LIVING CONDITIONS AND TREATMENT OUTCOMES OF TUBERCULOSIS PATIENTS IN REGION 2 TSHWANE DISTRICT, GAUTENG PROVINCE OF SOUTH AFRICA

by

TOMBO BONGONGO

RESEARCH DISSERTATION

Submitted in fulfilment of the requirements for the degree of

MASTER OF PUBLIC HEALTH

in the

FACULTY OF HEALTH SCIENCES
(School of Health Care Sciences)
at

SEFAKO MAKGATHO HEALTH SCIENCES UNIVERSITY

SUPERVISOR: Dr H van der Heever

2017
DECLARATION

I declare that “LIVING CONDITIONS AND TREATMENT OUTCOMES OF TUBERCULOSIS PATIENTS IN REGION 2 TSHWANE DISTRICT, GAUTENG PROVINCE OF SOUTH AFRICA” (as a mini-dissertation or dissertation) hereby submitted to the Sefako Makgatho Health Sciences University for the degree of MASTER OF PUBLIC HEALTH has not previously been submitted by me for a degree at this or any other university, that it is my work in design and in execution, and that all material contained herein has been duly acknowledge.

T. Bongongo 02/10/ 2017
Initial & Surname Date

Student number: 201530131
DEDICATION

The present research dissertation is dedicated to:

The Lord Jesus Christ my saviour,
because I believe that He is present in everything I do
(Math 1:23)

My late parents Dominique Bongongo and Honorine Amba Boluka
because they instilled the culture of study within me.

My wife Claudine,
my daughter Joyce Divina
and to
my sons David and Daniel Gift
for their assistance and sacrifices.

Prophet TB Joshua of SCOAN,
for being a great inspiration to me.
I would like to acknowledge the contributions of the following individuals for their advice and support throughout the duration of this research dissertation process:

- Dr Hendry van der Heever, my supervisor, for his patience, assistance and guidance throughout the entire process of this research.

- The academic and non-academic staff members of the School of Public Health, Sefako Makgatho Health Sciences University, for their assistance.

- Tshwane district office staff members, district doctors, nurses, community health workers, administrative personnel, patients and their relatives who agreed to participate or produce information for the accomplishment of the current research.

- To my family and friends for their advice, support and encouragement.
ABSTRACT

Introduction:
Tuberculosis appears to be linked to the living conditions of the affected people (WHO, 2016). Many tuberculosis patients are subjected to poor living conditions such as overcrowded environments, tobacco smoke environments, poor ventilated housing, malnutrition, general stresses of life, social deprivation, etc. Cure, death, default, failure and relapse are the different tuberculosis treatment outcomes.

Aim:
The aim is to describe the living conditions and treatment outcomes of tuberculosis patients in region 2 Tshwane District of Gauteng Province of South Africa.

Methodology:
A cross-sectional design was used. This study includes all tuberculosis patients registered in the nine clinics of Tshwane region 2 from 1st January 2014 to 1st December 2015 who consented to take part. A total of hundred and eighty respondents participated. A trained assistant helped in collection of data and a structured questionnaire was used after being piloted. Descriptive statistics were used to describe data. All statistical analysis was performed on SAS, version 9.4. Association between variables were tested for significance using the Fisher Exact or Chi-Square test. P value equal or less than 0.05 was considered significant. Odds ratio and CI 95% are used while reporting the results.

Results:
There is an association between HIV status and tuberculosis treatment outcomes; specifically, in cure, death and default. The p values were respectively 0.0011, 0.0269 and 0.0372.
There is an association between food security and tuberculosis outcomes with significant differences in relapse (p=0.0290).
There is no association between house dwelling conditions and tuberculosis treatment outcomes (p=0.1166).
There is an association between indoor pollution and tuberculosis treatment outcomes; specifically, in cure and death (p<0.0001).

Conclusion:
HIV status, food security and indoor pollution as components of living condition are strongly associated with the tuberculosis treatment outcomes as demonstrated by the current study.
# TABLE OF CONTENTS

| Title page                                      | I |
| Declaration                                      | II |
| Dedication                                      | III |
| Acknowledgements                                | IV |
| Abstract                                        | V  |
| Table of contents                               | VI |

## CHAPTER 1 INTRODUCTION

1.1 Introduction 1

1.2 Problem statement 2

<table>
<thead>
<tr>
<th>Study setting</th>
<th>1.3 Study setting</th>
<th>1.3.1 Geographical profile</th>
<th>1.3.2 Health facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.3.3 Population</td>
<td>1.4 Rationale for the study</td>
<td>1.5 Study aim</td>
</tr>
<tr>
<td></td>
<td>1.6 Research questions</td>
<td></td>
<td>1.7 Objectives</td>
</tr>
<tr>
<td></td>
<td>1.8 Outlay of the study</td>
<td></td>
<td>1.9 Conclusion</td>
</tr>
</tbody>
</table>

## CHAPTER 2 LITERATURE REVIEW

2.1 Introduction 5

2.2 Living conditions of tuberculosis patients 7

2.2.1 HIV/AIDS 6

2.2.2 Food security/socio-economic conditions 7

2.2.3 housing dwelling conditions 7

2.2.4 Indoor pollution 10

2.3 Tuberculosis outcomes 13

2.4 Conclusion 13

## CHAPTER 3 METHODOLOGY

3.1 Introduction 14
### 3.2 Study design
3.3 Study setting
3.4 Study population
3.5 Sampling
3.6 Inclusion criteria
3.7 Data collection

3.8 Bias
3.9 Reliability and validity

3.10 Data analysis
3.11 Ethical considerations
3.12 Conclusion

<table>
<thead>
<tr>
<th>CAPTER 4 RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Introduction</td>
</tr>
<tr>
<td>4.2 Description of study respondents</td>
</tr>
<tr>
<td>4.2.1 Region 2 clinics of respondents</td>
</tr>
<tr>
<td>4.2.2 Age</td>
</tr>
<tr>
<td>4.2.3 Gender</td>
</tr>
<tr>
<td>4.2.4 Level of education</td>
</tr>
<tr>
<td>4.2.5 Occupation</td>
</tr>
<tr>
<td>4.3 Description of living conditions of tuberculosis respondents</td>
</tr>
<tr>
<td>4.3.1 Respondents HIV status</td>
</tr>
<tr>
<td>4.3.2 Food security</td>
</tr>
<tr>
<td>4.3.3 Housing dwelling conditions</td>
</tr>
<tr>
<td>4.5.1 HIV status and tuberculosis treatment outcomes</td>
</tr>
<tr>
<td>4.5.2 Food security and tuberculosis treatment outcomes</td>
</tr>
<tr>
<td>4.5.3 House dwelling condition and tuberculosis treatment outcomes</td>
</tr>
<tr>
<td>4.5.4 Indoor pollution and tuberculosis treatment outcomes</td>
</tr>
<tr>
<td>4.6 Conclusion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER 5 DISCUSSIONS, CONCLUSION AND RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Introduction</td>
</tr>
<tr>
<td>5.2 Main findings and discussion of findings</td>
</tr>
<tr>
<td>5.2.1 HIV status and tuberculosis treatment outcomes</td>
</tr>
<tr>
<td>5.2.2 Food security and tuberculosis treatment outcomes</td>
</tr>
<tr>
<td>5.2.3 House dwelling conditions and tuberculosis treatment outcomes</td>
</tr>
<tr>
<td>5.2.4 Indoor pollution and tuberculosis treatment outcomes</td>
</tr>
<tr>
<td>5.3 Conclusion</td>
</tr>
</tbody>
</table>
5.4 Limitations of the study

5.5 Recommendations

References

APPENDIX

Appendix A: Questionnaire

Appendix B: Request of conducting a research in region 2 Tshwane Health district.

Appendix C: Clearance certificate from Sefako Makgatho Health Sciences University

Appendix D: Authorisation letter from Tshwane Health District
CHAPTER 1: INTRODUCTION

1.1 Introduction

Tuberculosis (TB) is one of the infectious diseases with an intriguing relationship with the human immunosuppressive virus (HIV)/acquired immunodeficiency syndrome (AIDS). It constitutes, together with HIV/AIDS, a major public health problem in South Africa as well as globally (WHO, 2015).

Despite the multiple efforts, such as awareness about tuberculosis provided by the community health workers while doing door-to-door visits into the communities, health education in different health facilities, pamphlets and other documents’ distribution, screening of the disease in all patients attending primary health facilities and offering free sputum testing to all cases of cough as described in Citybuzz (2017), tuberculosis is still ravaging the world.

World Health Organization (2015) reports that almost 9.6 million people, worldwide, are infected by tuberculosis and 2.7 million of the infected live in Africa. It is actually a leading killer among HIV positive individuals (Medecins sans Frontieres, 2011; WHO, 2015).

Tuberculosis alone in South Africa appears to be the driving cause of death (DOH SA, 2014). Its mortality rate was 46 per 100 000 population in 2015. This number increased while adding tuberculosis clients with HIV co-infected and was estimated to 133 per 100 000.

From the South African National Tuberculosis guidelines (2014), the different tuberculosis treatment outcomes are: cure, death, default, failure and relapse. The guidelines define cure as a patient who had a positive smear or culture before initiation of the treatment, and ended up being negative at the end of the treatment period as well as at least on one previous occasion 30 days prior; dead is a patient who passed on during the course of tuberculosis treatment no matter the reasons; default is considered when a patient completes at least one month of treatment and returns after interrupting treatment for two months or more; failure is considered for a patient who received treatment but remains or became smear or culture positive before the end of treatment period; relapse is considered for a patient who got cured but at the end of the treatment period developed tuberculosis again.

1.2 Problem statement

As a family physician working in region 2 of Tshwane district of Gauteng Province, the researcher is in charge of the ward base outreach team (WBOT). This is one of the programmes initiated by the South African Department of Health that uses community health workers (CHWs) and strengthens the primary health care system. It allows community health workers to move from house to house and discover the patients in their various environments. The different reports from the CHWs converge on what has been reported by WHO (2016) and Millet et al. (2011) on the deprived living conditions of tuberculosis patients.

The South African statistics talk about 312 380 new and relapsed tuberculosis cases with prevalence of 715 per 100 000 population in 2014 (WHO, 2015). Such a large number of patients may have a negative impact in the health of the communities, since the disease is contagious or communicable.
Considering the fact that not much has been described on the relationship between living conditions and tuberculosis treatment outcomes in South Africa, specifically in region 2 of the Tshwane health district, the researcher would like to determine the living conditions of tuberculosis patients, the different tuberculosis treatment outcomes and find out whether there is an association between the two variables in region 2 of Tshwane health district.

1.3 Study setting

1.3.1 Geographical profile

Region 2 of Tshwane district is located in the northern part of Gauteng Province, South Africa. It is a rural area situated at about 70 km from Pretoria centre, alongside the national road to Polokwane.

1.3.2 Health facilities

Region 2 in the Tshwane health district comprises of eleven different clinics and a district hospital which has been known as Jubilee Hospital. It is located in Hammanskraal that originated years ago and was named after a popular cattleman Hamman (South Africa history online, 2016). Among the clinics, there is only one community health centre (Temba CHC) and two maternity obstetrical units (MOU). The two MOUs (Temba CHC and Rifentse clinic) are the only facilities that are open 24 hours a day.

The surrounding villages such as Temba, Suurman, Dilopye, Rifentse, Ramotse, Kanana, Kekanastat, Kekana Gardens, Mandela Village, Majaneng and so on converge on Hammanskraal where shopping and many other commercial activities are taking place. Each and every village has its own clinic.

There are primary and secondary schools, a police station, and a magistrate court, while other recreational areas and a game reserve are situated next to Kekana Gardens as described by South Africa history online (2016).

1.3.3 Population

The population in Hammanskraal, in an area of 7.60 square kilometres, consists of 21345 people, where the majority are black Africans who speak predominantly Tswana (Census, 2011). They are involved in various activities from farming to selling various goods (South Africa history online, 2016).

1.4 Rationale for the study

Tuberculosis, as an infectious disease, found its ground in poor communities whereby certain factors such as poor housing conditions, malnutrition and smoking contribute to the spreading and emergence of the disease (Munoz et al., 2017). Tuberculosis was the cause of 7.2% of deaths in the country in 2015 (Raborife, 2017). Stats South Africa confirms that it was one of the leading underlying natural causes of death in the country in 2015. Looking at the outcomes specifically the number of death that occur in the country due to tuberculosis, it seems imperious to conduct a study whereby the association between the living conditions and tuberculosis treatment outcomes can be discussed.
1.5 **Study aim**
To investigate the living conditions and treatment outcomes of tuberculosis patients in region 2 Tshwane district of Gauteng Province of South Africa.

1.6 **Research questions**
1. What are the living conditions of tuberculosis patients in region 2 Tshwane district of Gauteng Province of South Africa?
2. What are the treatment outcomes of tuberculosis patients in region 2 Tshwane district of Gauteng Province of South Africa?
3. What are the factors associated with the treatment outcomes of tuberculosis patients in region 2 Tshwane district of Gauteng Province of South Africa?
4. What are the baseline characteristics of tuberculosis patients in region 2 Tshwane district of Gauteng Province of South Africa?

1.7 **Objectives**
1. To determine the living conditions of tuberculosis patients in region 2 Tshwane district of Gauteng Province of South Africa.
2. To determine the treatment outcomes of tuberculosis patients in region 2 Tshwane district of Gauteng Province of South Africa.
3. To determine factors associated with treatment outcomes of tuberculosis patients in region 2 Tshwane district of Gauteng Province of South Africa.
4. To determine the baseline characteristics or socio-demographic characteristics of tuberculosis patients in region 2 Tshwane district of Gauteng Province of South Africa.

1.8 **Outlay of the study**
Chapter 1: General outline of the study including the title, introduction, problem statement, setting, rationale of study, study aim, research questions and objectives.
Chapter 2: Theoretical knowledge about the study is provided in this chapter. This literature review defines the dissertation’s framework.
Chapter 3: Studies the methodology of the research: type of study, its aim, research questions, objectives, study population and sample, data collection and analysis.
Chapter 4: Presents data, analysis of data, comparison of data and interpretation.
Chapter 5: Results are discussed, and conclusions and recommendations are presented in this chapter
References, clearance certificate from the University and authorisation letter from the Tshwane health district.
1.9 Conclusion

Few studies on tuberculosis treatment outcomes with reference to living conditions have been undertaken in South Africa as well as globally. These studies found worldwide in the literature mostly report poor living conditions as a factor associated with the occurrence of tuberculosis.
CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Tuberculosis is a serious public health problem in many countries in the world including South Africa. Although health education, pamphlets and other documents’ distribution and screening of TB have been provided in all patients attending primary health facilities, the disease is still ravaging populations with 7.1% of natural deaths in 2015 (Statistics SA, 2017; Rabile, 2017). This chapter presents the living conditions of tuberculosis patients and also highlights the tuberculosis treatment outcomes using the funnel approach. It will also present some established relationship between the living conditions and the TB treatment outcomes.

2.2 Living conditions of tuberculosis patients

2.2.1 HIV/AIDS

Zumla et al. (2000) in the United Kingdom confirmed that tuberculosis and HIV infection had increased in prevalence worldwide. HIV infection appears to be a predisposing factor for developing tuberculosis. Statistics indicate more tuberculosis patients are expected in future; and tuberculosis will be the leader cause of death in many HIV related deaths. Due to the opportunist infections that can occur in HIV infected people, mortality will remain high even if patients are put on treatment for tuberculosis as well as for HIV infection. The issue of tuberculosis and HIV infection has to be considered seriously by all the stakeholders in order to prevent an irreparable situation developing.

Liza and Shama (2006) in United States of America considered HIV infection as an associated factor that exposes patients to latent tuberculosis and later to active tuberculosis. They have attributed to all HIV individuals a certain percentage of probability of developing tuberculosis once they found themselves exposed; it is between 5 to 15 percent. It was stated that tuberculosis remains the most prominent cause of death and also the main opportunistic infection among people living with HIV infection.

Pizzi (2016), looking at the impact of HIV infection in tuberculosis treatment outcomes, collected data from different European mines during a two-year period. He focused his work on the interaction between HIV infection with tuberculosis without complications as well as on HIV infection with MDR-TB. After analysing data, he concluded to a lower tuberculosis success rate among tuberculosis patients without complication as well as patients with MDR-TB. No relationship was found between tuberculosis treatment failure and HIV infection. Due the tied association between the HIV infection and tuberculosis treatment outcomes and the lower tuberculosis treatment success rate, the author encouraged more studies in order to get an optimal duration of tuberculosis treatment on the HIV infection.

Karo et al. (2016) studied in a two-year period the impact of HIV on tuberculosis treatment outcomes among nine European mines. They used data from the surveillance of notifiable disease that was conducted in Europe. The analysis showed a lower treatment success rate among the MDR-TB, a high association with death and no association between HIV infection and tuberculosis treatment failure. The study confirmed a strong association between HIV and different tuberculosis treatment outcomes except for treatment failure; it is also highlighted that HIV increases the death rate among tuberculosis clients.
Gebremarian et al. (2016), after conducting a record review of TB patients on DOT in Southern Ethiopia, concluded that there was a higher mortality within TB patients with co-infection HIV than TB patients without co-infection HIV. The suggestion was to screen for co-infection HIV all tuberculosis patients; for those who will be reactive to the test, more care has to be applied.

Ukwaja et al. (2016) confirm that co-infection HIV, multiple drug-resistance (MDR-TB) and treatment failure were predictors of unsuccessful TB treatment in rural Nigeria. To avoid this kind of outcome, emphasis has to be put on close monitoring of TB patients, on the assistance in socio-economic living conditions of TB patients as well as promotion of activities against HIV spreading.

Minaleshewa et al. (2016) conducted in Ethiopia a record review that assessed the tuberculosis treatment outcomes and factors associated with them. They considered a five-year period, and included HIV positive patients treated for tuberculosis. In the group of tuberculosis patients, patients with positive and negative smear for pulmonary tuberculosis were included. In conclusion, it was noted that a large number of patients with tuberculosis had an unsuccessful treatment outcome. Based on that, care and appropriate intervention should be considered for patients with high risk of unsuccessful treatment.

Yenework et al. (2017) conducted a record review targeting to investigate the factors associated with unsuccessful tuberculosis treatment outcome among the HIV infected individuals in Ethiopia. After analysis of data, the results showed that more than seventy percent of tuberculosis patients with co-infection HIV had successful tuberculosis treatment outcomes. Yet the success rate was still below the targeted rate of the Global Plan to stop tuberculosis (2011-2015). Among the factors associated with unsuccessful treatment outcomes were: living outside the Gondar town, weighing less than 43.7 kg at the beginning of anti-tuberculosis treatment, being a bed-ridden patient and complaining about the side-effects of anti-tuberculosis treatment. It was advised to trace the factors associated with unsuccessful tuberculosis treatment in order to strengthen the management rather than improve the treatment of tuberculosis patients co-infected with HIV. Gafar et al. (2013) in South Africa undertook a four-year retrospective study based on record review while trying to improve the poor cure rate of tuberculosis noted in Limpopo Province. In the study, certain factors such as HIV status, gender, age and treatment regimen were assessed in order to find out whether they could affect the tuberculosis treatment outcome. It appears that there is an association with some of them; therefore, all parallel programmes with the tuberculosis programme should be strengthened. In all facilities, an integration of different programmes has to be applied; and more studies incorporating other factors should be encouraged in the province.

Mahtab et al. (2017) in Cape Town conducted a study with the tuberculosis population. Half of the tuberculosis participants were co-infected with HIV. One of the study objectives was to identify risk factors associated with tuberculosis outcomes. The two groups of tuberculosis participants were compared. The results show a high rate of death and a low treatment completion rate among the participants with co-infection HIV. In the study it has been acknowledged that the burdens of tuberculosis and HIV infection are a concern in that community. Tuberculosis participants with co-infection HIV are having a higher mortality and lower treatment completion rate compared to tuberculosis participants without co-infection HIV.
Nglazil et al. (2015) in Cape Town conducted a three-year retrospective and record review whereby the HIV infection and antiretroviral therapy were indicators for a better appreciation of the tuberculosis treatment outcome. After analysing data, tuberculosis participants with co-infection HIV not on antiretroviral treatment present high mortality and default rate, while no relationships were noted in terms of death and default rates between the HIV positive and the HIV negative tuberculosis participants.

2.2.2 Food security/socio-economic conditions

Hoorn et al. (2016) in the Netherlands, from twenty-five articles, they selected eighteen for a systematic review and meta-analysis. Tuberculosis treatment adherence as well as outcomes were assessed on the basis of psycho-emotional and socio-economic interventions. After reviewing and analysing articles that were more constituted by randomized controlled trials, the psycho-emotional and socio-economic interventions taken separately or combined showed a relationship with better tuberculosis treatment outcomes. This led to a conclusion that psycho-emotional and socio-economic interventions in tuberculosis participants are associated with successful treatment outcomes.

Lodha et al. (2014) used two teaching health facilities in Delhi to conduct a randomized controlled trial that studied the impact of micro-nutrient supplementation among children on treatment for tuberculosis. They were investigating the tuberculosis treatment outcomes after insertion of micronutrient supplements. The expected result was weight gain and clearing of radiological lesions on the lungs. However, this study was not able to reach the mentioned expectation. With the introduction of micronutrients, children with intrathoracic tuberculosis presented a height gain.

Pedrazzoli et al.’s (2016) studies revealed that poverty, food insecurity and poor nutrition can be a favourable ground whereby tuberculosis can be developed. To come out of this situation which can negatively impact on the tuberculosis treatment outcome, a plan was initiated to assist tuberculosis patients for a better adherence to the treatment as well as better treatment. The World Food Programme provides an incentive to tuberculosis clients who are enrolled in the national tuberculosis programme. This initiative plan assists to have a good adherence to the treatment and also to boost the challenging nutritional status of patients as well as their households. This initiative led to a successful DOT4 in Afghanistan.

Dirlikov et al. (2015) in Canada argue that poor socio-economic conditions of people across the world, coupled with tuberculosis, multi-drug related tuberculosis, HIV and non-communicable disease are a major threat to health. They suggested as a contribution that the tuberculosis control programme must be strengthened since it is part of public health imperative as well as an economic development plan. Tankimovich (2013) in Texas, after reviewing twenty articles published between 1998 and 2013, had an answer to his apotheosis which was an existence of a barrier in terms of detecting and treating tuberculosis among low-income communities, the homeless, and immigrants. The low-income communities, the homeless and immigrants seem to be vulnerable and hardly reachable. The TB incidence in these populations is likely to be higher than in the general population. This high incidence was estimated at twenty times beyond what has been observed in a general population. Managing tuberculosis or other health problems among immigrants, the homeless and the low-income communities should be approached bio-psychosocially rather than only biologically. Monetary incentives and amelioration of accessibility of care can be good interventions for them.
Rahayu et al. (2015) noticed that lack of education or knowledge on tuberculosis is disadvantaging Indonesian people. They consult later, most of the times when the disease complications are already there. This is one of the reasons that make the country to be classified among the top five countries in the world with a high tuberculosis prevalence. An enrichment of the community by initiating tuberculosis educational programmes will enable the Semarang district of Indonesia to acquire knowledge in tuberculosis and therefore improve their living conditions. Although the living conditions will remain poor, at least the community will be aware of prevention and the symptomatology of tuberculosis and can change their behaviour towards the problem.

Richer et al. (2014) have noticed that most of patients infected with tuberculosis and HIV are experiencing financial constraints. These constraints prevent them from accessing affordable health care. They experience delay in the diagnosis and treatment as well as unsuccessful outcomes. The constraints also expose them to an increased transmission of the disease, morbidity and mortality. By the fact of being vulnerable, they need to be supported economically or to be given a tuberculosis grant in order to minimise the infection. Even a small amount of economic support or grant will help them to adhere to and improve the treatment uptake.

Belard et al. (2016) found a low treatment success rate and high MDR-TB rate in the Republic of Gabon. This outcome was attributed to the lack of funds as well as insufficient resources allocated to the tuberculosis programme. Like many of the sub-Saharan countries, Gabon is one of nations that struggles with high tuberculosis incidence. Looking at the situation that negatively impacts on the health system, it is important to initiate strategies such as health promotion and DOT. The two strategies may be a recipe that may raise the treatment success rate and therefore ameliorate the tuberculosis treatment outcome in the country.

Ramona et al. (2011), while looking at the reasons that can explain the poor tuberculosis treatment outcome noted in the African continent, picked up a certain delay in diagnosing and treating the tuberculosis infection. This delay was related to the belief that a huge number of Africans consult first the traditional healer before attending to modern medicine. This belief leads to a late consultation and therefore to a poor tuberculosis treatment outcome. To improve the treatment outcome, the establishment of a partnership between modern health practitioners and traditional healers on the continent is recommended.

Lutge et al. (2013) conducted in South Africa a randomized controlled trial where tuberculosis participants were grouped in two clusters. Knowing that poverty affects the adherence to treatment and negatively impacts on the tuberculosis treatment outcome, an economic support as a voucher was offered to participants in the intervention cluster. Both clusters received the anti-tuberculosis therapy. The target was to assess whether that economic support may assist the community in terms of reducing the burden of tuberculosis. R120 per month was the economic intervention. This sum was the equivalent of foodstuffs the patient was entitled to collect from the shops. As a result, although there is a strong significance between the frequency of foodstuffs collection and the tuberculosis treatment success, the study did not establish a relationship between economic support to a tuberculosis participant and a better tuberculosis outcome.

Peltzer and Louw (2014) assessed in South Africa the prevalence and factors associated with tuberculosis treatment failure, death and default among people or districts well-known for a history of hazardous alcohol use. Forty clinics were considered in the study and respondents lived in shacks or traditional housing. The result showed a high rate of treatment failure,
death as well as default among the well-known people with a history of alcohol use. For possible intervention against poor tuberculosis treatment outcome, many factors were to be considered such as alcohol use, housing conditions, etc.

The South African Department of Health (2015) confirms that the mining communities are seriously affected by tuberculosis. The spread is subjected to numerous factors such as prolonged working condition, exposure to silica dust and to occupational and poor ventilation. Another factor that has been associated with the spread is poor socio-economic living conditions like poor sanitary, lack of knowledge on tuberculosis and other health conditions, co-infection HIV, silicosis and others. The spread affects also the neighbouring countries since many of the mine workers are immigrants.

Metabasin et al. (2017) in South Africa conducted a qualitative study in the clinics of Free State. The study aimed to assess the adherence to the tuberculosis treatment in order to assist patients who are unable to complete the full course of anti-tuberculosis therapy. After interviewing participants, many factors were noted to be associated to lack of adherence to tuberculosis treatment such as hunger, lack of family support as well as knowledge on the side effects of drugs and so on. A health education programme will enable the Free State Province of South Africa to improve the adherence to the treatment and ameliorate the tuberculosis treatment outcomes.

Cramm et al. (2010) in the Eastern Cape in South Africa discovered that the incidence and the prevalence of the disease is the highest in the country. Despite the knowledge of tuberculosis which is fairly good, stigma and lack of trust around tuberculosis and other infections are identified as factors that make bad the picture of the province in terms of tuberculosis. It is because of these two reasons that people are not ready to disclose their status. This attitude seems to lead patients to traditional healers before they can be directed to consult the modern health practitioners. The same attitudes become responsible for the fatality and poor tuberculosis cure rate observed in the province.

2.2.3 Housing dwelling conditions

Ranzani et al. (2016) compared the homeless new tuberculosis clients living in Brazil to their treatment outcomes. Knowing that homelessness is the key factor that makes Brazil have a high tuberculosis burden, these homeless new tuberculosis respondents were exposed to all sorts of things such as smoking, drugs and alcohol. After being initiated into anti-tuberculosis treatment, it appears that the treatments for all of them were unsuccessful. As a remedy, an intervention targeting the use of alcohol, smoking and drugs has to be carried out. Also, an accommodation plan which assists to keep the homeless in a home has to be added. Such an intervention will assist to improve the tuberculosis treatment outcomes in Brazil.

Munoz and Pardo (2008) disclose the living condition of freshly arrived immigrants in England. They live in isolated communities and chair apartments which are not well ventilated and are overcrowded. Many are smokers, lack resources and suffer from social deprivation. Environment contributes to the emergence or transmission of the tuberculosis if care is not be taken. Due to lack of accommodation, some immigrants found themselves homeless and exposed to the risks of developing the transmissible diseases such as tuberculosis.

Fenton and Castro (2006) present some of the steps that should be followed in order to prevent and control tuberculosis infection in the correctional and detention facilities. They suggest an early screening of the disease before the detainee can be put in the cell, followed by initiation of an anti-tuberculosis treatment for detainees who will be identified as
tuberculosis patients. Precautions must be taken since the infection can be transmitted with droplets from one individual to another. The correctional and detention services have to work hand in hand with the nearest health facility in connection with such patients. Evaluation of the programme should be put in place.

### 2.2.4 Indoor pollution

From the World Health Organization, Lonroth et al. (2015) focused their views on the possibilities of eradicating tuberculosis in the developed countries. It should be done in steps considering different challenges that face the named countries: migration of people from poor to rich countries, and progression from latent to active tuberculosis. Eight key points were developed as priorities for this large programme. Authors have to commit themselves politically, establish funding and populations in need, screening of the disease, monitoring and evaluation of the programme and research on tuberculosis. Although measures will be put in place, due to many parameters surrounding tuberculosis, this eradication will be a multi-sectorial approach that has to consider or include poor countries in order to reach its target.

Medea et al. (2015), in Georgia established the relationship between death rate and smoking tobacco. Almost sixteen percent of deaths occurring in males and seven percent in females are caused by tobacco smoking. Among countries with a high-burden of tuberculosis, tobacco smoking seems to be a major health problem. It increases by two the possibility of developing tuberculosis. It has been associated with a high incidence of multiple drug resistance (MDR) tuberculosis. It raises the morbidity and death rates. Tobacco smoking is actually one of the factors that worsen tuberculosis treatment outcomes. To avoid such outcomes, an appeal is made to all stakeholders on smoking cessation programmes especially in tuberculosis patients. While reducing the smoking, we provide space to a better tuberculosis outcome.

Jeyashree et al. (2016) in India wanted to know whether an amelioration of tuberculosis treatment outcomes among patients with tuberculosis of the lungs can be obtained by applying a smoking cessation intervention. This was a systematic review whereby randomized controlled trials were selected on the basis that they compare two treatments. One has to help tuberculosis patients who smoke to have a good treatment outcome by stopping smoking while the other treatment does not target smoking cessation. The treatment can be medical drugs or through counselling or other psycho-social interventions provided that the target is to stop smoking. Based on this, no study fulfils the criteria. Authors encourage studies that target smoking cessation interventions among tuberculosis populations. This because of the smoking which is part of the risk behaviours of human beings and quite a number of smokers are infected with a severe form of tuberculosis. Tuberculosis is one of the killer diseases in the poor countries.

Castillo et al. (2011) in the Philippines studied the effect of smoking on the treatment outcomes among tuberculosis patients motivated by the fact that not much has been written on the tuberculosis treatment outcomes versus smoking while it is known that smoking worsens the prevalence of tuberculosis. In the objectives, they aimed to establish the relationship between smoking and the tuberculosis treatment outcomes. This study was conducted in a hospital where the direct observe treatment strategy (DOTS) was applied. In conclusion, the study showed a relationship between smoking and tuberculosis treatment failure.

Masieedi (2017) in Iran studied among new tuberculosis patients the effect of smoking and smoking cessation programmes on the tuberculosis treatment outcomes. All participants
included in the study were tuberculosis patients. The sputum collected after two months, twenty and twenty-four months of treatment were the different elements considered in the tuberculosis control. The status of smoking was evaluated after eight weeks. After data analyse, the study showed a high cure rate among new tuberculosis patients who are not smoking and also among those who stopped smoking after eight weeks of treatment compared to patients who were still smoking. Take home message was to include in the tuberculosis programmes smoking cessation strategies.

Mashishale et al. (2015) in India confirmed that the country is one of the highest worldwide in terms of tuberculosis prevalence and cigarette smoking. Both constitute a significant risk factor for tuberculosis. Based on the two parameters, a study was conducted among new tuberculosis patients on the effects of smoking on the treatment outcomes. Respondents were grouped based on the fact that they never smoked, smoking and ex-smokers. Among respondents who were smoking and the ex-smokers, the bacteriological control remained positive after eight weeks of treatment initiation. These two groups of new tuberculosis respondents presented a substantial high rate of defaults, treatment failures and relapses, and smoking is associated with a risk of severe form of disease or tuberculosis and a slow bacteriological conversion.

Daxini et al. (2015) in India, knowing that smoking is one of the roots of tuberculosis, studied the impacts of smoking among patients who defaulted tuberculosis treatment. After analysing data, it appeared that smoking increases the risk of defaulting tuberculosis treatment more in comparison to the respondents who do not smoke. This was high among women smokers. It was advised, from this study, that smoking should be prohibited while starting tuberculosis treatment in order to reach a good compliance.

Aziza et al. (2015) conducted in Egypt a case-control study where tuberculosis patients were divided into two groups. The first group was constituted with tuberculosis respondents who are smoking and in the second group they put tuberculosis respondent non-smokers. The first target of this study was to detect the clinical as well as the radiological effects of secondary smoking on a tuberculosis client; and the second was to establish the progression of tuberculosis as a disease considering the tobacco exposure. After analysis, the results show that, in both groups, the clinical features were similar. Although there was a similarity in the clinical presentation, symptoms were coming out late among the smokers. This delay negatively impacts on the treatment outcome. The clinical outcome shows that the non-smokers gained more weight than the smokers and their clinical outcome was far better. Sputum bacteriological conversion was three times much better among the non-smokers than smokers. They found radiological lesions in both lungs among the smokers while among the non-smokers lesions were found in one side of the chest. A smoking cessation programme has to be incorporated into tuberculosis management.

Driessche (2015) studied in primary health care facilities of Kinshasa-Congo the effect of smoking on outcome of HIV and tuberculosis patients. He reported that there is an elevated risk of getting infected or developing active tuberculosis while exposed to smoking. There is also a high death rate within a smoking population worldwide. The study was motivated by the fact that less studies in the literature speak about the outcomes of patients on antiretroviral therapy or anti-tuberculosis treatment and smoking cigarettes. While comparing smoking to the outcomes of a population of tuberculosis patients already on treatment and six months after initiation on antiretroviral therapy, high mortality and loss to follow-up were noted among the smokers compared to the patients who never smoked.
Khan et al. (2015) in South Africa confirmed that tobacco smoking can cause cancer, heart diseases as well as tuberculosis. They conducted a retrospective cohort study in order to assess the tuberculosis treatment outcomes among users of tobacco to establish the baseline characteristics that can be associated with the use of tobacco as well as to determine the population of users of tobacco having tuberculosis. Data collected and analysed show that smoking is one of the societal behaviours associated with the emergence of tuberculosis and also affects negatively the treatment outcomes.

Van Zyl et al. (2013) in South Africa confirmed that tobacco use constitutes a severe health hazard. On the list of what it can expose, it can bring shorter life expectancy for the users. It can also expose users to different health conditions such as cancer, chronic pulmonary diseases, heart diseases, tuberculosis and so on. It affects passively or actively the exposed person. I can be associated with other behaviours such as drinking and eating disorders. It can also expose to certain habits and psychologic conditions like absenteeism at work, tiredness, anxiety, mood disorder, etc. It is true that stopping smoking may reverse all the above mentioned adverse effects on the body. But quitting has never been successful for all smokers, as it can induce relapse or failure rate. This is why psychologists, when involved in the smoking cessation therapy, apply the motivational interview steps.

Goedele et al. (2013) described the baseline characteristics of tobacco users in South Africa, their stage while considering the motivational steps and also their views on the different adverse effects that tobacco can cause to health. Knowing that the country has a high prevalence in terms of HIV infection, it was noticed that respondents to the study are aware of the negative effects of tobacco, specifically in tuberculosis. They are ready to quit tobacco. Some have already stopped without even being psychologically supported. The study suggests that a smoking cessation programme can be part of the services offered while handling or managing a tuberculosis case.

Fokazi (2013) in Cape Town highlights the fact that tuberculosis treatment outcomes and tobacco smoking seem to be a major public health problem. Many tuberculosis clients who smoke have their culture conversion delayed. By the end of the first two months of tuberculosis treatment, also called the intensive phase, all patients should be having a negative sputum result. It appears that clients smoking are not converted at this stage while compared to the clients who are non-smokers. This, most of the time, leads to an extension of the duration of treatment and may not be successful. From the study, a strong recommendation of quitting cigarette smoking while starting on tuberculosis treatment has to be applied. This request, once applied, may assist the client to improve the tuberculosis treatment outcome.

Peltzer (2014) assessed, over socio-health variables, smoking among tuberculosis clients in South Africa. Respondents were from the primary health care facilities all over the country, and there were more males than females. A questionnaire was used as a tool and answered by the respondents at the beginning and after six months. After analysis, the study showed that respondents especially males and other respondents who had a chronic illness presented with an elevated usage of tobacco during the assessment period. Chronic illness and the male gender were the socio-health variables associated with smoking among tuberculosis patients in South Africa.
2.3 Tuberculosis treatment outcome

2.3.1 Global tuberculosis treatment outcomes in patients without co-infection HIV

While the World Health Organization (WHO) Global Report (2016) confirms that there is an increase over time of number of tuberculosis cases who got successfully treated, the WHO Global Report (2013, 2014) shows a reduction of tuberculosis treatment success rate from 87% to 83% globally among the new and relapse patients. The Global Report (2014) reveals that the reduction is due to the increased number of tuberculosis notifications from India. That increase number of patients, notified as having tuberculosis, was not evaluated in terms of treatment outcome. The report continues by stating that, without Indian statistics, the overall treatment success in the category of new and relapse cases will fall from 86% to 74%.

2.3.2. Global tuberculosis treatment outcome in patients with co-infection HIV

WHO Global Report (2014) shows a tuberculosis treatment success rate for co-infected HIV of 75%, which is lower compared to the treatment success rate of tuberculosis without co-infection HIV (83%). In terms of death rate, the number is higher among tuberculosis patients with co-infected HIV than tuberculosis patients alone (11% versus 3%). The gap between the two groups was attributed to late screening of co-infection HIV and the delay in the initiation of the patients on anti-retroviral therapy (ART).

2.3.3 Tuberculosis treatment outcomes in South Africa

From the WHO Global Report (2015), new and relapsed tuberculosis patients registered in 2014 had a treatment success rate of 78% while the tuberculosis with co-infection HIV had 76%. MDR-TB had, in 2014, a 48% treatment success rate.

2.4 Conclusion

The literature presents the living conditions of tuberculosis patients in various aspects such as housing conditions, homelessness, smoking, alcohol, drugs, co-morbidities like co-infection HIV and MDR-TB, food security, malnutrition, poverty, African beliefs like consulting traditional healers before modern health practitioners, dispensing method like direct observed therapy (DOT), insufficient resources in the tuberculosis programme, and type of work like mining with its working conditions that expose people to tuberculosis. All these various aspects of living conditions are factors that can be associated with the spreading or emergence of tuberculosis as described by the literature.

The current statistics show an improvement in tuberculosis treatment outcomes globally; nevertheless, South Africa as a country has to produce more effort so that the global target of successful treatment rate of 85% can be reached.
CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter outlines the design, study setting, study population, sampling, inclusion criteria, data collection and analysis, bias and ethical considerations.

3.2 Study design

This is a cross-sectional quantitative study that was used to study the living conditions and treatment outcomes of tuberculosis patients in region 2 Tshwane district, Gauteng Province of South Africa. Affordability, feasibility and simplicity were the reasons that justified the choice of this study design.

3.3 Study setting

The research was conducted in region 2 of Tshwane district which is located in the northern part of Gauteng Province, South Africa. It is a rural area situated about 70 km from Pretoria centre, alongside the national road to Polokwane, Limpopo Province of South Africa.

3.4 Study population

A study population is a set of people with one or more characteristics in common who are the focus of a research. (Singh, 2007). All who were part of the study were all confirmed tuberculosis patients who received treatment in the 24-month period from 1st January 2014 up to 1st December 2015 and were registered in one of the nine clinics of region 2 Tshwane district.

3.5 Sampling

A sample is a selected group of participants that represent the larger population from which they were chosen. The selection process that results in the formation of the said sample is thus termed ‘sampling’ (Mbaezue, 2012). Sampling can also be defined as an estimated value to represent the population (Keller, 2010).

No sampling of the study population was done as all respondents were considered. The estimated study sample for statistical analysis was 180.

3.6 Inclusion criteria

All confirmed tuberculosis patients registered and treated in one of the nine clinics of region 2 Tshwane district from 1st January 2014 up to 1st December 2015 were included.

3.7 Data collection

Data collection started after the approval of the protocol by Sefako Makgatho Health Science University Research Committee (MSUREC). The researcher trained a research assistant who is a retired nurse who expresses herself in English and Se-Tswana. The two then collected raw data from the tuberculosis patients in region 2 of Tshwane district. A structured questionnaire was administered at the clinics as well as in the respondents’ homes after it had been tested in a pilot study. The respondents were thoroughly informed regarding the study, its aim and objectives. It was only after fully understanding that the respondents were advised to consent. They were free to agree or not to agree to participate in the study. A refusal of
participating in the study did not have an impact on the treatment of the patient. For those who accepted to participate, they had the choice of choosing to answer the English or Se-Tswana questionnaire since these are the two spoken languages in region 2 Tshwane. Any time during the process of administering the questionnaires, if a respondent felt uncomfortable, he or she had the right to notify the researcher or researcher assistant who could stop the process.

This questionnaire has four sections, namely: baseline characteristics, tuberculosis diagnosis, treatment outcome and living conditions. As a co-morbidity, an HIV question was inserted in the questionnaire, and respondents were free to disclose or not their status. As it is described in the protocol, the researcher and his assistant were bound to confidentiality and no respondent’s identity was needed during the entire research process.

3.8 Bias

Christopher et al. (2010) define bias as a systematic error that has been introduced at any step of the research study, for instance study design, data collection, sampling, data analysis as well as publication of the results. Bias leads to the selection or encouragement of one outcome or answer over others. In order for the results to be as close to the truth as possible, the researcher has to minimise errors. This study was subject to bias, more specifically by volunteer bias. To reduce this bias, the potential respondents were informed that the questionnaire would be completely anonymous. In this way, the respondents did not fear that there could be negative consequences associated with the way they might have answered the questions. The effect of the errors introduced by bias was also minimized to some extent by including all patients in the tuberculosis programme of region 2 Tshwane district.

Bias of interpretation was minimized by the choice of retired nurses confident in English and Se-Tswana, and also by training the research assistant on how to administer the questionnaire.

3.9 Reliability and validity

3.9.1 Reliability

Reliability is the extent to which a tool will provide the same results when used to measure similar subjects-in the same conditions- over again (Slavin, 1992). The researcher and his assistant collected data from the respondents (tuberculosis patients) themselves. The researcher dwelt with the primary data which were produced by the respondents. The patients’ records and addresses are still available in the registers of the nine clinics of region 2 Tshwane district.

3.9.2 Validity

Validity is the extent to which the research measures what it intends to measure (Slavin, 1992). The researcher and his research assistant administered a questionnaire that was piloted in another area. This piloted questionnaire was reviewed by peers in the class and also by the supervisor before it was applied in region 2 of Tshwane district.
3.10 Data analysis

After the raw data had been cleaned and captured in a Microsoft Excel spreadsheet, all statistical analyses were performed on SAS (SAS Institute Inc, Carey, NC, USA), version 9.4. Relationships or associations were all tested for significance using the Fisher Exact or Chi-Square test. P values equal or less than 0.05 were considered significant.

Results are presented in the form of frequencies and tables from which interpretations are made. Odds ratio and 95% confidence interval will be used while reporting the results.

3.11 Ethical considerations

Data collection took place after the proposal had received ethical approval from the Sefako Makgatho Health Science University Research Committee (SMUREC/H/150/2016: PG). Permission to collect the data from region 2 of Tshwane district (database clinics and homes) was granted by the Tshwane district authority (See appendix).

Respondents were informed about their right to withdraw at any time from the study if they experience any discomfort with the discussions. They were assured absolute confidentiality and anonymity.

An informed consent form was signed by the respondents, the parents or guardians in case of the minors; Assent from the minor in writing (agreement to participate) if he or she chooses to participate. This was done before administering the questionnaires.

3.12 Conclusion

This chapter highlighted the cross-sectional design used for investigating the living conditions and the treatment outcomes of tuberculosis patients in region 2 Tshwane district of Gauteng Province of South Africa. The use of a questionnaire permitted the researcher to gather data. The questionnaire consisted of four components that corresponded with the five objectives of the current research study: living conditions, tuberculosis diagnosis, treatment outcomes of tuberculosis patients, co-morbidity (co-infection HIV) and baseline characteristics. No sampling was done since all the 80 patients retrieved in the tuberculosis registers were considered. Only respondents who consented to be part of the study, after been given a full explanation of it, were considered for the sample. Data analysis was done as described above.
CHAPTER 4: RESULTS

4.1 Introduction

Data collected from the 180 respondents were analysed and the results will be presented in this part of the research study. In this chapter, respondents will be described according to the clinic of origin, age, gender, level of education and employment. The analysis goals are to describe:

- the living conditions of tuberculosis patients such as their food security, house dwelling conditions, indoor pollution levels as well as their HIV status,
- the tuberculosis treatment outcomes namely cured, death, default, failure or relapse, and
- any relationship between the living conditions and tuberculosis treatment outcomes.

4.2 Description of study respondents

4.2.1 Region 2 clinics of respondents

Data was collected within region 2 Tshwane district that has nine clinics. The frequency of respondents from each clinic is presented in the table below (see table 4.1).

Most respondents (35.6%, n=64) were from Temba community health centre, followed by Ramotse clinic (17.8%, n=32) and then Suurman clinic (16.1%, n=29). Respondents from Adelaide Tambo clinic made up 8.3% (n=15), Kekana Gardens clinic made up 6.7% (n=12), Gateway clinic made up 6.1% (n=11), Mandisa clinic made up 4.4% (n=8), New Eersterus clinic made up 3.3% (n=6) and the least were from Dilopye clinic (1.7%, n=3).

<table>
<thead>
<tr>
<th>Clinics</th>
<th>Frequency(n)</th>
<th>Percent %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adelaide Tambo</td>
<td>15</td>
<td>8.3</td>
</tr>
<tr>
<td>Dilopye</td>
<td>3</td>
<td>1.7</td>
</tr>
<tr>
<td>Gateway</td>
<td>11</td>
<td>6.1</td>
</tr>
<tr>
<td>Kekana gardens</td>
<td>12</td>
<td>6.7</td>
</tr>
<tr>
<td>Mandisa</td>
<td>8</td>
<td>4.4</td>
</tr>
<tr>
<td>New Eeesterus</td>
<td>6</td>
<td>3.3</td>
</tr>
<tr>
<td>Ramotse</td>
<td>32</td>
<td>17.8</td>
</tr>
<tr>
<td>Suurman</td>
<td>29</td>
<td>16.1</td>
</tr>
<tr>
<td>Temba</td>
<td>64</td>
<td>35.6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>180</td>
<td>100</td>
</tr>
</tbody>
</table>

Figure 4.1: Respondents according to the different clinics (n=180)

4.2.2 Age

Of the 180 respondents, 4 was the age of the youngest and 76 was the age of the oldest. The mean age of the respondents was 41 years of age.

<table>
<thead>
<tr>
<th>N</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td>41.0</td>
<td>13.87</td>
<td>32</td>
<td>4</td>
<td>76</td>
</tr>
</tbody>
</table>

Figure 4.2: Analysis of age (n=180)
4.2.3 Gender

The 180 respondents were comprised of 59.4% (n=107) males and 40.6% (n=73) females.

4.2.4 Level of Education

Respondents were categorised into four levels of education: ‘No school’ for respondents who had no formal education, ‘primary’ for those who had only completed up until primary school, ‘secondary’ for those who had reached or completed secondary and ‘tertiary’ for those who had reached or completed tertiary education.

Most respondents 59.4% (n=107) reached secondary education. 27.2% (n=49) were at primary level. 9.0% (n=16) did not have any formal education and 8 (4.4%) reached or completed tertiary level.
4.2.5 Occupation

Respondents were divided into two groups based on their occupational statuses. On one side, respondents without occupations are represented in the table below as ‘unemployed’ and on the other side working respondents are represented as ‘employed’.

Of the 180 respondents, n=93, (51.7%) were employed and n=87, (48.3%) were unemployed.

4.3 Description of living conditions of tuberculosis respondents

For the purpose of the current study, HIV/AIDS, food security, house dwelling conditions and indoor pollution levels were studied to define the living conditions of tuberculosis patients living in region 2 Tshwane of Gauteng. These are some of the variables used by community health workers in assessing the living conditions of individuals in different communities.
4.3.1 Respondents HIV status

Respondents were free to (or not to) disclose their HIV statuses. For those who disclosed, their statements were compared with the blood results in the clinics’ registers.

Most respondents (n=83, 46.1%) had a positive HIV status. Twenty seven percent (n=49) were not willing to disclose their HIV status and 26 percent (n=48) had negative HIV statuses.

![Figure 4.6 Frequency of respondents based on their HIV status (n=180)](image)

**Figure 4.6 Frequency of respondents based on their HIV status (n=180)**

4.3.2 Food security

Food security is defined by the World Food Conference (1974) as a state connected to the supply and accessibility of food by people.

WHO (2017) reports that an undernourished or poorly nourished population run a risk of developing tuberculosis and a good nutrition in tuberculosis management, remains a major contributing factor while targeting a good outcome.

Respondents were divided into two groups: “Yes” are respondents who have food in their homes from beginning to the end of the month. “No” referred to respondents who experienced a shortage or complete lack of food during some days of the month.
Most respondents (n=124, 69%) had food and those who experienced food problems were in the proportion of (n=56, 31%).

![Figure 4.7: Respondents response to food security (n=180)](image)

**4.3.3 House dwelling conditions**

Arthur (2015) outlined that tuberculosis incidence can be reduced by improving the housing conditions with regard to structural issues as well as functional ones. By housing conditions, he enumerated: lighting, air or ventilation, cleanliness of rooms and reduction of overcrowding.

In this study, the researcher used a standard questionnaire (WBOT) that was modified after the pilot. All the criteria for differentiating the well, somewhat and poorly maintained houses were incorporated.

Most respondents (71.1%) reside in a well-maintained house while 13 respondents (7.2%) live in poorly maintained houses. In between the two types of houses, there were 21 percent.
Figure 4.8 Respondent’s house dwelling conditions (n=180)

4.3.4 Indoor pollution or cigarette smoke inside the house

Feng et al. (2014) considered cigarette smoking as a major risk factor with an elevated prevalence of latent tuberculosis. All smokers have to be seen as a high-risk population for latent tuberculosis infection. Discouraging cigarette smoking during awareness campaigns should be part of the latent TB prophylaxis.

In the current study, through indoor pollution or cigarette smoke inside the house, the researcher considers all respondents who are smokers or who are sharing a house/room with a smoker. The respondents in this case can either be active or passive smokers.

Most respondents (n=111, 61.7%) were not living in a house with cigarette pollution, while 69 (38.3%) of respondents were exposed to cigarette smoke.

Figure 4.9 Frequency and percentage of respondents based on cigarette smoke
4.5 Relationship between living conditions and tuberculosis treatment outcomes

4.5.1 HIV status and tuberculosis treatment outcomes

HIV status as a living condition has been compared to tuberculosis treatment outcomes.

Of 180 respondents, 46.1% (n=83) had positive HIV statuses, 27.2% (n=49) were negative for HIV and 26.6% (n=48) did not reveal their HIV statuses.

Among respondents with positive HIV statuses: 37.3% (n=31) got cured, 26.5% (n=22) passed away, 31.3% (n=26) defaulted tuberculosis treatment, 3.6% had treatment failure and 1.2% (n=1) relapsed.

Among the group of respondents with negative HIV statuses: 67.3% (n=33) got cured, 10.2% (n=5) passed away, 14.2% (n=4) defaulted treatment, 4.0% (n=2) had treatment failure and 4.0% (n=2) relapsed.

The Fisher Exact test yielded an overall p value of 0.0003 for the table which was significant and indicated that there is an association between HIV status and tuberculosis treatment outcomes. This was followed up by pair-wise comparisons of the positive and negative percentages for each tuberculosis treatment outcome, applying the Fisher Exact Test. The p values, indicated in the table below, showed significant differences in the percentages for cure (0.0011), death (0.0269) and default (0.0372).

<table>
<thead>
<tr>
<th>HIV status</th>
<th>TB treatment outcomes</th>
<th>Cured</th>
<th>Death</th>
<th>Default</th>
<th>Failure</th>
<th>Relapse</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td></td>
<td>31</td>
<td>22</td>
<td>26</td>
<td>3</td>
<td>1</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>37.35%</td>
<td>26.51%</td>
<td>31.33%</td>
<td>3.61%</td>
<td>1.20%</td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td></td>
<td>33</td>
<td>5</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td></td>
<td>67.35%</td>
<td>10.20%</td>
<td>14.29%</td>
<td>4.08%</td>
<td>4.08%</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
<td>22</td>
<td>19</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45.83%</td>
<td>29.58%</td>
<td>8.33%</td>
<td>6.25%</td>
<td>0.00%</td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>Positive vs Negative</td>
<td>0.0011</td>
<td>0.0269</td>
<td>0.0372</td>
<td>1.0000</td>
<td>0.5549</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>86</td>
<td>46</td>
<td>37</td>
<td>8</td>
<td>3</td>
<td>180</td>
</tr>
</tbody>
</table>

Figure 4.10 Tuberculosis treatment outcomes based on respondents’ HIV status (n=180)

4.5.2 Food security and tuberculosis treatment outcomes

In this section, food security has been compared to tuberculosis treatment outcomes.

Of 180 respondents, 68.8% (n=124) had food every single day in their homes and 31.1% (n=56) had food shortages.

Among respondents who had food in their homes: 45.9% (n=57) got cured, 27.4% (n=34) passed away, 20.1% (n=25) defaulted tuberculosis treatment, 6.4% (n=80) had treatment failure and none of them relapsed.

Among the respondents who did not have food in their homes: 51.7% (n=29) got cured, 21.4% (n=12) died, 21.4% (n=12) defaulted treatment, none had treatment failure and 5.3% (n=3) relapsed.
Looking at the impact of food security in the tuberculosis treatment outcome, a significant difference was detected in the component relapse ($p=0.029$) using Fisher’s Exact Test.

<table>
<thead>
<tr>
<th>Food security</th>
<th>TB treatment outcomes</th>
<th>Cured</th>
<th>Death</th>
<th>Default</th>
<th>Failure</th>
<th>Relapse</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
<td>57</td>
<td>34</td>
<td>25</td>
<td>8</td>
<td>0</td>
<td>124</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45.97%</td>
<td>27.42%</td>
<td>20.16%</td>
<td>6.45%</td>
<td>0.00%</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td>29</td>
<td>12</td>
<td>12</td>
<td>0</td>
<td>3</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td></td>
<td>51.79%</td>
<td>21.43%</td>
<td>21.43%</td>
<td>00.00%</td>
<td>5.36%</td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>Yes, vs No</td>
<td>0.5207</td>
<td>0.4626</td>
<td>0.8442</td>
<td>0.0591</td>
<td>0.0290</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>86</td>
<td>46</td>
<td>37</td>
<td>8</td>
<td>3</td>
<td>180</td>
</tr>
</tbody>
</table>

Figure 4.11: Table of association of tuberculosis treatment outcomes with food security (n=180).

### 4.5.3 House dwelling conditions and tuberculosis treatment outcomes

In this section, house dwelling conditions were compared to tuberculosis treatment outcomes.

Of 180 respondents, 71.1% (n=128) were staying in well-maintained houses, 21.6% (n=39) used the somewhat maintained houses and 7.2% (n=13) were in poorly maintained houses.

Among the respondents who used the well-maintained houses: 52.3% (n=67) got cured, 22.6% (n=29) died during the course of treatment, 21.0% (n=27) defaulted, 2.3% (n=3) had failure and 1.56% (n=2) relapsed.

Among the respondents who used the somewhat maintained houses: 38.4% (n=15) got cured, 33.3% (n=13) died, 17.9% (n=7) defaulted, 10.2% (n=4) had failure and none relapsed.

In the group of respondents staying in poorly maintained houses: 30.7% (n=4) got cured, 30.7% (n=4) died, 23.0% (n=3) defaulted, 7.6% (n=1) had failure and 7.6% (n=1) relapsed.

Looking at the usefulness of house dwelling conditions in the tuberculosis treatment outcome, no significant difference was detected ($p=0.117$, using the Fisher’s Exact Test)

<table>
<thead>
<tr>
<th>House dwelling Conditions</th>
<th>TB treatment outcomes</th>
<th>Cured</th>
<th>Death</th>
<th>Default</th>
<th>Failure</th>
<th>Relapse</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well maintained</td>
<td></td>
<td>67</td>
<td>29</td>
<td>27</td>
<td>3</td>
<td>2</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td></td>
<td>52.34%</td>
<td>22.66%</td>
<td>21.09%</td>
<td>2.34%</td>
<td>1.56%</td>
<td></td>
</tr>
<tr>
<td>Somewhat maintained</td>
<td></td>
<td>15</td>
<td>13</td>
<td>7</td>
<td>4</td>
<td>0</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td></td>
<td>38.46%</td>
<td>33.33%</td>
<td>17.95%</td>
<td>10.26%</td>
<td>0.00%</td>
<td></td>
</tr>
<tr>
<td>Poorly maintained</td>
<td></td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30.77%</td>
<td>30.77%</td>
<td>23.08%</td>
<td>7.69%</td>
<td>7.69%</td>
<td></td>
</tr>
<tr>
<td>p-value comparing all 3</td>
<td>above</td>
<td>0.1396</td>
<td>0.366</td>
<td>0.9062</td>
<td>0.0545</td>
<td>0.3112</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>86</td>
<td>46</td>
<td>37</td>
<td>8</td>
<td>3</td>
<td>180</td>
</tr>
</tbody>
</table>

Figure 4.12: Table of association of house dwelling conditions with tuberculosis treatment outcomes (n=180).
4.5.4 Indoor pollution and tuberculosis treatment outcomes

In this section, indoor pollution has been compared to tuberculosis treatment outcomes.

Of 180 respondents, they were categorized into two groups: “Yes” or those exposed to indoor pollution were (n=69) and “No” or the non-exposed were (n=111).

In the exposed: 15% (n=11) were cured, 65.2% (n=45) died, 17.4% (n=12) defaulted and there was 1.5% (n=1) failure.

Among the non-exposed: 67.6% (n=75) were cured, 0.9% (n=1) died, 22.5% (n=25) defaulted, 6.3% (n=7) had failed and 2.7% (n=3) relapsed.

Using Fisher’s Exact Test, there is an association between indoor pollution and tuberculosis treatment outcomes (p<0.0001).

The pair wise comparison of “Yes” (Indoor pollution) and “No” (Indoor pollution) with the different components of tuberculosis treatment outcomes shows a statistical significance with cure (p<0.0001) and death (p<0.0001).

<table>
<thead>
<tr>
<th>INDOOR Pollution</th>
<th>TB treatment outcomes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cured</td>
<td>Death</td>
</tr>
<tr>
<td>Yes</td>
<td>11</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>15.9%</td>
<td>65.2%</td>
</tr>
<tr>
<td>No</td>
<td>75</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>67.6%</td>
<td>0.9%</td>
</tr>
<tr>
<td>p-value</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Yes vs No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>86</td>
<td>46</td>
</tr>
</tbody>
</table>

Figure 4.6: Table of association of inside house pollution with tuberculosis treatment outcomes (n=180).

4.6 Conclusion

The statistical analysis of the study data has been outlined through this chapter. It is divided into five sub-titles:

Introduction of the chapter followed by description of respondents. Looking at the data in this section, most of the respondents were from the nine clinics of region 2 Tshwane with majority participation from the Temba community health centre (35.6%). There were more males (59.4%) than females. The age ranges of respondents were from 4 to 76 years. Respondents with up to secondary level of education had the highest participation level (59.4%). Most of the respondents were employed (51.7%).

There was a description of living conditions of tuberculosis respondents. Data shows a high rate of respondents who are HIV reactive (46.1%). Most of the respondents are not experiencing food insecurity (68.8%). Seventy one percent live in well-maintained houses and most of them are not exposed to indoor pollution nor cigarette smoke inside their houses (62%).
There is a description of tuberculosis treatment outcomes. 5 tuberculosis treatment outcomes (cured, death, default, failure and relapse) were defined in this section.

Association between living conditions and tuberculosis treatment outcomes were established. Among tuberculosis respondents living with co-infection HIV, there is a statistically significant relationship since the overall p=0.0003. Comparing the positive HIV with the negative HIV, there is a statistically significant relationship between living conditions and tuberculosis treatment outcomes while considering cure, death and default rates.

Analysis shows a significant association between food security and tuberculosis treatment outcomes (p=0.0285), while comparing respondents who had food security with those who did not, this association is more prevalent in the ‘relapse’ category (p= 0.0290). No association was found between house dwelling conditions and tuberculosis treatment outcomes (p=0.1166). This is well shown in ‘cure’ and ‘death’ categories where both p-values are less than 0.0001. Indoor pollution and tuberculosis treatment outcomes show a statistical significance in cure as well as in death (p < 0,0001 for both).
CHAPTER 5: DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This study aimed to investigate the living conditions and treatment outcomes of tuberculosis patients in region 2 Tshwane district of Gauteng Province of South Africa. In this chapter findings that have been presented by this current study will be discussed compared to the outcomes of similar studies conducted in the world, limitations of the study will be emphasised, conclusions will be drawn from the discussions and recommendations will be presented to the key role players.

5.2 Main findings and discussion of the findings

This section will report the results or findings of the study.

5.2.1 HIV status and tuberculosis treatment outcomes

With a sample of 180 respondents, 83 (46.11%) of respondents had positive HIV status, 49 (27.22%) respondents were negative and 48 (26.66%) did not reveal their HIV status. The comparison of each HIV group (positive and negative) to the different tuberculosis treatment outcomes such as cure, death, default, failure and relapse shows a high cure rate of tuberculosis (67%) in the negative HIV status, while in the positive HIV status it is 27% with a high default rate of 31%. Data analysis done shows an association between HIV status and tuberculosis treatment outcomes. This association with the treatment outcomes is well established with the categories cure, death and default.

Karo et al. (2016) supported the above results in their European study conducted among two groups of tuberculosis. In one group they included tuberculosis with co-infection HIV and in another group it was those who did not have HIV as a co-infection. While comparing the two groups based on the tuberculosis treatment outcomes, results of the study show a poor treatment outcome and also a high death rate among the tuberculosis respondents with co-infection HIV. Subsequently, they found also a poor treatment outcome among tuberculosis respondents treated for MDR-TB with co-infection HIV. In order to ameliorate the tuberculosis treatment outcome among the clients with co-infection HIV, the authors encouraged more studies to be conducted in the direction of determining the duration of tuberculosis treatment for tuberculosis clients with co-infection HIV.

In Ethiopia Gebremariam et al. (2016), in a retrospective study using a record review, the above outcomes were supported in the sense that a high death rate as well as poor treatment outcome were found among the tuberculosis respondents having HIV as a co-infection. This was confirmed later in the same country by Sinshaw et al. (2017) while setting a target named Global Plan to stop tuberculosis 2011-2015.

Ali et al. (2017) in Ethiopia estimate the number of people infected with both HIV and tuberculosis to be around thirty percent. They indicate that the two conditions are the most serious issues that face Africa as a continent. Their study looked at the outcomes and the factors associated with them among patients on anti-tuberculosis treatment and also those infected with HIV. After analysis, they came up with a conclusion stating that a lower cure
and success rate was observed among tuberculosis respondents having co-infection HIV compared to respondents who had tuberculosis only. Advanced age and smear positive pulmonary tuberculosis were some of the factors that contribute to the poor treatment outcomes.

Mohammed et al. (2017) in their retrospective study conducted in one hospital of Ethiopia, determined the tuberculosis treatment outcomes and associated factors among the respondents attending the health facility. Although HIV was not the target in this study, it appears that both patients with a positive bacteriological sputum smear and respondents with co-infection HIV were likely to have a poor tuberculosis treatment outcome. This result supports the outcome of this region 2 Tshwane study.

Duru et al. (2016) in Imo-Nigeria, after a record review among the new cases of tuberculosis, found a cure rate estimated to forty-six percent followed by the default and death rates respectively at ten and seven percent. Duru et al came up with a similar relationship between HIV status and tuberculosis treatment outcomes by the fact that HIV was one of the factors that significantly worsens the tuberculosis treatment outcomes. Both tuberculosis and HIV are destroying and ruining populations.

In Cape-Town Nglazi et al. (2015) grouped respondents according to their HIV status as well as whether they were on antiretroviral therapy. This was a record review that took a two-year period and was aimed at tuberculosis treatment outcomes. Only tuberculosis clients were considered in the sample. Findings show a higher death rate among TB patients with co-infection HIV and not on antiretroviral therapy. There was no difference in terms of death and default rates among tuberculosis patients without co-infection HIV and tuberculosis with co-infection HIV on retroviral therapy.

Mahtab and Cotzee (2017) in Cape-Town have observed that with the occurrence of HIV, tuberculosis incidence is increasing in the country. This current study is a cross-sectional that aimed to describe the outcome characteristics of tuberculosis clients and detect the risk factors associated with the above outcomes among respondents who are co-infected with HIV. The study was conducted to a large number of people infected either by tuberculosis or HIV; and both. Among people having dual infection (tuberculosis and HIV), there was poor treatment completion and a high mortality rate compared with the individuals with only tuberculosis infection. The risk factors associated with this poor outcome were lack of smear (never screened for tuberculosis) and the client having a past history of tuberculosis treatment.

Mabunda et al. (2015) in Limpopo Province of South Africa studied factors associated with tuberculosis mortality. It was described through a retrospective study conducted within the province. The inclusive criteria were having been labelled as a tuberculosis patient and having passed away after being initiated on anti-tuberculosis drugs. As regards the findings, tuberculosis patients with co-infection HIV had a higher mortality rate compared to other tuberculosis patients without HIV co-infection. It was concluded that HIV co-infection was considered as one of the associated factors that leads to higher mortality within tuberculosis patients in Limpopo Province.

Naidoo (2015) in Johannesburg, while describing the characteristics of tuberculosis clients presenting with tuberculosis drug-induced liver injury features, categorised his respondents
into two groups based on their HIV status. The observation of that descriptive analysis found that tuberculosis respondents having liver injuries and also a positive HIV test result are likely to have high death and loss of follow up rates. The conclusion was in favour of a strong association between tuberculosis, HIV co-infection and poor tolerance of tuberculosis medication.

5.2.2 Food security and tuberculosis treatment outcomes

Respondents (n=180) were categorised in two groups: food security “Yes” (having food at home almost every day) and food security “No” (no food one or some of the days). In the category food security “Yes”, there were 124 (68.8%) respondents while in food security “No” there were 56 (31.1%). All respondents regardless of the category were assessed on the basis of the different tuberculosis treatment outcomes: cure, death, default, failure and relapse. The outcomes were as presented in the table 4. In the category food security “Yes” there was a high cure rate of 46 percent, the death rate was 27 percent, the default rate was 20 percent and the failure rate was 6 percent. In food security “No” the cure rate was 52 percent; the death and default rate were 21 percent and the relapse rate 5 percent. Using Fisher’s Exact Test while analysing the “Yes” and the “No” of each component of treatment outcome, a significant difference was picked up in the component relapse with a p value less than 0.05.

WHO (2013) reports an increased mortality and morbidity in the developing countries. This is the result of tuberculosis infection which has been associated with poverty. Poverty more often presents itself with features of under-nutrition. The report stated that, although there is not much evidence in the literature that supports the fact that nutritional care can improve tuberculosis treatment outcome, as it is the case in the region 2 Tshwane study, there is a room for nutritional care in developing countries that encounter undernourished tuberculosis clients. This should be applied to avoid future health risks. The report concluded with the fact that food security with an access and adherence to the disease medication can improve the tuberculosis treatment outcome. An absence of food security in an anti-tuberculosis medication can, in certain settings, lead to a catastrophic cost in the management of the condition.

Cegielski et al. (2012) conducted in the United States of America a study that aimed to assess the effect of nutritional status in the occurrence of tuberculosis. This is a continuation of a previous survey named NHANES I. In this current study adult respondents were followed during a ten-year period. Data collection was done through medical records, death certificates and interviews. This follow-up study came up with results that show a tuberculosis incidence of 95% for respondents underweight, 8.9% for the overweight and 5.1% for the obese. And hypoalbuminemia is considered as a risk factor associated with the occurrence of tuberculosis while vitamins such as A, riboflavin and other elements like iron were not compliant. Although the study does not tell us anything such as the disease outcomes, it has established the association that exists between nutritional status and tuberculosis incidence as shown through the region 2 Tshwane survey.

Gupta et al. (2009) in India raised the point that malnutrition and tuberculosis are linked and constitute a major health problem in many areas of the world. Globally, they are found in the underdeveloped or low socio-economic parts of the world. The two conditions are linked in the sense that malnutrition by suppressing the immunity will expose the individual to different infections like tuberculosis. Patients with tuberculosis will lose their appetite and
end up being malnourished. Once on anti-tuberculosis medication, the nutritional status will improve and the clients will be out of malnutrition. In those underdeveloped regions, it appears that there is a high prevalence of HIV infection. This infection is the factor that makes worse the two conditions named above. There is necessity to establish the nutritional status of all tuberculosis clients in order for them to benefit from nutrition supplementation. This study highlights the association between the nutritional status and the need of nutrition supplementation in managing tuberculosis.

In India, Bhargava et al. (2013) like many other authors such Gupta (2009) have understood that the outcome of a tuberculosis treatment might be affected by under-nutrition. This is one of the risk factors that comes with the tuberculosis treatment. In this Indian study, the nutritional status of the respondents was assessed at the beginning of the treatment (just after the diagnosis of tuberculosis is made) and at the end of the treatment. The aim is to find out, through this study, whether the nutritional status is associated with death when the client is still on medication. Body mass index (BMI) was used to distinguish underweight, overweight and obese. Looking at the results, more women (80%) than man (67%) were lying between moderate to severe under-nutrition before the treatment of anti-tuberculosis. At the end of the treatment, half of women and a third of men still had their weight between moderate and severe under-weight. That means more than fifty percent of patients remain after treatment of anti-tuberculosis in chronic state of under-nutrition. Five percent of the respondents passed away while on medication. Analysis shows that severe under-nutrition diagnosed before the tuberculosis treatment was coupled to twice the high risk of death. The region 2 Tshwane study as well as this Indian study highlight the association between tuberculosis treatment outcomes and nutrition. It is only that in the region 2 Tshwane study this association is more in the direction of patients relapsing while in the Indian study it is linked with death. In the Indian study, as in most of the studies talking about nutrition and tuberculosis outcomes, assessment of nutritional status should be part of the management of tuberculosis.

Samuel et al. (2016) in Bengal-India, based on the fact that tuberculosis treatment and its adherence are linked to socio-economic status of the clients (poor nutrition and poverty), conducted a cohort whereby nutritional support was given to a group of poor individuals (earning less than 2 US dollars per day) having tuberculosis and another group of poor tuberculosis respondents did not receive anything. They wanted to find out the relationship that may exist between poor treatment outcomes in tuberculosis and nutritional support. By poor tuberculosis treatment outcomes, the authors targeted: loss-to-follow-up, failure and death. After giving food parcels to the first group, the results showed 50% of reduced risk of poor treatment outcomes among respondents who received nutritional support compared to those who did not receive any support. They came up with the suggestion that all anti-tuberculosis programmes should incorporate nutritional support in order to improve the treatment outcomes. In this study as well as in the region 2 Tshwane study, the association between socio-economic conditions and treatment outcomes has been established. However, the authors did not attach the poor tuberculosis treatment outcomes with one of the components such as death, cure, failure or relapse.

Dargie et al. (2016) in Addis Ababa, Ethiopia, conducted a cross-sectional study that aimed to determine the prevalence of under-nutrition in a population of tuberculosis. The study was limited to the adult respondents having the condition within the public health facilities. A structured questionnaire was use as a tool for data collection. After analysis of data, they found a high level of undernutrition (39.7%) associated with tuberculosis in the public sector in Addis-Ababa. This result, although presenting some similitude with the one from region 2 Tshwane in terms of association between nutrition and tuberculosis outcomes, is silent in
terms of directing attention to the most likely components of treatment outcomes which are affected. However, it expressed the wish of including an assessment of the nutritional status as well as diet counselling in the management of tuberculosis in the poor countries.

Lutge et al. (2013) in South Africa studied the tuberculosis treatment outcomes after providing economic support to the tuberculosis respondents. The study was conducted in many local clinics of one of the provinces of the country with a high prevalence of tuberculosis. The economic support consisted of a foodstuffs voucher that was given monthly for local shops. The value of the voucher was equivalent to one hundred and twenty South African Rand (roughly fifteen American Dollars). The sample was divided into two groups: one group (36.2% of respondents) did not receive support while the second group (32.3%) received it for a short period of time. As an outcome, the economic support boosted significantly the treatment success rate. The authors would appreciate to apply such support in a big group such as the entire country for a larger picture of treatment outcomes. Deprived communities are the most vulnerable when it comes to tuberculosis spreading (Millet et al., 2011). The study is silent on the different tuberculosis treatment outcomes except success rate; however, it shows a clear picture of an association that exists between poor socio-economic status that includes the lack of food security and tuberculosis treatment outcomes.

According to the Nutrition Information Centre of Stellenbosch University (2009), although South Africans are receiving freely the medication against tuberculosis from each and every health facility established in the country, the statistics show that the cure rate is still below the global target. Some of the facts that have to be considered in order to increase the success rate are nutritional factors. The occurrence and the burdens of tuberculosis are also linked to the nutritional status of the individual. A poor diet or lack of meal may expose the client to the disease, even to its severe forms. There is a link between poor nutrition or malnutrition (weakens the immune system) and poor tuberculosis outcomes. This is applied to adults as well as children. The relationship between nutrition or food security and tuberculosis has been established as it was done in the region 2 study.

5.2.3 House dwelling conditions and tuberculosis treatment outcomes

The 180 respondents were categorised in well maintained houses, somewhat maintained houses and poorly maintained houses in the proportion of 128, 39 and 13. Among respondents living in a well-maintained house, 52.3% got cured, 22.6% passed away, 21% defaulted, 2% failed to complete treatment and 1% relapsed. In somewhat-maintained houses: 38% got cured, 33% died, 17.9% defaulted, 10% failed to complete treatment and 0% relapsed. In poorly-maintained houses: 30.7% were cured, 30.7% died, 23% defaulted and 7.7% failed and relapsed. Analyse done with Fisher’s Exact Test did not show significant difference between house dwelling conditions and tuberculosis treatment outcomes since the p value was greater than 0.05.

The Canadian Tuberculosis Committee (2007) considers housing conditions as part of well-being. It is one of the socio-economic indicators of health. With poverty, it is unlikely that housing conditions will be of quality. The committee establishes an association between poor housing conditions and poverty. It defines poor housing conditions as crowding, inadequate ventilation, tobacco smoke, mould and duration of exposure to tuberculosis infection. By establishing the association between poor housing quality and poverty, the committee stated that these two elements (poor housing and poverty) lead to a high occurrence of disease such
as tuberculosis. The committee suggested that decisions have to be taken when it comes to the issue of tuberculosis infection and inadequate housing conditions. Although nothing was said on poor housing and the treatment outcomes which is the aim of the region 2 Tshwane study, poverty and poor housing are strongly attached to the occurrence of tuberculosis. More surveys are needed to clarify the issue of poor house conditions and tuberculosis treatment outcomes.

Munoz and Pardo (2008) in United Kingdom (UK) highlighted that tuberculosis remains a major public health issue within immigrants in the UK. They are from Asia and sub-Saharan Africa and get affected while they are not yet established in the kingdom. They get infected with tuberculosis mostly during their first year in the United Kingdom. They live in groups and share apartments. In these apartments, they face overcrowding, poor ventilation which is sometimes aggravated by cigarette smoke inside the room, poor nutritional conditions or lack of food security, poor social capital, lack of immigration papers, language barriers and so on. All these conditions expose them to a lot stress. In such life conditions, the tuberculosis treatment can be less successful. Others are homeless with a high rate of tuberculosis infection. This rate has been estimated to be twenty times higher compared to what is happening to the ‘normal’ population. This implies a high mortality rate among homeless tuberculosis individuals.

There is not much in the literature that talks about housing conditions and tuberculosis treatment outcomes. The little literature that there is links housing condition and socio-economic status. Poor socio-economic status or poverty is attached to poor housing conditions that can lead to tuberculosis infection. Poor housing quality is attached to the occurrence of tuberculosis infection and also impacts negatively on the treatment outcomes. This does not correlate with the region 2 Tshwane which does not find any association between the poor dwelling house and the tuberculosis outcomes. However, more studies have to be conducted in order to get more light on the matter.

5.2.4 Indoor pollution and tuberculosis treatment outcomes

Of the 180 respondents, 69 (38.3%) were exposed to cigarette smoke and 111 (61.6%) were not exposed. Among the exposed, 15.9% got cured, 65.2% died during the treatment, 17.5% defaulted treatment, there was a 1.5% failure rate and there were no cases of relapse. Of the non-exposed to cigarette smoke group: 67.6% got cured, 0.9% died, 22.5% defaulted treatment, there was a 6.3% failure rate and 2.7% experienced relapse. Using Fisher’s Exact Test, there is an association between indoor pollution or cigarette smoke inside the house and tuberculosis treatment outcomes (p<0.0001). This association is well established in the component cured and death. There is a high rate of treatment success among the non-exposed to cigarette smoking and high death rate among the respondents with indoor pollution.

Gergia (2015) conducted a two-year retrospective cohort study in Tbilisi- Georgia. The aim was to establish the tuberculosis treatment outcomes between two groups of adult tuberculosis respondents. The first group was constituted by tuberculosis clients who were not smoking (or never smoked), while in the second group were all other respondents. Whether you stopped or you are still smoking you belong to the second group. This second group had two sub-groups: past smokers or all respondents who stopped smoking tobacco eight weeks before the study and current smokers. As a tool, a standardized questionnaire
regarding smoking tobacco was used. Poor tuberculosis treatment was defined as: default, failure and death while on anti-tuberculosis treatment. Data was analysed and the result shows a high risk of poor treatment outcome within the current smokers while past smokers had also the same outcome but not as considerable as it was among the current smokers. Although the author did not give the percentage of each and every component such as death, default and failure, the take home message supports the outcome of the region 2 Tshwane survey.

Johnson et al. (2016) conducted, in Bahru- Malaysia, a study that aimed to determine factors associated with poor treatment outcome in tuberculosis infection. Three factors were nominated: poor social status, smoking tobacco and smear positive (sputum). Looking at the hypothesis that the above three factors may lead to poor tuberculosis outcomes, data were collected, analysed and showed that only smoking and a positive smear were strongly associated with poor tuberculosis outcomes. Authors would like to have more surveys done in order to support their findings. In this direction, the region 2 survey actually supports the findings of this study in a sense that smoking, as described in the region 2 result, leads to death and decreases the success rate of the tuberculosis treatment outcomes.

In Southern Mexico, Bonacci et al. (2013) studied the possibilities of a link between tobacco use and incidence, mortality rates and treatment outcomes of pulmonary tuberculosis. They included only patients having acid-fast bacilli in the sputum and were part of the local DOTS programme. In this group, there respondents who were smoking and non-smokers. Analysis done showed that respondents who smoke were more likely to end up with an unpleasant outcome. The occurrence of pulmonary tuberculosis is likely to be elevated in the smoker-population. The study advises to include in all programmes of tuberculosis control strategies for preventing or stopping cigarette smoking.

At Khyber Teaching Hospital in Pakistan, Khan et al. (2015) conducted a survey whereby one of the objectives was to assess the tuberculosis treatment outcomes among a population of smokers. 472 respondents were registered for the study. Among them, they have included all patients with pulmonary and extra-pulmonary tuberculosis who, also, had diabetes mellitus and HIV infection. Some of them were smoking tobacco and others did not. These were the two groups that were formed for the purpose of this study. At the end of the treatment, the smear was checked and the treatment outcomes were defined based on that result. Among the smokers, the number of male respondents was ten times higher than females. Results show that gender, age group and marital status of respondents had a significant relationship with smoking since the p-values were equal or less than 0.05. There was a high rate (79.4%) of unsuccessful tuberculosis treatment outcomes which were observed among the smokers (women and men. This led to the conclusion that not only is smoking a factor associated with the occurrence of tuberculosis, but it also points to the unsuccessful outcomes of the disease as noted in the region 2 Tshwane survey.

In Egypt, Aziza et al. (2015) studied the clinical, radiological and evolution of smoking among patients diagnosed with pulmonary tuberculosis. They divided the respondents into two groups: 59 smokers and 45 non-smokers making a hundred and four respondents. Analysis conducted and the results showed that no clinical differences were noted in terms of the symptoms. Radiologically, diffuse lesions were pick up on the films of the smokers while the same pictures were seen on the non-smokers’ films but on one of the lungs. It was noted that the non-smokers gained weight and their sputum was converted by the second month of treatment by 95.6 percent. Their treatment outcome was good in 91 percent of the cases
compared with the smokers who had 35 percent in treatment outcome and delayed sputum conversion. This study presents how hurtful smoking can be in the clinical, radiological and outcome aspects of tuberculosis which the region 2 Tshwane survey currently supports. The need of incorporating in the tuberculosis control programmes all smoking cessation strategies as presented in many studies has been highlighted as well in this Egyptian survey.

Integrated Tuberculosis and Anti-Retroviral Treatment (ITART) in Kinshasa-Democratic Republic of Congo (2011) conducted a study on tobacco use and the tuberculosis treatment outcome among respondents initiated in antiretroviral therapy (ART) for HIV. With the approval of Carolina University in the United States of America, the study was conducted in primary health care facilities in Kinshasa. The sample size was 599, and respondents were grouped in three categories: previous smokers, current smokers and never smoked. Respondents smoking for more than ten years and started ART during their tuberculosis treatment were found to be five times more likely to be lost to follow up, almost four times more likely to die and three times more likely to experience adverse tuberculosis treatment outcomes - all in comparison to those who had never smoked. Apart from the loss of follow up and adverse tuberculosis treatment outcomes, a similarity has been noted in the death rate of this study while comparing it to the death rate of the region 2 Tshwane study. As a recommendation, counselling has to be provided in order reduce tobacco use as well as to ameliorate the tuberculosis treatment outcome in primary health care in Kinshasa.

Louwagi and Yusuf (2013) revealed that there is an increased risk for adverse tuberculosis treatment outcomes among patients who smoke. The study was conducted among tuberculosis patients with some of the objectives such as assessment of the readiness to quit smoking, and the beliefs on the effects of tobacco. It was a cross-section survey using a structured interview-administered questionnaire, done in one of the highest prevalence South Africa areas in terms of HIV infection. In this survey, they distinguished the past smokers and the current smokers who tried to stop smoking but failed. It was noticed that fewer women and respondents who reach matric smoke, while smoking was common in the group of respondents who do not have a permanent work, among respondents who do not often have food at home, among alcoholics and also the substance abusers. It has been proven that smoking has a destructive effect. Respondents were aware of this and a few expressed the wish of quitting. A huge wish of incorporating smoking cessation in the tuberculosis programmes was raised in the study since the awareness of adverse treatment outcomes.

Murrison et al. (2016), in Johannesburg, South Africa, studied within males the link between pulmonary tuberculosis and current tobacco smoking. It was a case-control that included respondents having a bacteriological proof of the disease and having smoked for the past eight weeks. All the respondents were on antiretroviral treatment (ART) for HIV infection. After analysis, the results showed tripled likelihoods of tuberculosis among the smokers, while the past smokers had doubled their likelihoods of disease when compared to the likelihoods within respondents who were not smoking. There is an association between the occurrence of tuberculosis, HIV status and smoking. The occurrence of tuberculosis in HIV patients is higher for the current smokers, followed by the past smokers (stopped smoking) and the non-smokers. The current study brought up the strong association that exists between occurrence of tuberculosis and tobacco use as well as the burden of smoking in the treatment outcomes of tuberculosis in the city of Johannesburg. The region 2 Tshwane survey expresses the same association and burden, especially regarding cure and death rates.
Sitas et al. (2004) conducted a case-control in South Africa from the deceased who were smokers five years ago. The deceased records allowed the researchers to differentiate the two causes of death: causes related to smoking and causes not related to smoking such as external cause (Motor Vehicle Accident) and alcohol related death. From a sample of five thousand deceased, all known as smokers while living and from 25 years and above as it was stated by the family members, the results show among the different diseases that were associated with the death that tuberculosis (20%) was significantly associated. This survey confirmed the association between smoking and death among tuberculosis patients as described in the region 2 survey. The study also presents smoking as a factor associated with 8% of adult deaths countrywide.

5.3 Conclusion

The main findings of the current study were compared to the literature’s findings. HIV as a comorbidity appears to be strongly associated with the tuberculosis treatment outcomes in the region 2 study as well as in many articles of the literature. In the current study, this association is well supported by treatment outcome components which are cure, death and default. Food security has an impact on the tuberculosis treatment outcomes. Lack of food or malnutrition is actually a factor associated with the occurrence of the disease and can also negatively impact on the treatment outcome as presented by many articles in the literature, while nutritional care associated with adherence improves the tuberculosis treatment outcomes. Of course, as established in the literature, there is a relationship between food security and the outcome of tuberculosis treatment. In the region 2 survey, this association is well defined in the component relapse. Regarding house dwelling conditions, not much has been said in the literature. The current study has not found an association between house dwelling conditions and the tuberculosis treatment outcomes. Indoor pollution has been strongly demonstrated to have a relationship with the occurrence as well as with the outcomes of tuberculosis treatment. This association is found in the literature and also in the current region 2 survey.

5.4 Limitations of the study

The study results may seem consistent with other surveys; nevertheless, this current region 2 Tshwane study has its own specificity when it comes to the living conditions and treatment outcomes of tuberculosis patients within the South African milieu. Data collection, as stated above in chapter 3 (methodology), was a self-administering questionnaire whereby respondents or family members (in case the patient passed away) expressed themselves by ticking the preferred answer which he or she found in the tool (questionnaire). Apart from the above point, the findings of the current study may have some limitations. It is limited by the fact that not all tuberculosis patients in region 2 Tshwane district were included because of
the size of the area and the time allocated for data collection. The overall sample size (n=180) might not reflect the certainty on the ground. The sample considered might have been larger if the time of data collection could have been extended. Because of this limitation, current findings may not be extrapolated to higher levels (countrywide).

Second limitation: some relatives did not accept to participate only because their relatives or the tuberculosis patients passed away and this study or questionnaire reminded them of their bad experiences. The overall sample size (n=180) did not reflect the truth on the ground.

5.5 Recommendations

Smoking cessation strategies to be applied in all tuberculosis clients.

Nutritional status assessment to be incorporated in all tuberculosis programmes especially before patients can embark on anti-tuberculosis regimen.

HIV test to be offered to all individuals diagnosed with tuberculosis.

More studies to be conducted on housing dwelling conditions and tuberculosis treatment outcomes.
References


- 40 -


APPENDIX

Appendix A: Questionnaire

In case of death, relatives can be interviewed.

All responses will be cross-checked with the information kept in the clinics registers.

A. Baseline characteristics:

<table>
<thead>
<tr>
<th>Age (years) or date of birth</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Gender:</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Level of education</th>
<th>None</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Marital status</th>
<th>Single</th>
<th>Married</th>
<th>Divorced</th>
<th>Widowed</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Employment:</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Which clinic are you attending?

B. Tuberculosis diagnosis and treatment outcome

<table>
<thead>
<tr>
<th>Date or month or year of TB diagnosis:</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Place of diagnosis:</th>
<th>Clinic</th>
<th>Hospital</th>
</tr>
</thead>
</table>

Did you take TB medication / treatment? | Yes | No |

If ‘Yes’ you were on TB treatment and for how many months? (duration of TB treatment you took)

<table>
<thead>
<tr>
<th>What was the treatment outcome?</th>
<th>Cure</th>
<th>Death</th>
<th>Default</th>
<th>Failure</th>
<th>Relapse</th>
</tr>
</thead>
</table>
C. Living conditions:

1. HIV test and outcome

<table>
<thead>
<tr>
<th>Do you know your HIV status?</th>
<th>Yes</th>
<th>No</th>
<th>I am not comfortable with this question</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is it?</td>
<td>Positive</td>
<td>Negative</td>
<td>I am not comfortable with this question</td>
</tr>
</tbody>
</table>

2. Food security

<table>
<thead>
<tr>
<th>Are you every day having food in your house?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you receiving a grant or food parcel every month?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Can it happen that you sleep hungry (because of lack of food)?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Do you have a refrigerator in your house?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Do you have a stove in your house?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

3. Housing dwelling conditions

<table>
<thead>
<tr>
<th>House dwelling conditions:</th>
<th>Well maintained</th>
<th>Somewhat maintained</th>
<th>Poorly maintained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yard dwelling Conditions:</td>
<td>Well maintained</td>
<td>Somewhat maintained</td>
<td>Poorly maintained</td>
</tr>
<tr>
<td>Number of rooms in your house? (bedrooms + dining room)</td>
<td>1</td>
<td>2</td>
<td>More than 2</td>
</tr>
<tr>
<td>Number of windows in your house?</td>
<td>0</td>
<td>1</td>
<td>2 or more</td>
</tr>
</tbody>
</table>

4. Indoor pollution or cigarette smoke inside of the house

<table>
<thead>
<tr>
<th>Are you smoking cigarettes or have you stopped smoking cigarette?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>If you stopped smoking cigarettes, for how long?</td>
<td>More than 1 year</td>
<td>Less than 1 year</td>
</tr>
<tr>
<td>Is there someone smoking in your house or are you sharing a house with a smoker?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Thank you for answering the above questions.
Appendix B: REQUEST OF CONDUCTING A STUDY IN REGION 2 TSHWANE HEALTH DISTRICT

To the Manager                                      Pretoria, 10th April 2015.
Tshwane District health
The Fields Building
Hilda Street
Hatfield/ Pretoria

REQUEST OF CONDUCTING A STUDY IN REGION 2 TSHWANE HEALTH DISTRICT

Dear Manager,

I would like to request for the above-mentioned subject.

I am Medical Doctor working in region 2 of Tshwane district since 2013; and also in second year of MPH (Master in Public Health) at Sefako Makgatho Health Sciences University.

As one of the requirements for me to fulfil the MPH programme, I have to conduct a research which will be presented as a dissertation to the University.

My area of interest is tuberculosis. Since we always face some challenges in the sub-district in terms of managing this condition, my research may serve as a contribution to this public health issue that affects my working area. My topic is: Living conditions and treatment outcomes of tuberculosis patients in region 2 Tshwane health district of Gauteng Province.

Hoping that a permission will be granted in order to use all the clinics of region 2 Tshwane district as sites for my research study, I am thanking you in advance for your consideration.

Kind regards,

Dr T. Bongongo
Temba CHC
bongongotombo@gmail.com
APPENDIX C. CLEARANCE CERTIFICATE

Sefako Makgatho Health Sciences University
Research & Postgraduate Studies Directorate
Sefako Makgatho University Research Ethics Committee
(SMUREC)

Molotogi Street, Ga-Rankuwa 0208
Tel: (012) 521 5617/3698; fax: (012) 521 3749
Email: lorato.phiri@smu.ac.za
P.C. Box 163 Medunsa 0204

APPROVAL NOTICE - NEW APPLICATION

04 August 2016

Dr T Bongongo
Department of Public Health
P.O Box 215
Medunsa, 0204

MEETING: 03/2016

SMUREC Ethics Reference Number: SMUREC/R/150/2016: PG

The New Application received on 17 March 2016, was reviewed by members of Sefako Makgatho University Research Ethics Committee 07 April 2016 and approved on 04 August 2016.

Title: Living conditions and treatment outcomes of tuberculosis patients in Region 2 of Tshwane district, South Africa

Researcher: Dr T Bongongo
Supervisor: Dr H van der Heever
Department: Public Health
School: Health Care Stainosis
Degree: MPH

Please note the following information about your approved research protocol:

Protocol Approval Period: 04 August 2016 – 04 August 2017

Please remember to use your protocol number (SMURECN/150/2016: PG) on any documents or correspondence with the REC concerning your research protocol.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modification, or monitor the conduct of your research and the consent process.

After Ethical Review: Please note a template of the progress report is obtainable in the Research Office and should be submitted to the Committee before the year has expired. The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit. Translation of the consent document in the language applicable to the study participants should be submitted.

International Organization (IORC0008691), Institutional Review Board (IRB0000/0340) Expiry date: 09 December 2018, Federal Wide Assurance (FWA000023543) Expiry date: 31 August 2017 and NREC No: REC 21/04/05-003

Sincerely,

[Signature]

DR C BAKER
DEPUTY CHAIRPERSON SMUREC

[Stamp]

Date: 04/08/2016
APPENDIX D. AUTHORISATION LETTER FROM TSHWANE HEALTH DISTRICT

Gauteng Provinces
Republic of South Africa

TSHWANE RESEARCH COMMITTEE
PROVISIONAL CLEARANCE CERTIFICATE

Title: Living conditions and treatment of TB patients in Region 2 of Tshwane District, South Africa

Researcher: Dr T Bongongo

Supervisor: Dr H van der Heever

Department:

DECISION OF THE COMMITTEE

The study will be allowed to be conducted once the research ethics committee grant the approval.

NB: THIS OFFICE REQUESTED A FULL REPORT ON THE OUTCOME OF THE RESEARCH DONE

Date: 28/09/2015

Dr. Molapane Chuene-Shabangu
Chairperson Tshwane Research Committee
Tshwane Health District