might be related to TB
- ◯ I would not go to the health facility

If you would not go to the health facility, what is the reason?
- ◯ Not sure where to go
- ◯ Cost
- ◯ Difficulties with transportation/distance to clinic
- ◯ Do not trust medical workers
- ◯ Do not like attitude of medical workers
- ◯ Cannot leave work (overlapping work hours with medical facility working hours)
- ◯ Do not want to find out that something is really wrong
- ◯ Other

Have you ever experienced the following over the last 12 months?
- ☐ Night sweating for 3 weeks
- ☐ Cough longer than 2 weeks
- ☐ Fever or hot body for 3 weeks
- ☐ Weight loss in past 2 months
- ☐ Has someone in your HH had TB?
- ☐ N/A

Attitudes towards TB

Do you know people who have or had TB?
- ◯ Yes
- ◯ No

What is your feeling about people with TB disease?
- ◯ "I feel compassion and desire to help."
- ◯ "I feel compassion but I tend to stay away from these people."
- ◯ "It is their problem."
- ◯ "I fear them because they may infect me."
- ◯ "I have no particular feeling."
- ◯ Other

In your community, how is a person who has TB usually regarded/treated?
- ◯ Most people reject him or her
- ◯ Most people are friendly, but they generally try to avoid him
- ◯ The community mostly supports and helps him or her
- ◯ Other

Do you think that HIV positive people should be concerned about TB?
- ◯ Yes
- ◯ No

If Yes, why?
- ◯ Person with HIV is more likely to develop TB
- ◯ Do not know
- ◯ Other

If No, why?
- ◯ Person with HIV is not more likely than person without HIV to develop TB
- ◯ Do not know
- ◯ Other

C. Syntax and output of final logistic regression model

```
. logit gdknow i.Uses i.REL i.relTB i.LOE i.LOC i.prov, or

Iteration 0:   log likelihood = -421.21135
Iteration 1:   log likelihood = -378.63499
Iteration 2:   log likelihood =  -378.4325
Iteration 3:   log likelihood = -378.43208
Iteration 4:   log likelihood = -378.43208

Logistic regression                             Number of obs   =        611
                                                LR chi2(15)     =      85.56
                                                Prob > chi2     =     0.0000
Log likelihood = -378.43208                     Pseudo R2       =     0.1016
```

gdknow	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Uses						
Middle class	1.053489	.2475394	0.22	0.824	.664695	1.669698
Richest	1.336354	.4708724	0.82	0.411	.6698777	2.665922
REL						
Pentecostal churches	1.343611	.3066878	1.29	0.196	.858977	2.101676
Traditional churches	1.389414	.3245043	1.41	0.159	.8790818	2.196008
Other groups	.6080931	.2458791	-1.23	0.219	.2752907	1.343225
None	.5513916	.2194502	-1.50	0.135	.2527479	1.202909
relTB						
Yes	2.665919	.6069521	4.31	0.000	1.706291	4.165247
LOE						
Primary	2.216881	1.082421	1.63	0.103	.8513975	5.772349
Secondary	2.509186	1.211665	1.91	0.057	.9738557	6.465037
Tertiary	6.860966	4.648176	2.84	0.004	1.818495	25.88561
LOC						
Urban	1.296151	.4439712	0.76	0.449	.6623586	2.536402
prov						
Manicaland	1.099106	.3861732	0.27	0.788	.5520373	2.188321
Masvingo	.5596855	.2434616	-1.33	0.182	.2386018	1.312848
Matabelend South	1.313502	.6118206	0.59	0.558	.5271652	3.272765
Midlands	1.081202	.4190594	0.20	0.840	.5058158	2.311113
_cons	.1759309	.1174044	-2.60	0.009	.0475672	.6506934

D. Ordinal logistic regression model

```
. ologit satt i.gdknow age i.REL i.prov i.LOC i.Uses, or

Iteration 0:   log likelihood =  -485.7183
Iteration 1:   log likelihood = -468.42207
Iteration 2:   log likelihood = -468.37332
Iteration 3:   log likelihood =  -468.3733

Ordered logistic regression                     Number of obs   =        628
                                                LR chi2(13)     =      34.69
                                                Prob > chi2     =     0.0009
Log likelihood =  -468.3733                     Pseudo R2       =     0.0357
```

satt	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
gdknow						
Good	1.046682	.1792586	0.27	0.790	.7482295	1.464181
age	.9879107	.0053429	-2.25	0.025	.9774942	.9984383
REL						
Pentecostal churches	1.326777	.2819534	1.33	0.183	.8748004	2.012272
Traditional churches	.9277164	.2047749	-0.34	0.734	.6019072	1.429885
Other groups	2.29354	.8370808	2.27	0.023	1.121607	4.689992
None	1.186548	.4280485	0.47	0.635	.5850778	2.406341
prov						
Manicaland	.9825792	.3121543	-0.06	0.956	.5271697	1.831406
Masvingo	.7923288	.3136765	-0.59	0.557	.3646882	1.721429
Matabelend South	.8662253	.3785759	-0.33	0.742	.3678078	2.04005
Midlands	.9966655	.3566923	-0.01	0.993	.4942157	2.009936
LOC						
Urban	1.1704	.3701452	0.50	0.619	.6297049	2.17536
Uses						
Middle class	1.258582	.2775116	1.04	0.297	.8169503	1.938955
Richest	1.778749	.5905786	1.73	0.083	.927896	3.409807
/cut1	-.2331347	.4460327			-1.107343	.6410733
/cut2	3.95403	.5273542			2.920435	4.987626

E. Ethics clearance certificate

R14/49 Dr Shepherd Mufudzi Machekera

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M170240

NAME: (Principal Investigator)	Dr Shepherd Mufudzi Machekera
DEPARTMENT:	School of Public Health Harare, Zimbabwe
PROJECT TITLE:	Association between Community Knowledge and Stigmatizing Attitudes towards Tuberculosis across Five Provinces in Zimbabwe
DATE CONSIDERED:	24/02/2017
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Eustasius Musenge
APPROVED BY:	Professor P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	27/02/2017

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in February and will therefore be due in the month of February each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

Date 01/03/2017

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

F. Test for multicollinearity among variables in the final LR model

```
. collin Uses REL relTB LOE LOC prov
(obs=611)

  Collinearity Diagnostics

                       SQRT                  R-
  Variable      VIF     VIF    Tolerance    Squared
----------------------------------------------------
      Uses      2.26    1.50    0.4429      0.5571
       REL      1.01    1.01    0.9853      0.0147
     relTB      1.02    1.01    0.9806      0.0194
       LOE      1.08    1.04    0.9218      0.0782
       LOC      2.06    1.43    0.4864      0.5136
      prov      1.58    1.26    0.6344      0.3656
----------------------------------------------------
  Mean VIF      1.50

                         Cond
        Eigenval         Index
---------------------------------
    1     5.9665          1.0000
    2     0.5161          3.4002
    3     0.2201          5.2061
    4     0.1522          6.2620
    5     0.0755          8.8879
    6     0.0524         10.6667
    7     0.0171         18.6542
---------------------------------
 Condition Number        18.6542
 Eigenvalues & Cond Index computed from scaled raw sscp (w/ intercept)
 Det(correlation matrix)    0.2985
```