FACTORS INFLUENCING TREATMENT ADHERENCE AMONG PATIENTS WITH PULMONARY TUBERCULOSIS AT THREE SELECTED SITES OF RWANDA

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DECLARATION

I, declare that this Dissertation entitled" Factors influencing treatment adherence among patients with pulmonary tuberculosis at three selected sites of Rwanda" contains my own work except where specifically acknowledged.

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DEDICATION

I dedicate this research project to almighty God, my parents, my co-workers and relatives for their support and encouragement throughout my studies, I cannot also forget other people like my supervisors who greatly took part in the accomplishment of this work.

ABSTRACT

Tuberculosis is a major threat to the public health of the people and approximately affects more than 10.4 million worldwide. Non adherence with tuberculosis (TB) treatment has apparently been cited as one of the major barrier which has contributed to the wide spread of TB, relapse and multi-drug resistant TB (MDR-TB) in patients with tuberculosis. Adherence to TB treatment is associated with many factors such socio economic factors, patients related factors and health system related factors. Adherence to TB treatment is important for promoting individual and public health status. **Aim of this study**: To assess the factors influencing treatment adherence among patients with pulmonary tuberculosis (PTB) at three selected sites of Rwanda. **Research methodology**: A cross sectional study was conducted in TB patient followed in three health settings of Rwanda (Remera Health Center, Kibagabaga and Masaka district hospitals). Purposive total population sampling technique was used to recruit study participants. **Ethical consideration**: The data from this study were kept confidentially and anonymity was maintained using the codes to questions. The permission to conduct this study was obtained from the respective authorities. **Results:** From a total of 80 participants analyzed, 67.5% were male and most of them aged between 30 and 39 years with proportion of 43.8% and on education level, 60% of participants attended primary studies, 28.8% were smokers, 23.8% did not know treatment durations of PTB, 80% did not believe in prayers as a motivator for TB treatment adherence. Those who have parents, children and co-workers reminders strongly associated with TB treatment adherence with P value of 0.000, 0.008 and 0.000 respectively. Education on how to take TB medication strongly associated with adherence with P value of 0.000. Overall knowledge score of participants was 62% and adherence score was 68.8%. **Conclusion:** Generally, the adherence level to anti-TB treatment among TB patients were low because the score was 68.8% which is less than 70% according to visual analogue scale (VAS) used in the study to categorize the responses score. Effort must be made to strengthen DOTs in order to improve TB treatments adherence.

Keywords: Adherence, pulmonary tuberculosis, influencing factors, Treatment, DOTs

LIST OF ABBREVIATIONS AND ACRONYMS

AIDS: Acquired Immunodeficiency Syndrome

CMHS: College of Medicine and Health Sciences

CHWs: Community Health Workers

DOTS: Direct Observed Treatment Short course

HBM: Health Belief Model

HIV: Human Immunodeficiency Virus

HLA-DR2: Human Leukocyte Antigen-antigen D Related

INH: Isoniazid

IRB: Institutional Review Board

LMICs: Low and Middle Income Countries

MDR-TB: Multi-drug Resistant Tuberculosis

MOH: Ministry of Health

MTB/RIF: Mycobacterium tuberculosis and resistance to rifampin

NTDLP: National Tuberculosis, Leprosy and Lung Disease Program

PTB: Pulmonary Tuberculosis

RH: Rifampicin

SPSS: Statistical Package for the Social Sciences

TB: Tuberculosis

UK: United Kingdom

VASs: Visual Analogue Scales

XDR: Extensively Drug Resistant

WHO: World Health Organization

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CHAPTER ONE: INTRODUCTION

1.1. Introduction

Tuberculosis (TB) is classified among major threat on the public health of people and it remains among the top 10 causes of death globally (World Health Organization, 2017).Non adherence with (TB) treatment has apparently been quoted as one of the major barriers which have contributed to the wide spread of TB and multi-drug resistant TB (MDR-TB) in patients with tuberculosis infection. The effort of TB control is threatened by drug resistant tuberculosis (DR-TB). This serious issue occurs when the patients treatment interrupt as result of poor adherence and TB drugs in short supply (Bhadke *et al.*, 2016).

1.2. BACKGROUND OF THE STUDY

Adherence to tuberculosis (TB) treatment is important for promoting individual and public health safety. In 2014, 9.6 million people became ill with TB and 1.5 million died, ranking TB alongside HIV as a leading cause of death worldwide. More than 95% of TB deaths occur in low and middle-income countries (LMICs) (Moghaddam *et al.,* 2016).

In 2017 the study conducted in Kosovo, southeast Europe, the magnitude of TB patients adherence and non-adherence to treatment were 85.5% and 14.5% respectively (Krasniqi *et al.*, 2017).In 2015, 63,189 new TB cases reported in Brazil and the incidence of 30.9 cases/100,000 residents notified with cure adherence of 72.5% and poor adherence of 11.0% in patients who initiated TB treatment (Beraldo *et al.*, 2017).

In India, 7.7% of patients with TB were discovered to have a past history of anti-TB interruption. India is classified amongst the countries with the highest burden of TB accounting for 21% of the global incidence. Inadequate adherence to treatment speed up the risks of morbidity, mortality and dissemination of TB infection in vulnerable community (Bhadke *et al.*, 2016).

In the study carried out in China found that, about 15% of the patients were poorly adherents to TB treatment. This percentage was notably higher than in other Chinese cities such as Jiangsu (11.4%), Ningxia (6.7%) and Anhui (9.5%) patients. It also found that the level of mortality and cure rate of TB depended on drugs compliance. The mortality in compliance patients was 0.0%

compared with noncompliance patients which account for 11.9% of mortality rate (Gong *et al.*, 2018).

In Singapore MDR-TB cases emerged, whereby six new cases were identified in 2011 compared to three cases in 2010, it was resulted from poor adherence to treatment of pulmonary tuberculosis (PTB) that led to failure to attain microbiological treatment (Lee *et al.*, 2016).

The study conducted in Ethiopia (2016) identified that, out of 500 patients diagnosed with TB, 8% of patients were known to have MDR-TB. Poor adherence to TB treatment was 36.6% and 35% had extra pulmonary tuberculosis. Turkey report showed that 65.5% of patients met the standards of good adherence while 34.5% did not. Patients with advanced age found to be more non-adherent. The cohort study conducted in Cameroon on the sample of 1688 TB patients 20% poorly adhered to anti-TB treatment (Daksa, Kebede and MarIam, 2016).

The highest figure of TB cases found in south Asia at the rate of 29% and in Africa at the rate of 26%, 75% of global TB deaths occur in those two continents. South Africa, India and China are categorized in countries with high burden of TB with prevalence of 1.98 million in India, 1.4 million in China and 0.5 million in South Africa. Quantitative and qualitative study conducted in Nigeria indicated that, 24.5% of patients on anti-TB treatment were not adhering well. The expenditure on anti-TB medications remains a big problem in poor adherence of TB treatment (Woimo *et al.*, 2017).

In sub-Saharan Africa countries, there is high prevalence of TB patients who lose follow up of TB treatments that varies from 11.3 to 29.6%. This variation is due to different factors that persuading non-adherence to TB treatment (Gebreweld et al., 2018). In South Africa, the prevalence of TB treatment non-adherence accounted for 7.2% among patients with TB infection (Kigozi *et al.*, 2017).

Previous study in Ethiopia 75.5% of participants adhered to anti-Tb regimen and 14.5% presented poor adherence. In contrast with previous studies in this country, this study indicated high poor adherence rate to treatment in new corroborated patients with pulmonary TB (Woimo *et al.*, 2017).

Quantitative study performed in Khartoum state in Sudan revealed that 86% of TB patients had achieved their treatment adherence whereas 14% of patients had interrupted treatments. Most of

those patients defaulted before period of data collection. This high rate of interruption was comparable to rates reported in previous studies carried out in Khartoum State. The mentioned high rate is much greater than the target rate of WHO which is 3% (Osman, Ali and Prins, 2016). The study conducted in Nigeria among 229 patients with TB infection, 19% reported to have interrupted their TB treatment (Ibrahim *et al.*, 2014).

Kenya as the country in East Africa it was found that non-adherence rate of TB treatment among patients with tuberculosis for 15% regardless the implementation initiatives tailored by Kenya National Tuberculosis, Leprosy and Lung Disease Program (NTLDP) of TB management goal of 70/85 targets, whereby 70% of tuberculosis infection must be detected and 85% of diagnosed patients must be treated (Kiplangat Arap Sang, 2017). A prospective study carried out in the North-west, Tanzania in 2017 indicated 16.9% of poor adherence to TB drugs in the first two months of treatments (Kidenya *et al.*, 2017).

In Rwanda, according to retrospective study of adult patients with TB smear positive in 2007 among 48 clinics, it was found that 90% of patients were adherent to TB treatment while 10% have poor adherence to treatments. The adherence in patients with HIV-TB co-infection was considerably very low and 12% of patients diagnosed with PTB had died (Kayigamba *et al.*, 2013). Poor adherence to TB treatment is among of the independent predictor of MDR-TB. As in Rwanda there are centers of MDR-TB patients in selected district hospitals that are still receiving the patients with drug resistance TB ad currently no quantitative studies conducted which show the factors influencing TB treatment adherence, the study emphasized on the factors influencing TB treatment adherence in patients with pulmonary tuberculosis.

1.3. PROBLEM STATEMENT

Across the world, many countries implemented the Direct Observed Treatments (DOTs) as one of the measures of improving TB treatment adherence and it promoted the significant reduction rate of resistance, failure and relapse (Wynne *et al.*, 2014). Adherence to DOTs in practice is variable across different health settings in Rwanda.

Despite of growing evidence for the treatment of tuberculosis in rich and resource-poor settings, information on adherence with tuberculosis treatment in Rwanda is missing. Through financial support from many different international donors, Government of Rwanda through ministry of health has expanded its tuberculosis program health services to improve treatment services. But, despite of this extension, the staffs still have inappropriate data on levels of TB treatment adherence and related factors that help them to optimize treatment efficiency. So far, there has been only one retrospective cohort study conducted in Rwanda to investigate treatment adherence among patients with tuberculosis (Kayigamba *et al.*, 2013). Previous study in Canada on TB adherence mentioned that, poor adherence was the most important cause of failure in initial TB treatment (Reis, 2016). In addition, studies done in different places indicated that poor adherence was found in the range of 21.2% and 32.9%, this poor adherence was associated with a number of factors (Kutyabami *et al.*, 2014). The studies done recently showed 26% of MDR-TB cases in Ethiopia, 9.5% in Zambia, 54% in Nigeria and 9.4% in Rwanda. Consideration of MDR-TB has been ignored in sub-Saharan Africa until recently where new cases of TB were significantly occurring in different population and most of the studies conducted related to drug resistant rather than factors contributing to this resistance (Warkicho *et a.l*, 2017).

To date, the review of literatures did not reveal quantitative studies regarding TB treatment adherence in Rwanda and related factors. Therefore, the current study was conducted to assess factors influencing TB treatment adherence in patients with pulmonary tuberculosis.

1.4. THE AIM OF THE STUDY

1.4.1. Main objective

To assess the factors influencing treatment adherence among patients with pulmonary tuberculosis in selected health settings, Rwanda.

1.4.2. Specific objectives

1. To assess the level of TB treatment adherence among patient with pulmonary tuberculosis.
2. To assess the factors associated with TB treatment adherence among patients with pulmonary tuberculosis.
3. To examine the relationship between selected factors and TB treatment adherence among patients with pulmonary tuberculosis.

1.5. RESEARCH QUESTIONS

1. What is the level of TB treatment adherence among patient with pulmonary tuberculosis?
2. What are factors associated TB treatment adherence among selected population?
3. What is the relationship between selected factors and TB treatment adherence among patients with pulmonary tuberculosis?

1.6. SIGNIFICANCE OF THE STUDY

This study has four main areas of significance:

Nursing practice

The findings of this study would help health care providers especially nurses and physicians working in TB ward of Remera Health Center, Kibagabaga and Masaka hospitals to be aware of factors contributing to treatment non-adherence among patients with tuberculosis infection. It would also improve the existing body of knowledge regarding TB treatment adherence.

Nursing research

This study would serve as baseline for further researchers to use the empirical findings in their research.

Nursing education

The findings of this study can help nursing students and nurses to know the factors hindering adherence to TB treatments among patients followed at Remera Health Center, Kibagabaga and Masaka district hospitals. It can also be a source of literature for other students to use it in their own study.

Nursing administration

This study would help the hospitals in general and nursing managers in particular to take measures that reduce the factors leading to patients default from TB treatment at Remera Health Center, Kibagabaga and Masaka hospitals basing on the findings that were generated from this study.

1.7. DEFINITIONS OF CONCEPTS

Adherence: It refers to the extent of which the patient respects recommended medical instructions regarding prescribed treatment (Alsaddig, Khalid and Ahmed, 2014).

Tuberculosis: Tuberculosis (TB) is contagious and airborne disease caused by bacterium called mycobacterium tuberculosis that affects usually the lungs (World Health Organization, 2017).

Pulmonary tuberculosis: Tuberculosis infection is transmittable disease that is acquired by person to person contact through droplets that contain mycobacterium tuberculosis bacteria. It mainly affects the lungs and can also affect other parts of the body (World Health Organization *Global*, 2018).

Multidrug-resistance (MDR): is the development of TB caused by Mycobacterium tuberculosis which has resistance at least to Isoniazid (INH) or Rifampicin (RH) (Falzon *et al.,* 2017). According to World Health Organization, Multidrug-resistant TB (MDR-TB) is TB that does not respond to at least the effect of Isoniazid and rifampicin which are the two most powerful drugs in the regimen of TB treatment. anti-TB (World Health Organization and Global Tuberculosis Programme, 2016).

Factors: Are the components that contribute to particular circumstances. In this study, patient factors, social factors, healthcare system factor will be studied.

Tuberculosis patient: According to this study, it is a patient who was diagnosed with tuberculosis and who is on the TB treatments.

1.8. ORGANIZATION OF THE STUDY

This study has six chapters. The first chapter highlights the review of the general information reflecting on the research topic that provides details about the background, the problem statement, the objectives of the study. The second chapter covers the literature review which describing comprehensive situation of pulmonary tuberculosis on the global scale, this includes brief history of PTB, risk factors associated with pulmonary tuberculosis, prevalence, PTB management and description of factors influencing TB treatment adherence and non adherence which are social-economic related factors, patient related factors, healthcare related factors and tuberculosis knowledge related factors.

The third chapter describes the methodology used in the study from research design up to the limitations of the study. The fourth chapter centered on the presentation of results from the data analysis where the data were presented in tables and bar charts. Clear explanations to understand well the meaning and relevance of the findings were provided. The fifth chapter discussed the findings got from data analysis where demographics features of participants, factors associated with TB treatments and level of TB treatment adherence were discussed using available literatures, and the last chapter is the conclusion and recommendations of the study. In a few words, this research came up with appropriate recommendations for four different disciplines in order to strengthen the measures and strategies to improve patient adherence to TB treatment.

1.9. Conclusion of chapter one

The chapter one highlights introduction, background of the study, problem statement, objectives of study, significance of the study, subdivisions of the study and definition of key terms. Different studies about TB treatment were review and it was found that TB treatment adherence remains an issue worldwide. In Rwanda no current studies conducted about TB treatment adherence, only one retrospective study carried out in 2007 which has found that the level of TB treatment adherence was 90% and 10% did not adhere well and some complication like MDR-TB was associated with this non adherence.

CHAPTER TWO: LITERATURE REVIEW

2.1. INTRODUCTION

This chapter highlights the existing literature on the features of factors leading to adherence and non-adherence of treatment among patients with tuberculosis. Different empirical studies and theories relatively to this study are available. The terms adherence, non-adherence, factors, tuberculosis treatment, prevalence are considered in this literature review. The literature reviews of studies conducted in last five years (2015-2018) are included in this study. Google scholar, HINARI and Medline plus are the search engines that were used to identify the literature.

2.2. THEORETICAL REVIEW

Pulmonary tuberculosis (PTB) is a communicable disease caused by bacteria called Mycobacterium tuberculosis and is transmitted via the air droplets containing tubercle bacilli. When someone who contacted TB, the disease is spread through coughing, talking, sneezing or spitting, and the droplets are retained in the air and the bacteria can be inhaled by a nearby someone. Those tubercle bacilli get inside the body through the respiratory pathway after inhalation, it affects mainly the lungs parenchyma and a person can expel droplets containing bacilli in air (Ban *et al.*, 2018).

2.2.1. Brief history of tuberculosis

Historically, mycobacterium genus starts to affect people more than 150 million years ago. In Egypt, 2400 BC, it was found skeletal deformities that showed pott's lesions which were typical characteristic of tuberculosis. In Ancient time, TB was known as Phthisis disease which was described by Hippocrates as killer disease and defined its tubercular lung lesions as characteristic. More discoveries went on, in Greece, Isocrates was the first to assume that TB was the infectious disease Greek physician Clarissimus Galen indicated fever, cough, sweating and hemoptysis as the symptoms of TB and (Barberis *et al.*, 2017).

In eighteenth century in Western Europe, TB become epidemic and was killing 900/100000 population every year. TB was called the robber of the young because young people were more affected by this disease than other people. Social living conditions such as poor ventilated house, overcrowding, malnutrition were closely associated with TB during this decade (Frith, 2014).

In 19th century, the great scientist Robert Koch used methylene blue staining recommended by Paul Ehrlich and discovered tubercle bacillus in animal serum. In the next decades, Mantoux tuberculin skin test, anti-tubercular drugs and BCG were discovered. Koch was able to identify the etiology of TB and from his discovery, he got Nobel prize in 1905 (Agarwal *et al.*, 2017).

Currently TB remains as major public health threat, for this matter, WHO used many strategies based on improving TB therapy, early diagnosis and preventive measures in order to eliminated Mycobacterium tuberculosis on the global level (Barberis *et al.*, 2017).

Among people infected with Mycobacterium tuberculosis, 5 to 15% end up with PTB disease during their lifetime. But the chance of developing TB disease is predominantly found in people who are immune compromised.

2.2.2. Risk factors associated with pulmonary tuberculosis

The decline in TB incidence rate has been reported in different high TB challenges countries worldwide, recognition of risks factors leading to TB development help to improve its control (Kirenga *et al.*, 2015).

In the study conducted in Brazil 2014 revealed that frequent contact with people who had tuberculosis infection was the significant high risk factors of acquiring TB with the rate of 37% of cases in which 25% were from household contact and 12% for other kind of contacts. Living in house that has no means of piping water accounted for 10%, illiteracy contributed to 6% and smoking rated 4% among risk factors of having TB (Stevens *et al.*, 2014).

The patients with other chronic diseases such as chronic renal failure who need hemodialysis, patients who are under treatments of immunosuppressant after kidney transplant, malnourished people, tobacco smokers, are slightly at increased risks of latent TB reactivation to active TB and the incidence is more pronounced in these people categories than the general population because their immunity in compromised. These factors contribute much more for new tuberculosis cases in the countries where the number of TB incidence is low like Canada (Kirenga *et al.*, 2015).

In the study carried out in Pakistan (2015) highlighted that host factors such as diabetes, malnutrition, smoking, alcohol consumption, history of TB in the family and respiratory disease such asthma were found to significantly associated with TB infection. In addition to host factors,

social and environment factors play a major role in promoting the vulnerability of getting TB and among those factors there are crowding, poor ventilation, prolonged exposure to TB patients, poor health facilities, housing and socio-economic status were contributors to TB infection (Khaliq *et al.*, 2015).

In Uganda, the study conducted to determine the risk factors contributing to TB infection found that HIV was considered to be a risk factor with the rate of 41.4% while patients who had TB, 5.4% were diabetic. Other prevalence risk factors were history of smoking with the rate of 26.3%; poverty (39.5%) and overcrowding (57.3%) (Kirenga *et al.*, 2015).
Social determinants of tuberculosis such as unskilled occupation in health setting, low education, unemployment, young age between 25 and 34 years old, poverty, tobacco smoking, poor dietary intake, unpasteurized milk, alcohol abuse were reported to be major risk of TB in sub-Saharan Africa (Saidu, 2014).

Healthcare providers who work in facilities where many patients are undiagnosed TB disease, people who travel to endemic area of TB, homeless, foreign born immigrants, refuges, students and visitors from high TB burden countries are more likely to develop TB disease than general population. Lack of TB treatment or ineffective treatment of TB increases the risks of widespread of infection among others, smoking in HIV/AIDS patients increase the risks of getting TB easily since it aggravates body immunity (Cui *et al.*, 2017).

The study findings in South Africa notified that single marital status, dusty environment and being heavy drinker were reported to be predisposing factors associated with pulmonary TB in patients in patients with HIV. Working for long time in gold mines in South Africa increased the prevalence of people who contracted PTB as such it was associated with dust from gold mines and silica contact (Alberto, Rodriguez and Agbo, 2015).

From the data of study conducted in Ethiopia, revealed that history of imprisonment, tobacco smoking, previous exposure to TB treatment, several contact with TB patients, lack of job and living in rural areas were also associated with TB development (Desissa, Workineh and Beyene, 2018).

Various lines of findings indicated that some genetic factors contribute to development of TB and the convincing study carried out on twins because twins share theoretically the same characteristics, showed that genetic aspects are more useful in TB susceptibility. This study demonstrated the possibility of relationship of HLA-DR2 allele with risk of TB infection. The mutation that occurs in interleukin-12 receptor genes has been identified to be coupled with immune system inability to protect the body against mycobacteria (Srivastava, Kant and Verma, 2015).

2.2.3. Management of pulmonary tuberculosis

Effective TB treatment requires early diagnosis, HIV and drug resistance screening, administration of drugs under DOTs, and continuous support provision to patient throughout the treatment course. Four dugs regimen such as Isoniazid, Rifampicin, Pyrazinamid and Ethambutol are currently recommended by WHO and achieve over 90% of cure rates under the supervision of tuberculosis control program (Zumala *et al.*, 2013).The optimal TB treatment plan consists of an initial treatment phase requiring daily ingestion of 4 first-line anti-TB drugs for 2 months, followed by a 4-month continuation phase during. Proper treatment of all forms of TB is critical to reduce individual morbidity and mortality. In addition to that, proper treatment limits the development and spread of DR-TB (Distefano and Schimidt, 2016).

Nowadays, Bacilli Colmette Guerin (BCG) is the vaccine that is widely used in prevention of TB and administered to more than 4 billion people worldwide. Next to BCG, no other available vaccine that was developed(Luca and Mihaescu, 2013).This disease remains a major challenge to the global population, non-adherence to the treatment can lead high morbidity and mortality, some complications like MDR-TB and relapse can occur (Wynne *et al.*, 2014). The term adherence refer to the extent to which a patient takes medications upon agreed recommendations from a prescriber (Lam and Fresco, 2015) while non-adherence is defined as the failure of patient to respect a treatment regimen, termination of treatment very early and poor implementation of treatment guidelines provided by healthcare provider. Non adherence has various forms such as not taking the correct ordered dose, missing a drug prescription, taking a drug at the wrong time, shortening the therapy and forgetting to take doses due to different factors (Alikari and Zyga, 2014).

Poor adherence to TB treatment possibly may prolong infectivity and enhance the risk of TB relapse, continuing transmission, drug resistance and even death (Gong *et al.*, 2018).Adherence to TB treatments is a multidimensional phenomenon associated with different factors affecting taken behavior on treatment. Therapeutic regimen provided under DOTs as recommended by WHO indicated good outcome for both prevention and treatment of tuberculosis but non adherence to anti-tuberculosis medications has shown the main barrier to TB surveillance which led to increased risks of morbidity and mortality (Bhadke *et al.*, 2016)

The nurses are in the good position to control and eradicate the transmission of TB infection. This can be done through timely identification of new TB cases and help the patients to complete their course of TB treatment. Because, MDR-TB is increasing and associated with delay diagnosis, failure of TB prevention and treatment non adherence (Murphy, 2015).

There are types of tuberculosis other than PTB that exist depending on the affected body party. Among them there are; tuberculosis lymphadenitis, pleural, meningeal, genitourinary, peritoneal, ocular and musculoskeletal TB. Lymphadenitis TB is mostly found in patients with HIVand accounts for 21% of all extra pulmonary TB, ocular tuberculosis affects children and is manifested in the eyelids while musculoskeletal affects the bones and joint of spine, knee and hip joints (Çavuşoğlu, 2014).

2.3. EMPIRICAL REVIEW

This section revises different studies conducted in both developed and in developing countries findings about tuberculosis such as literature on prevalence, risk factors of developing TB, patient knowledge of TB and factors associated with treatment adherence.

2.3.1. Prevalence of tuberculosis infection

Although measures were taken worldwide, tuberculosis continues to be found in different low and high income countries of the world. It is also the main cause of deaths related to antimicrobial resistance. In 2016, almost 10.4 million of people diagnosed TB and 1.7 million died from TB disease (World Health Organization, 2017).With one million incidence of tuberculosis infection in people living with HIV in 2016, the African region accounted for 74%. The rate of new TB cases differ depending on the size of population where less than 10/100,000 TB cases were in high income countries and more than 500/100,000 people were in low income countries and treatment adherence is vital for successful treatment (Floyd *et al.*, 2018).

In 2016, 64% of TB cases were found in seven countries such as India, China, Indonesia, Philippines, Pakistan, Nigeria and South Africa. 1.7 million people died from TB cases whereby 0.4 million were among HIV patients and 53 million lives saved worldwide between 2000 and 2016 (World Health Organization, 2017). Moreover, the issue of TB drug resistance that is observed in the early initiation TB chemotherapy is of concern. Even though one single drug resistance is the most common type of resistance, WHO estimated that 5% of all TB incidence become multi drug resistant TB and inappropriate diagnosis of MDR-TB patients complicated in the other forms of resistant TB (Velayati, Farnia and Farahbod, 2016).

Prevalence of TB in China is very high, 15% of global TB cases are found in China after India and Indonesia. The data reported from 5th National Epidemiological Survey indicated that 456 TB cases out 100,000 populations have active TB (Gong *et al.*, 2018).In United Kingdom prevalence of TB cases in 2016 was 73.6% in people who were born outside the UK. TB prevalence in non UK born population stated to be 15 times greater than the UK born people (Public Health England, 2016).

In Brazil (2015), 63,189 people of new TB cases reported with 72.5% of cure rate and 11% of abandonment (Beraldo *et al.*, 2017)**,** in Pakistan TB prevalence accounted for 342/100,000 populations and new TB cases reported were 275 per 100,000 populations (Hussain, Malik and Hussain, 2016).

In Australia, the prevalence of TB remains significantly low where in 2015 reported 5.3/100,000 population annually corresponding to 1,244 people of case notification and 53.8% were male. With people from abroad such as visitors and migrants are the major sources of TB incidence in this continent where 84.2% of TB cases notified in non-Austrian born people. This indicates the need of continuous screening and surveillance measures (Jones *et al.*, 2017).

The burden of tuberculosis and HIV co-infection in sub-Saharan countries remains significantly high, for instance, the study done in Nigeria in 2015 indicated that, 44.6% of people had TB (Kooffreh *et al.*, 2016).

Uganda is classified in twenty countries that has the highest number of TB/HIV co-morbidity worldwide, between 2014 and 2015 this country located in Northern region of Rwanda accounted for 174/100000 cases of TB per year (Musaazi *et al.*, 2017).

In Rwanda, the incidence of TB in 2013 was 89 per 100,000 populations annually and 30% approximately confirmed with TB were co-infected with HIV (Rutanga *et al.*, 2015). According to TB surveillance in Rwanda report from 2014 to 2015, the prevalence of TB cases were 5,828 in which 72.6% were new and relapse, 25.8% of total TB cases were diagnosed between 2014 and 2015 (GASANA, 2015).

2.3.2. Factors contributing to TB treatment adherence and non-adherence

2.3.2.1. Socio-economic related factors

Different studies worldwide have indicated the relationship between non adherence to TB treatment and poverty even though TB treatment is free of charge, low socioeconomic status impact negatively on adherence due to the direct and indirect costs of treatment like additional cost of medication, transport means and even time waited for receiving the treatment. It was mentioned that for patients who used more than one transport means to reach treatment sites were five times more likely to interrupt TB treatment than patients who simply utilize on transport means (Herrero *et al.*, 2015).

2.3.2.2. Patient related factors

In different countries, many factors have led to TB treatment non-adherence, for instance in Argentina, treatment of patients with TB infection is free but non adherence to TB treatment is one of the critical issue to disease surveillance and its complications which lead to disease progression, death and the development of drugs resistance. In Argentina, tuberculosis treatment failure has increased significantly in the last decades (Reis, 2016).

In the study conducted in India 2016 reported that the induced side effects of anti-tuberculosis drug were the most important reason of interrupting TB treatment with the rate of 42.2%. Other factors found were feeling of early improvement accounted for 33.3% followed by moving to their workplace rated 9.6%. Gastritis, skin rashes and seizures were commonly reported to be anti-TB induced side effects and feeling of early improvement was ranked the second cause led to treatment non adherence reason as found in 33.3% of patients (Bhadke *et al.*, 2016).

Naturally the history changes of the disease have been arisen from HIV epidemic and become the emergence to anti-TB drug resistance. Sudan itself has 11 - 15% of the tuberculosis infections burden among patients in the Eastern Mediterranean Region. Treatment adherence in Sudan is lower than WHO target of 85% where only Sudan attained 82% with the poor adherence rate of 10%. Treatment adherence keeps on to be in the major barriers to be dealt by TB control programs on global level particularly in LMICs (Hashim and Mohamed, 2017).

The study carried out in Kenya (2017), found that some patient factors such as alcoholism, feeling well after taking drugs, drugs side effect associated with unwell feeling, absence of food and not appreciating the severity of disease due to low level of literacy contribute to TB treatment non adherence (Kiplangat Arap Sang, 2017).

Other factors including losing job when the diagnosis is confirmed, unable to go to their work due to time consuming TB treatment were also found to hinder TB treatment adherence. It was reported that being stigmatized, lack of social support, medication side effect, long treatment time, insufficient food were serious factors contributed to treatment non adherence (Gebreweld *et al.*, 2018).

A cross section study in south Ethiopia conducted in 2017 highlighted that non adherence of TB treatment was 24.5% and this rate was facilitated with various factors such as level of education, pill burden, types of transportation, knowledge, bill of medications other than anti-TB drugs, distance more than 10km and long travelling time were significantly associated with treatment non adherence. Further analysis showed that having poor knowledge about tuberculosis treatment was five times high risks of stopping TB treatment than those who had good knowledge. Patients who walked more than 10km were relatively non adherents higher than those who travelled less than 10km and for patients who didn't receive information at every visit, non-adherence to anti-TB treatment were three times greater than those who got it (Woimo *et al.*, 2017).

With the study conducted by Gube *et al.* in 2018 in south Ethiopia revealed that non adherence was high among the patients attending Arb Minch government health setting where 10.5% of TB patients who waited more than one hour didn't adhere to treatment. Other factors that associated with TB non adherence were distance with 8.4% rate and side effects of TB drugs. In this study,

cigarette smoking, alcohol use, education and sex were not found to be determinants of TB non adherence (Gube *et al.*, 2018).

The study carried out in Rwanda showed that, TB treatment non adherence was found mostly in patient with TB/HIV co-infection where 10% of TB patients in general were non adherents (Kayigamba *et al.*, 2013). No other literature currently available in Rwanda indicating other factors that contributing to TB treatment non adherence.

2.3.2.3. Healthcare provider related factors

Another study conducted in Mekelle, Ethiopia previously found that non adherence prevalence to anti-TB treatment in TB/HIV co-infected patients was 53.3%. Patients who hadn't caregivers who remind them to take their drugs were more probable to be non-adherent to treatment compared to those who had someone to remind them to take the drugs accordingly. The most reasons mentioned in this study for non-adherence were found that 67.2% were forgetting to take their drugs, 49.3% felt sick when their ingest their medications and 37.3% reported that they live too far from their treatment sites (Eden Kassa, 2014).

Although Ethiopia accomplished above 92% of health facility DOTS coverage, TB prevalence is still high and it is ranked 8th among the countries with high TB burden worldwide with estimation of TB incidence of 258/100,000 populations. Regardless of strong measures implemented to carry out DOTS service within the country, the indicators of program performance is still unsatisfactory as proven by the number of TB treatment defaulters that ranges between 10 and 20%, which is greater than the WHO target of less than 10% of non-adherence reduction (Gugssa Boru, Shimels and Bilal, 2017).

A qualitative study in Asmara, Eritrea in 2018 revealed that the main reason for TB treatment discontinuation was that the patients felt cured and approximately the half of patients was less informed about the standard treatment duration by healthcare providers. On the other hand, healthcare providers communication and positive behaviors towards the patients they serve were known to be promoting factors to TB treatment adherence among patients (Gebreweld *et al.*, 2018) .

2.3.2.4. Tuberculosis knowledge related factors

Treatment adherence remains a major problem in the control of TB like other long term disease, and it is estimated that globally only 50% of TB cases treated successfully. Poor adherence to TB drugs is influenced by many factors among them the knowledge is included (Heemanshu and Satwanti, 2016).

The study conducted Kosovo state in Southeastern Europe, show that despite of the health education delivered to them on TB disease, some of the participants equal to 18% did not know what can contribute to the development of tuberculosis. The participants were asked how TB is spread and prevented 27.7% had no true answer. The knowledge of TB treatment length, 75.3% answered correctly about duration of TB therapy however, 86.7%, 72.2% and 76.8% did not give the correct response to names of TB drugs, recommended daily dosage, and poor knowledge of side effects resulting from TB medications (Krasniqi *et al.*, 2017).

The cross sectional study carried out in China in 2015, found that 21% of patients missed more than one dose of TB drugs in two weeks and it was found that patients who have low level of education are more likely to have higher rate of TB non adherence and when the patient lack the knowledge regarding anti TB treatment duration is mainly associated with poor treatment adherence (Tang *et al.*, 2015).

In the study conducted in south Ethiopia, on 271 participants, 95.6% indicated good knowledge about TB and 4.4% did not know clinical manifestations of TB, 17% of them reported that they cancelled treatment after they felt cured before they finish their treatment course (Gube *et al.*, 2018).

Another study conducted previously in Ethiopia, Generally the knowledge among participants about TB was 36.5%. Women who were illiterates and living in the countryside were significantly considered to have low level of knowledge and 47.5% did not know how TB is transmitted. About 24% reported that they have no information about the etiology of TB. Many of them equal to 87.5% knew that TB is a communicable disease. Regarding complications arising from stopping anti-TB, 36.5% answered at least two complications and death was mostly reported, 12% did not recognize the consequences of drug noncompliance. For the duration of

TB treatment period, 84.5% were aware and 15.5% did not know the correct treatment duration (Tesfahuneygn, 2017).

In Kericho and Nakuru provinces of Kenya, in the study carried out in 2017, revealed that 94% and 95% had knowledge regarding their disease they were experiencing whereas 6% and 5% did not know the disease. The results of the study indicated that most of the patients greater than 90% with poor adherence to TB treatment were aware of their illness they were suffering from (Kiplangat Arap Sang, 2017).

In Nigeria, on 378 TB patients participated in the study, 19% of them had incidence of stopping treatment. Lack of knowledge of TB treatment duration, travel of long distance from home, feeling better was the mains reasons of treatment interruptions (Ibrahim *et al.*, 2014).

The study conducted in Asmara Eritrea, the majority of patients with TB had not sufficient knowledge about TB and many of them did not identify the cause, the route of TB transmission and its treatment duration. There were some patients who reported that TB is inherited disease and deadly one which has no treatment. A number of patients did not recognize the protocol of TB treatment for 6 months or more and the consequences associated with stopping anti TB drugs regimen a number of patients. Lack of patient knowledge and awareness about TB treatment was considerably linked to non-adherence (Gebreweld *et al.*, 2018).

2.4. Critical review and research gap identification

Different reviewed literatures highlighted some challenges in TB treatment adherence, for instance the study conducted conducted among patients with confirmed pulmonary tuberculosis in Argentina in 2010 indicated failure rate of 13.8% which is in contrast with international target of 5% of reduction. Another study conduct in Argentina in 2016 highlighted that, 31% of patients who participated in the study were found to be non adherent to treatment while 79% were adherent. This non adherence was associated with various factors such as smoking, alcohol consumption, mental problems (Reis, 2016).

The study in Nigeria found that 19% of patients with the TB patients interrupted their TB treatment and the associated major factors were long distance between patients home and treatment sites, insufficient knowledge of the TB treatment and tobacco smoking. Access to TB treatment is one of the key determinants for effective TB control services. Long travel is among factors that limit patient to have full access to the services particularly for the daily direct

observation of the treatment which occurs in the health facility during the intensive phase of TB treatment (Ibrahim *et al.*, 2014).

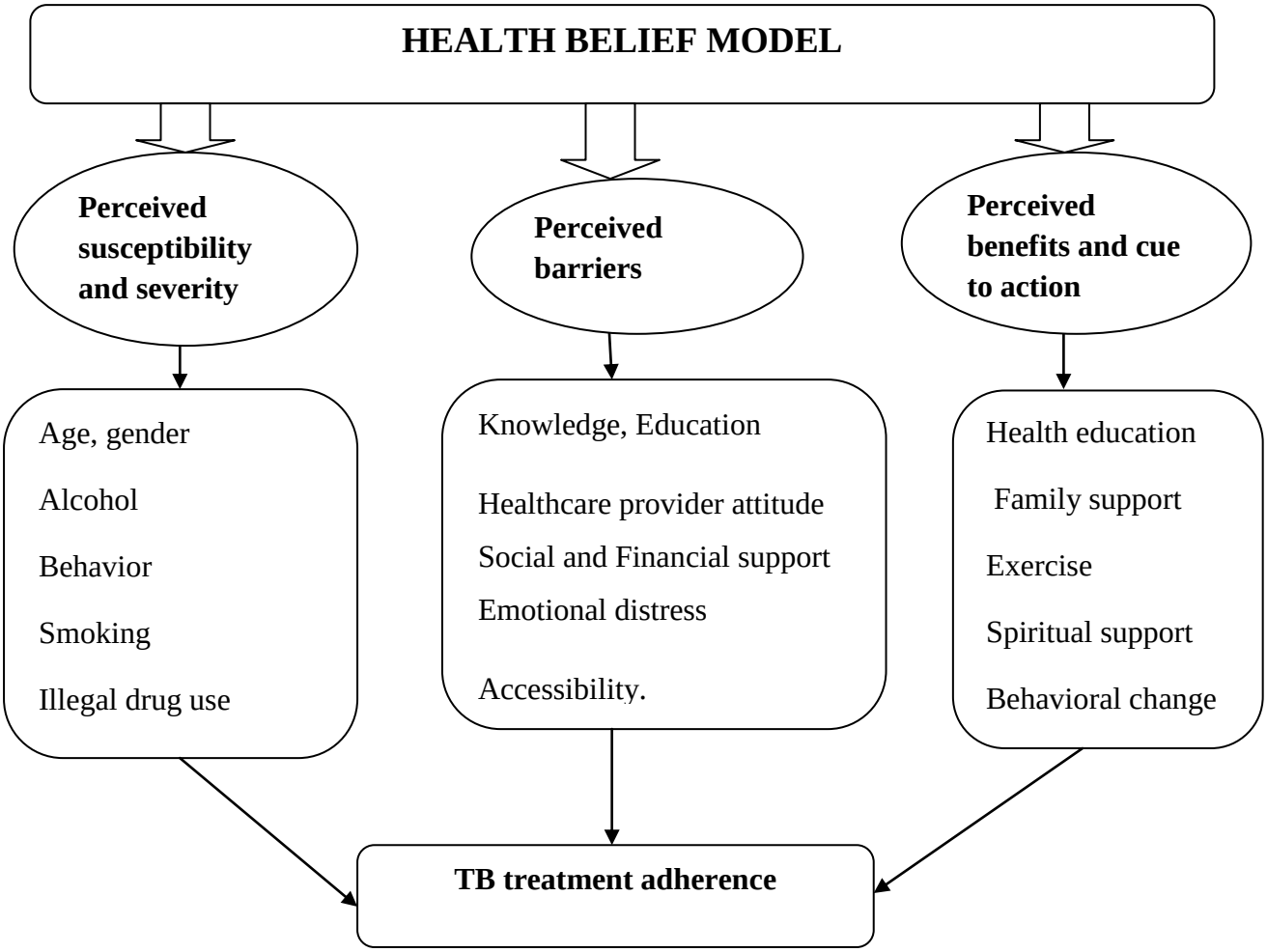
Regarding knowledge about pulmonary tuberculosis, the study conducted in 2016 in India which involved 109 patients with tuberculosis, 89.3% responded that they heard about tuberculosis and 64.7% reported that information was provided to them by healthcare providers. When asked if they know the cause of TB, 35.2% of participants knew that TB is caused by bacteria, 12.6% said smoking, 33.7% and 37.8% said cold and alcohol respectively. For the symptoms of TB, 48.4% of patients recruited in the study were aware that chronic cough is TB symptom. This indicated low level of knowledge of TB causes and its symptoms in these patients (Konda, Melo and Giri, 2016). In Rwanda review of literatures showed no current studies conducted about TB treatments adherence, the reason why a researcher initiates this study.

2.5. Conceptual framework

Conceptual framework is an analytical tool that helps the researcher to understand the connection between particular variables in order to make the research findings very meaningful (Adom and Joe, 2018). This conceptual framework was guided by five major tenets of Health Belief Model (HBM) such as perceived susceptibility, perceived severity, perceived barriers, perceived benefits and cue to action to present the factors influencing TB treatment adherence. Perceived susceptibility is defined as a person's perception of the risk of getting and being vulnerable to illness or disease. Perceived severity is a person’s feeling regarding the seriousness and medical consequences like death and disability if the disease or illness is left untreated (Tarkang and Zotor, 2015).

Perceived barrier refers to the patient’s feelings on the obstacles of carrying out recommended health actions to comply with treatments. Perceived benefit is the way a patient perceives the effectiveness of available actions to cure illness or disease. In this case, the patient would accept the recommended health actions if it was found to be beneficial. Cue to action are internal and external stimuli needed to influence the decision making process to agree to recommended health action to facilitate treatment adherence (Jones *et al.*, 2015).

Health believe model (HBM) was used to help understand the factors contributing to tuberculosis treatment adherence. HBM is more widely used model to understand and explain health related behaviors including treatment poor adherence (Holmes, Hughes and Morrison, 2014). According to the concept of HBM, a patient with TB disease with a given socio-demographic features and mental health status can take their drug regimen correctly under the following factors: patients must have basic knowledge regarding their illness, patients must perceive that they are vulnerable to TB and must know that TB disease and treatment non adherence can lead to severe medical and health problems; patients must be motivated by the efficiency of TB treatment which can result in the reduction of negative psychological factors at significant level; the existence of internal and external stimulus called "cue to action" is useful to stimulate adherence behavior among TB patients; TB patients must appreciate their self-ability to continue treatment until the last dose of medication (Tola *et al.*, 2017). Based on the concepts of HBM above listed, this model was applied to this study to identify the factors influencing TB treatment adherence among patients with pulmonary tuberculosis. To avoid biases and ensure the consistency, only the variables pertinent to the study were presented in the framework according to the Rwandan context.



Application of Health Belief Model adopted from (Reis, 2016)

These factors were grouped into three categories: first category represents perceived susceptibility and severity which includes: Age, gender, alcohol, smoking anxiety and illegal drug use. Second category is perceived barriers which cover the factors like knowledge, education level, drug side effects, healthcare provider attitude, social support, financial support, emotional distress and education. The last category is perceived benefits and actions. It has motivating factors such adequate health education, adequate family support, exercise and spiritual support. All these factors influence TB treatment adherence.

2.5.1. List of variables used in the study

The following are different variables under this study that were focused on when developing this instrument.

Independent variables	Dependent variables
Gender Age Alcohol Education level, occupation Social and Financial support Smoking and Illegal drug use Knowledge Healthcare provider attitude Emotional status, accessibility Health education Exercise Spiritual support Behavioral change	Treatment adherence level

2.6. Conclusion of chapter two

In chapter two, different studies conducted on TB treatment adherence and non-adherence, prevalence of TB globally and locally, risk factors and knowledge of patient regarding TB infection revised. In Rwanda there are not enough literatures about TB treatment non-adherence and its associated factors, it is in this context this study initiated. Chapter three is going to address research methodology.

CHAPTER THREE: METHODOLOGY

3.1. INTRODUCTION

This chapter provides the insight of process and methods that were used to conduct this study. This includes a study design, study area, study population, sampling strategy, sample size, instrument, data collection methods and procedures, data analysis, data management, data dissemination, limitation of the study and ethical consideration.

3.2. RESEARCH APPROACH

This study used quantitative approach. Quantitative research approach is defined as a method employed by a researcher to quantify and analyze variables to get the results pertaining to the study. In other words it is an approach used to analyze numerical data by utilizing specific statistics to get the answer of questions in the form of how, who, what, where, how many and how much (Apuke, 2017).

3.3. RESEARCH DESIGN

A non-experimental descriptive cross-sectional design was used in this study. It is a type of observational study that analyzes data from population or representative subset at specific point in time depending on the size of sample used and accessibly to the study population (Omair, 2015).

3.4. RESEARCH SETTING

This study conducted in three sites which are Remera Health Center, Kibagabaga and Masaka district hospitals. Kibagabaga hospital is located in Kigali city, Gasabo District, Kibagabaga sector. This hospital receives an average of 230 patients every day and it accounts for 120 beds. It refers 900 cases to referral hospital every year. In 2008, palliative care was first introduced in this hospital, and it is also among the center of Multidrug resistant TB management.

3.5. STUDY POPULATION

This study was conducted in three selected sites on patients diagnosed with pulmonary tuberculosis infection who are on Anti TB treatments. The total population in the three selected sites is 80 patients who are followed up for TB treatment program.

3.6. SAMPLING

3.6.1. SAMPLE SIZE

The total sample of 80 patients was used in this study in which 40 patients obtained from Remera Health Center, 30 patients from Kibagabaga hospital and 10 patients that are currently followed at Masaka hospital. According to the rule of thumb, if the population is less than 100, the whole population must be included and used as sample of the study and strive at least to get 80% response rate of the population (Baker, 2012). The same rule was applied in this study since the population is less than a hundred and sample of 80 patients represents the number of patients currently registered in these three sites who are on TB treatment.

3.6.1.1. Inclusion criteria

All registered patients with tuberculosis who are under TB treatments, who are on the first and second line.

Patient of 18 years old and above

Patient who consented for the study

3.6.1.2. Exclusion criteria

Patients less than 20 years old were considered as pediatrics

Patient with impaired memory

3.6.2. SAMPLING STRATEGY

Non probability total population sampling method was used in the study to recruit a sample of patients who participated in this study.

Patient who did not accept to be part of the study

3.6. INSTRUMENT FOR DATA COLLECTION

A tool that was used to assess factors influencing TB treatment adherence was adopted from previous researcher on factors contributing to TB treatment adherence among patients with tuberculosis infection and the permission to use the tool was obtained from the author. This tool

was contextualized to Rwanda settings and the tenets of Health Belief Model were applied. This questionnaire is made up of three sections that contain close ended questions:

Section A: Demographic and socio-economic features

Section B: Questions regarding treatment adherence

Section C: Questions regarding factors associated to TB treatment adherence

3.6.1. Validity of an instrument

According to Polit & Beck (2006),validity in research is defined as the ability of an instrument to measure what it claims to measure (Polit and Bck, 2006).In this study researcher adopted a tool that was developed by Reis, 2016 to evaluate the factors influencing TB treatment adherence.

3.6.1.1. Content validity

Content is how extent a measuring instrument represents every sing element of a construct. The researcher ensured that the questions in the tool are relevant to assess the content, whereby the important elements of construct highlighted in the literature were considered.

Table of content validity

Objectives	**Components of conceptual framework**	**Section of the research instrument**
To assess the level of TB treatment adherence among patient with pulmonary tuberculosis.	TB treatment adherence Perceived susceptibility, benefits and cue to action.	Section B
To assess the factors associated with TB treatment adherence among selected population.	Perceived susceptibility, barriers, benefits and cue to action	Section C
To examine the relationship between factors and TB treatment adherence among selected population.	TB treatment adherence Perceived susceptibility, barriers, benefits and cue to action	Section B, C

3.6.1.2. Construct validity

of a research instrument is the extent to which the instrument measures what it is intended to measure (Mohajan, 2017).The tool is valid in its construct because the questions that were asked to the patients are related to the conceptual framework, meaning that factors influencing TB treatment adherence in patients with tuberculosis were included in conceptual framework and were in the study instrument.

3.7.1.3. Face validity

Face validity refers to how correctly an instrument represents what it is attempting to measure (Polit and Bck, 2006). The researcher conducted a pre-testing of the instrument to ensure validity of the questionnaires in perspective of Rwandan health settings. The pre-testing was conducted on 8 patients who were voluntarily consent to participate and they were taken from one of three selected sites. These patients were not included in the main study. The researcher provided 8 questionnaires to 8 patients to answer questions inside the tool. The purpose of this pre-testing is to find out technical issues such as time limits and to identify any ambiguity in items of questionnaire. At the end, the study participants requested to report any challenges that have been encountered about the questions that were asked in the questionnaires.

3.7.3. Reliability

Reliability refers to how stable and consistent is a measuring instrument. The results should be the same once the instrument is given several times to different people at different time and consistency should not be changed (Berchtold, 2016). For maintaining the reliability of used instrument, only closed ended questions were asked. The same questions were administered to similar patients who participated in different places at different time so that the chance of getting very similar response would be expected.

For this study, Cronbach's Alpha to test consistency of the questionnaire was statistically calculated and the following results were obtained:

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.608	.771	49

After analysis, knowledge scores were categorized as low score: less than 70%, moderate score: 70 to 79% and high score: 80% to 100%. The same as level of TB treatment adherence was also classified into low (<70%), moderate (70-89%) and high (80-100%) level of adherence depending on the correct responses. This classification of knowledge and adherence was done with the guidance of visual analogue scales (VAS). Visual analogue scales (VAS) is a type of rating scale in which a researcher ranks the health outcomes according to her or his preference using scale in which the interval-level of measurements that are suitable for more statistical operations are considered. A researcher can use VAS to determine responses categories. Furthermore, VAS can be used in the format of single item coupled with a single question in order to classify the responses score into different categories (Sung and Wu, 2018).

3.8. DATA COLLECTION METHODS

After getting official permissions from IRB of University of Rwanda, College of Medicine and Health Sciences and from the study settings, the researcher went to the respective study sites, introduced himself to the participants and informed them about the study and explained the participants that participating in the study is voluntary and if they are willing they can sign a consent form of participation. Self-administered questionnaire was used to collect data from the patients who are on TB treatments in selected health settings. The patients who don't know to read the researcher helped them to answer the questions where the researcher read every question on questionnaires to those patients in order to get the answers from them. Data were collected approximately within two months period of time by the researcher.

3.9. DATA ANALYSIS

After data collection, data were entered, categorized and analyzed by SPSS version 21. Frequencies and proportion were used to summarize demographic characteristics of the study participants. Proportion was used to describe the overall factors on TB treatment adherence like healthcare provider related factors, patient factors and socio-economic factors. The relationship between factors influencing TB treatment adherence and patient knowledge about pulmonary tuberculosis was analyzed by logistic regression and correlation coefficient. After that, the data were imported in Microsoft Excel, tables and graphs were used for study results presentation. The treatment of the text was made in Microsoft Office Word. Statistical significance was used at P Value less than 0.05 to examine the factors associated with TB treatment adherence and variable with $P>0.05$ was considered to be statistically non-significant.

3.10. ETHICAL CONSIDERATIONS

This study initiated after being guaranteed by CMHS and getting official letters from selected hospitals. After this permission, the researcher explained the purpose of conducting the study and the time expected for the subjects' to participate. Expected benefits to prospective participants communicated to them. This study did cause neither harm nor inconvenience to the participants since it was a non experimental study. Codes were used to maintain anonymity of the participant and encourage the participant to give full and correct information in favorable environment and privacy was maintained where possible. The participants' information for the study kept confidentially and used for the purpose of this study and only the researcher has an access to all information. A signed informed consent form of the participant used to permit the researcher to conduct the study. Refusal to participate in the study did not involve any penalty or loss of benefits for the participants, therefore participation was voluntary and participants had the right to withdraw any time.

3.11. DATA MANAGEMENT

The data collected from the study was coded, entered in SPSS version 21 to be analyzed, and then stored on external disk; filled questionnaires kept in closed cupboard in order to maintain confidentiality. The data that stored electronically, password lock file software was used according to the UR rules and regulation regarding research dissertation.

3.12. DATA DISSEMINATION

The study results will be communicated through CMHS panel, to the health setting sites of data collection, workshop, seminars and conferences. Publication will be made in appropriate journals for being accessible to the users and feedback from the study will be provided to the managers of study settings to help them to improve measures regarding TB treatment adherence.

3.13. LIMITATIONS OF THE STUDY

3.13.1. Methodological limitations

The implementation of data collection method should encounter some minor errors because the researcher does not have an extensive experience in collecting the primary data. The researcher expects the possibility of not accessing all patients who abandoned their TB treatment and this may affect the sample of the study results. Unavailability of patients at the day of data collection was also another limiting factor for this study where the researcher conducted this study in three selected health settings of Rwanda. The findings of this study were not generalized for all TB patients under treatments in Rwanda, because the sample size of the study represented small population and involves only three sites.

3.13.2. Study site limitations

The delay in approving the permission letter by the study site authority can impact negatively, because the time attributed for data collection should be reduced. In addition, some study sites are located in remote area, the researcher expects to face some challenges of not finding enough participants since he can reach the study sites a bit late at the moment the patients have already gone home.

3.13. Conclusion to chapter three

This chapter focused on methodology that the study used which encompasses design, study area, population, sampling strategy and sample size, instrument of data collection, data collection method, how data were analyzed, data management, data dissemination, limitations of the study and ethical consideration that guided the study.

CHAPTER FOUR: PRESENTATION OF RESULTS

4.0. INTRODUCTION

This chapter addresses the presentation of the findings from this study regarding demographic characteristics, socio-economic factors, patient related factor, knowledge about PTB, treatment adherence, helacare provider related factor and interpretation of study results using odd ratios and P value.

4.1. DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

4.1.1. Distribution of participants according to their demographic characteristics

For this study the total number of participants was 80 with a response rate of 100%. The majority of participants were between the age 30-39 years and on their gender male was 67.5% (n=80) and on education level those who attended primary school were 60.0% (n=80) and for marital status single were most predominant with 55% (n=80) (Table 4.1.1).

Table 4.1.1. Distribution of participants according to their demographic characteristics

Variables	Items	Frequency (N)	Proportion (%)
Gender	Male	54	67.5
	Female	26	32.5
Age	20-29 years	20	25.0
	30-39 years	35	43.8
	40-49 years	19	23.8
	50-59 years	3	3.8
	60-69 years	2	2.5
	70 years and above	1	1.3
Education	None	10	12.5
	Primary studies	48	60.0
	Secondary studies	20	25.0
	College/University	2	2.5
	Others	0	0.0

Marital status	Single	44	55.0
	Widow	2	2.5
	Widower	1	1.3
	Married	32	40.0
	Divorced	1	1.3
Total		**N= 80**	**100%**

4.1.2. Distribution of participants according to their socio-economic factors

Almost 47.5% (n=80) of research participants had no occupation and 8.8% (n=80) were unable to work due to the disease, and 30%(n=80) were getting support from their partner against 30% (n=80) who had no support. 26.3% (n=80) of participants were living alone in their house, and 32.5% (n=80) were taking their medications because healthcare providers reminded them. The majority of the participants used 31-60 minutes to reach healthcare facility with a proportion of 40.0 % (n=80) and 56.3% (n=80) used their feet to go to the nearby healthcare facility, and 70.0% (n=80) of study participants were in second category of Ubudehe (Table 4.1.2).

Table 4.1.2. Distribution of participants according to their socio-economic factors

Variables	**Items**	**Frequency (N)**	**Proportion (%)**
Occupation	None	38	47.5
	Farmer	14	17.5
	Business	5	6.3
	Student	15	18.8
	Unable to work due to the disease	7	8.8
	Others	1	1.3
Source of support	Partner	24	30.0
	Family	16	20.0
	Friend	16	20.0
	No where	24	30.0
Number of people	Alone	21	26.3

living with the patient	Two	9	11.3
	Three	16	20.0
	Four	8	10.0
	Five	18	22.5
	More than five	8	10.0
Reminder to take TB medications	My partner	14	17.5
	Parents	5	6.3
	Children	1	1.3
	CHWs	13	16.3
	Co-workers	1	1.3
	Healthcare providers	26	32.5
	No one	20	25.0
Time used to reach nearest health facility	Less or equal to 30 min	26	32.5
	31-60 min	32	40.0
	1 hour to 2hours	14	17.5
	More than 2hours	5	6.3
	I don't know	3	3.8
Type of transport frequently used	By foot	45	56.3
	By car	15	18.8
	By bicycle	5	6.3
	By motorcycle	15	18.8
Ubudehe category	First category	7	8.8
	Second category	56	70.0
	Third category	17	21.3
	Fourth category	0	0.0
Total		**N=80**	**100%**

4.2. QUESTIONS REGARDING TB TREATMENT ADHERENCE

Regarding the adherence of Anti TB treatments approximately 87.5% reported not to forget to take their TB medications, 81.2% (n=80) never stopped their TB medications, 21.3% reported stopping their medications when felt sick, and 77.5% (n=80) are being motivated to take their medications when receive Health education, around 96.3% (n=80) do not get family support when taking TB medications, and almost 80% (n=80) reported to have not positive influence from prayers regarding taking anti TB, and 86.3% (n=80) complain on taking many pills, and 73.8% did not stop their TB medications because of being away from their home, but 82.5% (n=80) confirmed to adhere to their TB medications because, their health facility is not so far from their home. Approximately 75% (n=80) of participants do not fear drug toxicity and 82.5% do not take alcohol when taking medications, around 93.8% (n=80) are not getting too busy to adhere to TB medications, and 95% (n=80) reported to have sufficient food, 93.8% (n=80) it is not useless to take TB medications (Table 4.2). From the findings below, it was revealed that almost 68.8% were adhering well to TB treatments while 31.2 % were not adhering well.

Table 4.2. Adherence to PTB treatment

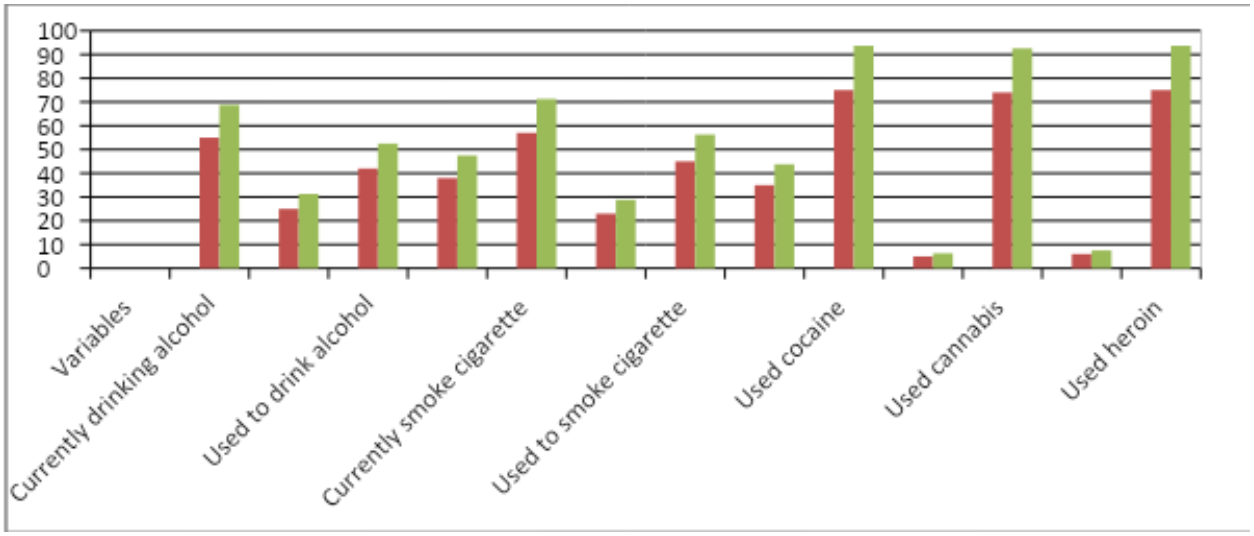
Variables	Items	Frequency (n)	Proportion (%)
Sometimes forget to take medications	Yes	10	12.5
	No	70	87.5
Ever stopped medications	Yes	15	18.8
	No	65	81.2
Taking medications when feeling sick	Yes	21	26.3
	No	59	73.8
Health education motivates you to adhere to TB medications	No	18	22.5
	Yes	62	77.5
Family support motivates you to adhere to TB medications	No	77	96.3
	Yes	3	3.8
Praying motivates you to adhere to TB medications	No	64	80.0
	Yes	16	20.0
Many pills to take	Yes	69	86.3
	No	11	13.8

Away from home	No	59	73.8
	Yes	21	26.3
Health facility away from home	No	66	82.5
	Yes	14	17.5
Fear of drug toxicity	No	60	75.0
	Yes	20	25.0
Taking alcohol	No	66	82.5
	Yes	14	17.5
Busy with other things	No	75	93.8
	Yes	5	6.3
Shortage of money for transport	No	62	77.5
	Yes	18	22.5
Shortage of food	No	76	95.0
	Yes	4	5.0
It is useless to take drugs	No	75	93.8
	Yes	5	6.3
Total		**N= 80**	**100%**

4.3. FACTORS ASSOCIATED WITH TB TREATMENT ADHERENCE

4.3.1. Distribution of participants according to the use of alcohol, smoking behaviors and illegal drugs

For this section drinking and smoking were evaluated on behalf of the participants, the study revealed that most of the participants were currently not drinking with 68.8% (n=80), and who used to drink were 47.5% (n=80), smokers were 28.8% (n=80) but those who used to smoke before were 43.8% (n=80), participants who used cocaine were 6.3% (n=80), those who smoke cannabis were a little bit high compared to those who used cocaine with 7.5% (n=80) and 6.3% (n=80) were heroin users (Figure 4.3.1.1).



Green: Proportion (%) **Red: Frequency (n)**

Figure 4.3.1.1. Distribution of participants according to the use of alcohol, smoking behaviors and illegal drugs

4.3.2. Distribution of participants according to their emotional status (Perceived barriers)

For participants emotional status 61.3% (n=80) agreed to feel everyday tired, and 62.5% (n=80) agreed to feel nervous due to TB medication taken, and 37.5% (n=80) agreed to feel hopeless when taking TB medications against the same proportion who disagreed. Almost 34% (n=80) disagreed to feel depressed when taking TB medications, 38.8% (n=80) disagreed to feel worthless by knowing the outcome of TB infection.45% (n=80) were very scared of losing job due to TB and 40% (n=80) denied of having restless sensations after taking TB medications (Table 4.3.2).

Table 4.3.2. Distribution of participants according to their emotional status (Perceived barriers)

Statements	Strongly disagree	Disagree	I don't know	Agree	Strongly agree
Feeling everyday tired with TB	**13 (16.3%)**	**8 (10%)**	**1 (1.3%)**	**49 (61.3%)**	**9 (11.3%)**
Nervousness when taking TB medications	**12 (15%)**	**13 (16.3%)**	**0 (0%)**	**50 (62.5%)**	**5 (6.3%)**
Hopeless when taking TB medications	**18 (22.5)**	**30 (37.5%)**	**0 (0%)**	**30 (37.5)**	**2 (2.5%)**
Depressed due to TB medications	**16 (20%)**	**34 (42.5%)**	**0 (0%)**	**28 (35%)**	**2 (2.5%)**
Worthless by knowing the outcome of the TB	**23 (28.8%)**	**31 (38.8%)**	**0(0%)**	**24 (30%)**	**2 (2.5%)**
Scared of losing job due to TB	**23 (28.8)**	**36 (45%)**	**1 (1.3%)**	**17 (21.3%)**	**3 (3.8%)**
Restless after taking TB medications	**21 (26.3%)**	**32 (40%)**	**1 (1.3%)**	**22 (27.5%)**	**4 (5%)**

4.3.3. Distribution of participants according to their knowledge about pulmonary tuberculosis

As regards to the knowledge of the participants regarding TB infection 100% (n=80) confirmed to be aware that TB is transmitted through airborne,70% (n=80) confirmed not to be transmitted in waterborne,57.5% (n=80) knew that TB can't be transmitted through sharing the same plates and 71.2% (n=80) said that it's can be transmitted by sharing the same bed, 82.5% (n=80) did not know that loss of weight is one of the signs of TB,62.5% (n=80) knew that night sweats is the symptoms of TB and 51.3% (n=80) confirmed to know that loss of appetite is one the symptoms of TB. On TB diagnosis 42.5% and 96.3% and 22.5% (n=80) of participants knew chest x-ray and Sputum sample and skin are used respectively. 41.3 % (n=80) of participants said patients may share food, 72.5% (n=80) said that TB sputum should be covered in a container during exam.

Almost 90% (n=80) of the participants knew that wearing facial mask is one of the preventive measure against PTB, and 95% (n=80) knew that without medications patients with TB will die, 93.8% agreed that household need to be screened for TB infection. 91.2% (n=80) knew that TB is preventable and curable disease, and 76.2% said that two months are not sufficient to treat TB infection, 95% (n=80) confirmed that six months are required to treat TB infection. Almost 85% said stopping medications before full dose is bad, 52.5% (n=80) said hemoptysis is one the complications of TB infection, 93.8% (n=80) reported not to be aware if meningeal TB is a complication of PTB and 76.3% (n=80) said that pneumonia is not a complication of PTB (Table 4.3.3). The overall average knowledge score of participants who answered questions correctly was 62% while 38% provided false responses out of 23 questions analyzed about knwoledge.

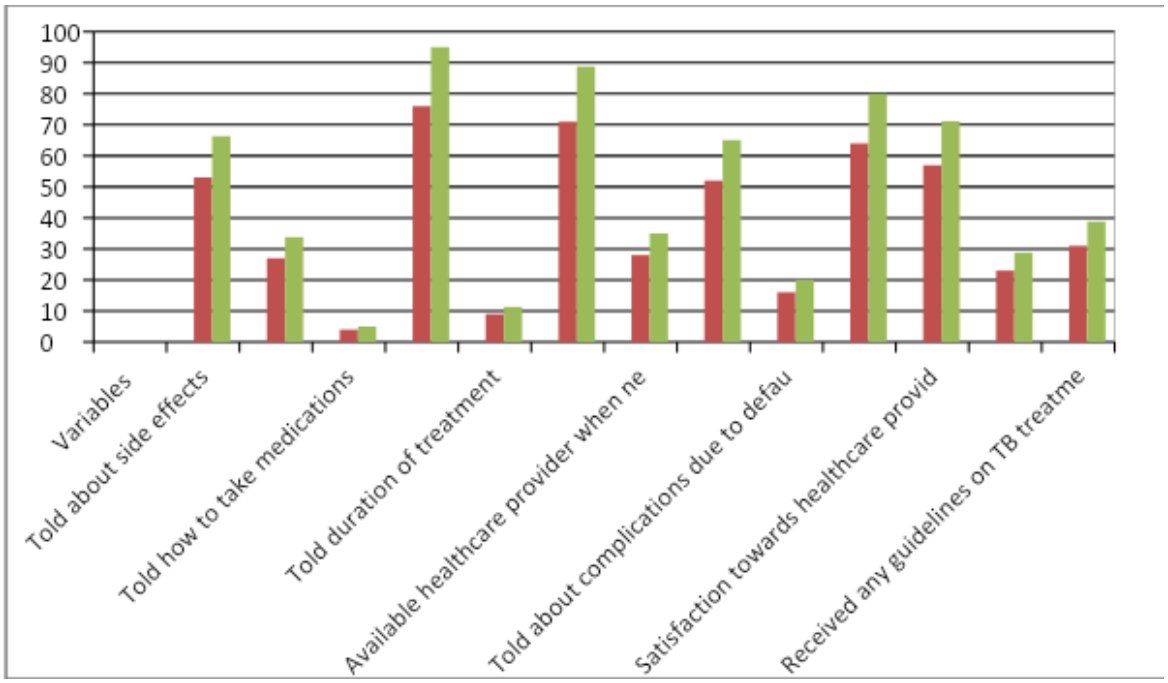
Table 4.3.3. Distribution of participants according to their knowledge about pulmonary tuberculosis

SN	Variables	Items	Frequency (n)	Proportion (%)
1	TB can be transmitted through Airborne	Yes	80	100
		No	0	0.0
2	TB can be transmitted through waterborne	Yes	24	30.0
		No	56	70.0
3	TB can be transmitted through sharing the same plates	Yes	34	42.5
		No	46	57.5
4	TB can be transmitted through sharing the same bed	Yes	57	71.2
		No	23	28.8
5	Weight loss is a symptom of PTB	Yes	14	17.5
		No	66	82.5
6	Night sweats is a symptom of TB	No	30	37.5
		Yes	50	62.5
7	Loss of Appetite is a symptom of TB	No	39	48.8
		Yes	41	51.3
8	Chest X-ray is used to diagnose TB	No	46	57.5
		Yes	34	42.5
9	Sputum sample is used to diagnose TB	No	3	3.8
		Yes	77	96.3
10	Skin test is used to diagnose TB	No	62	77.5
		Yes	18	22.5
11	TB patient do they share food with others	No	47	58.8
		Yes	33	41.3
12	TB sputum in covered container during exam	No	22	27.5
		Yes	58	72.5
13	Wearing mask will prevent PTB	No	8	10.0
		Yes	72	90.0
14	Without treatment people with	No	4	5.0

	PTB die	Yes	76	95.0
15	Households need to be screened for TB	Yes	75	93.8
		No	5	6.2
16	PTB is preventable and curable disease	Yes	73	91.2
		No	7	8.8
17	Two months are sufficient for curing TB	Yes	19	23.8
		No	61	76.2
18	Six months are required to complete TB medications	No	4	5.0
		Yes	76	95.0
19	Stopping TB treatment before full dosage	Yes	12	15.0
		No	68	85.0
20	Knowledge on consequences of stopping PTB medications	Yes	44	55.0
		No	36	45.0
21	Hemoptysis is a complication of PTB	No	38	47.5
		Yes	42	52.5
22	Meningeal TB is a complication of PTB	No	75	93.8
		Yes	5	6.3
23	Pneumonia is a complication of PTB	No	61	76.3
		Yes	19	23.8
	Total		**N=80**	**100%**

4.3.4. Healthcare provider related factors

Almost 66.3% (n=80) have never told about anti TB side effects, 95% (n=80) have been told how to take TB medications, and 88.8% told about TB medications duration, and 65% (n=80) get help from a healthcare provider when is needed. Approximately 80.0% of the participants have told about complications of Anti TB medications. 71.2% (n=80) are satisfied of help provided by healthcare providers and 61.3% (n=80) of the participants got guidelines on TB treatments (Figure 4.3.4.2).



Green: Proportion(%) **Red: Frequency (n)**

Figure 4.3.4.2. Healthcare provider related factors

4.4. RELATIONSHIP BETWEEN SELECTED FACTORS AND TB TREATMENT ADHERENCE AMONG PATIENTS WITH PULMONARY TUBERCULOSIS

To determine the association betwee selected factors and TB treatment adherence among patients with pulmonary tuberculosis, multivariate and bivariate logistic regression have been computed, and final model showed that those who have children reminder with OR 2.0 and P value 0.008 while others are statistically significant but with slightly neutral OR meaning lack of strong association. The time used to reach nearest health facility the more is less the more the patient is having strong association with adherence to medications with OR 1.6 (0.253-4.897) and P value of 0.02, and those who travel to healthcare facility with feet are 1.6 more likely to adhere to TB medications than those who goes with car, bicycle (OR=1.6, P value 0.021), Ubudehe category does have any influence on adherence of TB medications. On emotional status feeling hopeful when taking TB medications was strongly associated with adherence with OR 1.860 and P value 0.000, and on knowing the complications of TB was highly associated by adherence to medications with OR 1.699 (0.428-6.747) and P value 0.037. Considering healthcare providers

related factors, those who are told with them on how take medications have influence on adherence and strong association with OR 3.398 (0.723-15.961) and P value 0.000. Stopping medications when feeling better was negatively associated with OR 0.844 (0.414-1.718) P value 0.000, stopping medications when feeling better was positively associated with non adherence to TB treatments with OR 2.800 (1.424-5.506) and statistically significant with a P value 0.026, and taking medications when feeling sick was also strongly associated with non-adherence to TB mediations with OR 5.5 (1.373-22.038) and statistically significant with P value 0.038 (Table 4.4).

Table 4.4. Associated factors with TB treatment adherence among patients with pulmonary tuberculosis

Determinants			**COR (95% CI)**	**P Value**
Who remind you to take TB medications	Partner		1.143(0.235-5.562)	0.092*
	Parents		0.636(0.122-3.310)	.000**
	Children		2.0(0.350-11.439)	.008**
	CHWs		0.880(0.473-1.638)	.731*
	Co-workers		0.679(0.123-3.757)	.000**
	Healthcare providers		0.975(0.303-3.135)	0.660*
How long time do you use to reach your nearest health facility	Less than 30 minutes		1.6(0.253-4.897)	.020**
What type of transport do you use frequently	Foot		1.6(0.199-5.02)	.021**
	Car		0.99(0.223-3.709)	1.621*
	Bicycle		1.1(0.236-4.023)	0.962*
Which category of Ubudehe are you in?	First category		1	0.860*
	Second category		0.998(0.573-1.736)	.000**
Emotional status	Feeling tired	Disagree	0.956(0.6.11-1.496)	.000**
		I don’t know	1.495(0.589-3.806)	0.092*
		Agree	1.416(0.923-2.172)	.000**
		Strongly agree	1.055(0.602-1.847)	.000**

	Experience nervousness while taking TB medications.	Disagree	1.324(0.823-2.132)	0.011**
	Feeling restless after taking my medications.	Disagree	1.024(0.599-1.753)	.043**
		I don't know	1.351(0.741-2.462)	0.331*
		Agree	1.860 (1.102-3.140)	.000**
		Strongly agree	1.194(0.655-2.178)	0.661*
Knowledge on PTB	TB can be transmitted through: Sharing the same plates (**No**)		1.507(0.762-2.981)	0.044**
	This method is used to diagnose TB: Sample of sputum (**Yes**)		1	0.004**
	Does a person with TB eat together with the members of the family? (**Yes**)		0.883(0560-1.391)	0.025**
	Are two months sufficient for curing pulmonary tuberculosis? (**No**)		1.699(0.428-6.747)	0.037**
	To complete the treatment course of pulmonary tuberculosis requires: 4 months (**No**).		1.505(0.368-6.164)	0.000**
	To complete the treatment course of pulmonary tuberculosis requires: 4 months (**No**).		0.980(0.618-1.555)	.005**
Factors related to healthcare providers	Patient told about the possible side effects of each TB drugs taken (**Yes**).		3.398(0.723-15.961)	.000**

	Healthcare provider is available when is needed **(Yes).**	0.853(0.521-1.396)	0.001**
	Patient received any guidelines regarding TB treatment **(Yes).**	1	0.044**
Reason to stop Anti TB	Fear of drug toxicity (**No**).	0.844(0.414-1.718)	0.000**
Forget to take medications (**Yes**).		1	0.39*
Stop medications when feel better (**Yes**).		2.800(1.424-5.506)	.026**
Taking medication when feel sick (**Yes**).		5.5(1.373-22.038)	.038**
Motivator for taking Anti TB: Health education (**Yes**).		.844(.163-4.380)	.519*
Motivator for taking Anti TB: Exercise (**Yes**).		1.045(.994-1.098)	.999*
Motivator for taking Anti TB: Praying (**Yes**).		1.000(.994-5.241)	.647*

**: Variable is statistically significant *: Variable is not statistically significant

CHAP FIVE: DISCUSSION

5.0. Introduction

This chapter discussed the results of the current study with other available research findings. Different literatures were revised in order to compare the results found from demographic characteristics, socio-economic factors, patient related factor, knowledge about PTB, treatment adherence and helacare provider related factor. After that, conclusion and recommendations were made to different disciplines.

5.1. Demographic and socio-economic characteristics

This was a quantitative cross sectional study design which was conducted at Remera Health Center, Kibagabaga and Masaka district hospitals. Remera Health center and Kibagabaga District Hospital is located in Kigali city, Gasabo District, while Masaka district hospital is located in Kicukiro district. The total of 80 patients were used in this study in which 30 patients were from Kibagabaga hospital, 10 from Masaka hospital and 40 patients that were followed at Remera Health Center. The majority of participants were between the age 30-39 years with 43.8% (n=80); and predominated by male with 67.5% (n=80); the similar result was found in a study conducted in Somalia (Gupta *et al.*, 2004; Access, 2017).On education level those who attended primary school were 60.0% (n=80) and for marital status single were most predominant with 55% (n=80) contrary with study conducted in China where participants were above primary school predominantly with 40.62% (Juvenile middle school) and married ones were 72.13% (Cui *et al.*, 2017).

Treatment adherence among patients with pulmonary tuberculosis in Rwanda has become an interesting part of TB management and socio economic factor of the affected population plays a significant role in the adherence to TB medications, on the descriptive analysis of the above mentioned factor almost 47.5% (n=80) of research participants had no occupation which is a very big challenges for their survivor even though the Ministry of Health support them for feeding and transport and 8.8% (n=80) were unable to work due to the disease. Some result was found in a study conducted in Latvia showing that most of the TB patient are people with low income and most of them have no jobs or significant financial support (Ivanovs, Salmane-Kulikovska and Viksna, 2016), and 30% (n=80) were getting support from their partner against

30% (n=80) who had no support, the same result was found in a study conducted in Mexico (Centis, 2018), 26.3% (n=80) of participants were living alone in their house, and 32.5% (n=80) were taking their medications because healthcare providers reminded them (Gupta *et al.*, 2004; Ivanovs, Salmane-Kulikovska and Viksna, 2016). The majority of the participants used 31-60 minutes to reach their healthcare facility with a proportion of 40.0 % (n=80) and 56.3% (n=80) used their feet to go to the nearby healthcare facility, and 70.0% (n=80) of study participants were in second category of Ubudehe some result with a study conducted in India (Gupta *et al.*, 2004; Rajeswari *et al.*, 2016).

5.2. Level of TB treatment adherence

Adherence of Anti TB treatments showed to be approximately high with a proportion of 87.5% that reported not forgetting to take their TB medications, 81.2% (n=80) never stopped their TB medications, 21.3% reported stopping their medications when felt sick, and 77.5% (n=80) are being motivated taking their medications when receive health education, similar results was found in a study conducted in Equatorial Guinea showing high adherence on TB medications and some few who don't are due to shortage of TB drugs (Fagundez *et al.*, 2016). Around 96.3% (n=80) do not get family support when taking TB medications, and almost 80% (n=80) reported to have not positive influence from prayers regarding taking anti TB (Centis, 2018), and 86.3% (n=80) complained on taking many pills, and 73.8% to take them away from their home, but 82.5% (n=80) confirmed not to be so far away from health facility. 75% (n=80) of participants do not fear drug toxicity and 82.5% do not take alcohol when taking medications (Anjum, Daud and Mukhtar, 2009). 93.8% (n=80) are not getting too busy to adhere to TB medications, and 95% (n=80) reported to have sufficient food, 93.8% (n=80) it is not useless to take TB medications, this was confirmed by a study published by USAID (Fagundez *et al.*, 2016; USAID, 2016).

When classifying adherence into low, moderate and high level of adherence, the study revealed that, high level of TB treatments with a proportion of 87.5% reported not forgetting to take their TB medications and 81.2%(n=80) never stopped their TB medications and low level adherence of 21.3% (n=80) reported stopping their medications when felt sick. Moderate level of adherence with a proportion of 77.5% (n=80) participants are being motivated in taking their medications when receive health education. Similar results was found in a study conducted in Equatorial

Guinea showing high level of adherence on TB medications and some few who don't are due to shortage of TB drugs (Fagundez *et al.*, 2016). Around high level of adherence of 96.3% (n=80) do not get family support when taking TB medications while moderate level of adherence of almost 80% (n=80) of participants reported to have not positive influence from prayers regarding taking anti TB (Centis, 2018). High adherence level also of 86.3% (n=80) complained on taking many pills, and moderate adherence level of 73.8% (n=80) reported that, being away from their home doesn't affect them to adhere to their medications, but 82.5% (n=80) confirmed not to be so far away from health facility and 75% (n=80) of participants do not fear drug toxicity and 82.5% do not take alcohol when taking medications (Anjum, Daud and Mukhtar, 2009). High level of adherence also with 93.8% (n=80) are not getting too busy to adhere to TB medications, 95% (n=80) reported to have sufficient food and 93.8% (n=80) said that, it is useful to take TB medications as also confirmed in a study published by USAID (Fagundez *et al.*, 2016; USAID, 2016). The overall adherence level was low whereby 68.8% of patients were respecting TB treatment schedule and 31.2% were defaulting on treatment schedule due to various factors assessed. This is contrary to the study conducted in Ethiopia where the level of TB treatment adherence was high with the proportion of 88% (Daksa, Kebede and MarIam, 2016).

5.3. FACTORS INFLUENCING TB TREATMENT ADHERENCE

5.3.1. Patient related factors

For this section drinking and smoking are evaluated on behalf of the participants, the study revealed that most of the participants were currently not drinking with proportion of 68.8% (n=80) and those who used to drink were 47.5% (n=80). On the contrary, study conducted in South Africa showed that almost 80% use alcohol (Peltzer *et al.*, 2012), smokers were 28.8% (n=80) but those who used to smoke before were 43.8% (n=80), participants who used cocaine were 6.3% (n=80), those who smoke cannabis were a little bit high compared to those who used cocaine with 7.5% (n=80) and heroin user were 6.3% (n=80), compared to a study published by WHO showing the impact of smoking and using drugs, it confirmed that smokers and drug users attributed pulmonary TB (World Health Organization, 2009). For participants emotional status, 61.3% (n=80) agreed to feel everyday tired, 62.5% (n=80) agreed to feel nervous due to TB medication taken and 37.5% (n=80) agreed to feel hopeless when taking TB medications against

the same proportion who disagreed. Almost 34% (n=80) disagreed to feel depressed when taking TB medications, 38.8% (n=80) disagreed to feel worthless by knowing the outcome of TB infection, 45% (n=80) were very scared of losing job due to TB and 40% (n=80) denied of having restless sensations after taking TB medications (Rajeswari *et al.*, 2016).

As regards to the knowledge of the participants regarding TB infection 100% (n=80) confirmed to be aware that TB is transmitted through airborne,70% (n=80) confirmed not to be transmitted in waterborne similar study was conducted in Canada where participants confirmed all the above at high proportion (Fagundez *et al.*, 2016; Huddart *et al.*, 2018), 57.5% (n=80) knew that TB can't be transmitted through sharing the same plates, and 71.2% said that it can be transmitted by sharing the same bed. When asking the participants about pulmonary TB signs and symptoms, 82.5% (n=80) did not know that loss of weight is one of the signs of TB, 62.5 (n=80) knew that night sweats is the symptoms of TB and 51.3% confirmed to know that loss of appetite is one the symptoms of TB (Huddart *et al.*, 2018). On TB diagnosis, 42.5%, 96.3% and 22.5% (n=80) of participants knew that, chest x-ray, sputum sample and skin test are used respectively. On the other hand, 41.3 % (n=80) of participants said that, sharing the food cannot be a risk factor of TB transmission, 72.5% (n=80) said that TB sputum should be covered in a container always.

Almost 90% (72) of the participants knew that wearing facial mask is one of the preventive measure against PTB, and 95% (n=80) knew that without medications patients with TB will die, 93.8% agreed that households need to be screened for TB infection. 91.2% (n=80) knew that TB is preventable and curable disease and 76.2% said that two months are not sufficient to treat TB infection some result were found in a study conducted in Saudi Arabia (Samargandi *et al.*, 2012; Huddart *et al.*, 2018), 95% (n=80) confirmed that six months are required to treat TB infection. Almost 85% said stopping medications before full dose is bad, 52.5% (n=80) said hemoptysis is one of the complications of TB infection, 93.8% (n=80) reported not to be aware if meningeal TB is a complication of PTB (Peltzer *et al.*, 2012). Furthermore, 76.3% (n=80) said that pneumonia is not a complication of PTB (Samargandi *et al.*, 2012; Solliman *et al.*, 2012). The average knowledge of the participants on adherence regarding TB medications was high score of about 100% (n=80).

As regards to the knowledge of the participants regarding TB infection high score knowledge was attributed with a proportion of 100% (n=80) confirmed to be aware that TB is transmitted

through airborne, moderate score with proportion of 70% (n=80) confirmed not to be transmitted in waterborne and similar study was conducted in Canada where participants confirmed all the above at high and moderate score (Fagundez *et al.*, 2016; Huddart *et al.*, 2018). Low score with 57.5% (n=80) knew that TB can't be transmitted through sharing the same plates, and moderate score with 71.2% (n=80) said that it can be transmitted by sharing the same bed. Moderate score of 82.5% (n=80) of participants did not know that loss of weight is one of the signs of TB and low score of 62.5% (n=80) knew that night sweats is the symptoms of TB, low score of about 51.3% confirmed to know that loss of appetite is one of the symptoms of TB (Huddart *et al.*, 2018). On TB diagnosis low score of 42.5%, 22.5% and high score of 96.3% (n=80) of participants knew chest x-ray, skin and Sputum sample are used to diagnose pulmonary TB respectively. Low score with a proportion of 41.3 % (n=80) of participants said patients may share food, moderate knowledge score of 72.5% (n=80) said that TB sputum should be covered in a container all the time.

Participants were scored with high knowledge with a proportion of 90% (n=80) and they knew that wearing facial mask is one of the preventive measure against PTB, and 95% (n=80) knew that without medications patients with TB will die, while 93.8% agreed that households need to be screened for TB infection and 91.2% (n=80) knew that TB is preventable and curable disease, and medium knowledge was scored with a proportion of 76.2% (n=80) said that two months are not sufficient to treat TB infection, some result were found in a study conducted in Saudi Arabia (Samargandi *et al.*, 2012; Huddart *et al.*, 2018), but with high knowledge concerning TB treatment period with a proportion of 95% (n=80) and almost 85% said stopping medications before full dose is bad, but low knowledge score also with a proportion of 52.5% (n=80) said hemoptysis is one the complications of TB infection. Another high proportion of 93.8% (n=80) of participants negatively reported not to be aware if meningeal TB is a complication of left untreated PTB (Peltzer *et al.*, 2012) and 76.3% (n=80) said that pneumonia is not a complication of PTB (Solliman *et al.*, 2012). The average knowledge score is almost low because, only 62% of the participants had sufficient knowledge regarding pulmonary tuberculosis, this is consistent with the study conducted in Spain which indicated that 63.27% (n=98) of participants had enough knowledge about tuberculosis (Fagundez *et al.*, 2016). This small variation in proportions should be resulted from different sample size used.

5.3.2. Healthcare provider related factors

Sixty six point three percent (66.3%) have been never told about anti TB side effects, 95% (n=80) have been told how to take TB medications contrary to the study conducted in Uganda and Tanzania where TB patients have been told about the side effects of TB medications and all about their duration (Health and Welfare, 2006; Nwobi and Akpan, 2008). The total of 88.8% told about TB medications duration, and 65% (n=80) get help from a healthcare provider when is needed. Approximately 80.0% of the participants have been told about complications of Anti TB medications. The proportion of study participants equivalent to 71.2% (n=80) are satisfied of help provided by healthcare providers and 61.3% (n=80) of the participants got guidelines on TB treatments (Fagundez *et al.*, 2016; USAID, 2016).

5.4. RELATIONSHIP BETWEEN SELECTED FACTORS AND TB TREATMENT ADHERENCE AMONG PATIENTS WITH PULMONARY

To determine factors influencing treatment adherence among patients with pulmonary TB, multivariate and bivariate logistic regression have been computed ,and final model show that those who have children to remind them with OR 2.0 and P value 0.008 while others are statistically significant but with slightly neutral OR meaning lack of strong association (Gebreweld *et al.*, 2018). The time used to reach nearest health facility the more is less the more the patient is having strong association with adherence to medications with OR 1.6 (0.253-4.897) and P value of 0.02, and those who travel to healthcare facility with feet are 1.6 more likely to adhere to TB medications than those who go with car or bicycle (OR=1.6, P value 0.021). Ubudehe category does have any influence on adherence of TB medications; similar results were found in a study conducted in Eritrea (Gebreweld *et al.*, 2018). On emotional status, feeling hopeful when taking TB medications was strongly associated with adherence with OR 1.860 and P value 0.000, and on Knowledge knowing the complications of TB was highly associated by adherence to medications with OR 1.699 (0.428-6.747) and P value 0.037contrary to the study conducted in Kenya (Oyugi *et al.*, 2017). Considering Healthcare providers those who are told with them on how take medications have influence on adherence and strong association with OR 3.398 (0.723-15.961) and P value 0.000. Feeling of stopping medications was negatively associated with OR 0.844 (0.414-1.718) P value 0.000 (Rajeswari *et al.*, 2016).

On the other hand, stopping medications when felt better was positively associated with adherence to TB treatments with OR 2.800 (1.424-5.506) and statistically significant with a P value 0.026 similar results was found in a study on TB adherence in Equatorial Guinea (Fagundez *et al.*, 2016). Taking medications when feeling sick was also strongly associated with adherence to TB mediations with OR 5.5 (1.373-22.038) and statistically significant with P value 0.038 (USAID, 2016).

CHAPTER SIX. CONCLUSION AND RECOMMENDATIONS

6.1. INTRODUCTION

The aim of the study was to assess the factors influencing treatment adherence in patients with pulmonary tuberculosis. After analyzing the findings from the study, conclusion and recommendations were addressed.

6.2. CONCLUSION

In conclusion, the findings from this study were presented through tables and graphs interpreted using percentages, Odds ratios and P values. All participants were 100% (n=80) TB patients, the majority were knowledgeable about TB with low score at proportion of 62% on VAS, and on the factors influencing TB medications adherence; children remind their parents, less time to reach nearest health facility, travel with feet, having hopeful sensation in taking TB medications, knowing complications of TB infections and those who were told by healthcare providers how to take medications were strongly associated with adherence to TB medications. Generally, adherence level to TB treatments was considered to be low according to VAS interpretation.

To determine the relationship lies between factors influencing treatments adherence and knowledge about pulmonary TB the results showed that only time used to reach healthcare facility when is below 30 minutes was strongly associated with knowledge of patients with PTB with OR 8.500 (.901-80.193) and P value 0.020. Considering the above mentioned results, people in community are aware of most factors influencing TB adherence and most important they have sufficient knowledge on TB infection. Despite of good progress made in TB treatment adherence, some effort should be done for clarifying some few factors not well clarified on T B infections.

6.3. RECOMMENDATIONS

6.3.1. Nursing practice

Ministry of health should increase the awareness and community mobilization on the issues regarding Tuberculosis infection especially pulmonary as it is highly infectious particularly in low income countries.

For better TB treatment adherence, healthcare providers should continuously deliver health education to the patients and their family about pulmonary tuberculosis by focusing on the mode of transmission, signs and symptoms, complications related to TB treatments non adherence and the importance of completing the treatment course.

6.3.2. Nursing education

Educators can use these research results to improve their competences and the teaching and learning process.

Learners should revise these research findings in order to improve their knowledge which can help them to improve their practice.

6.3.3. Nursing research

Further studies with large sample size on treatment adherence and non-adherence on TB treatments should be conducted in the different parts of the country in order to elaborate more variables associated with TB treatment adherence and knowledge on TB infection, as the current study was only restricted in three health settings.

6.3.4. Policy makers

Government of Rwanda should do more than only caring for TB patients so that some incentives should be provided to patient's family as during the period of treatment TB patient don't work while some have family to take care of.

As it was found in the present study, less time used to reach nearest health facility was one of the predictors of TB treatment adherence, therefore the government of Rwanda through Ministry of Health should continue to avail primary healthcare services close to the population.

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APPENDIX A: CONSENT FORM FOR PARTICIPATION IN THE RESEARCH STUDY

Title of the study **"Factors influencing treatment adherence among patients with pulmonary tuberculosis"**

I am **Isaac NSANZAMAHORO**, a student from University of Rwanda, in master's program, in the track of medical surgical. I am doing the research on "**Factors influencing treatment adherence among patients with pulmonary tuberculosis"**. You are requested to read this form. If you have any concern, don't hesitate to ask for any clarification before agreeing to participate in the study.

Your participation involves providing the answers to the questions provided in the questionnaire. There are no known risks associated with participation in this study. There are no available financial benefits from this study, on the other hand, the study will help us to understand the factors affecting tuberculosis treatment adherence, and the measures that can be implemented in order to prevent the complications than can result from it. This study is anonymous; all data that are going to be collected will not contain your identity. We will do everything possible to ensure your privacy and keep your information confidential. Participation in the study is voluntary and you can withdraw your consent to participate any time without penalties.

If you have any questions about this study, contact me at +250 0785491943 or 0788490522 (Chairperson of CMHS IRB) 0783340040 (Deputy Chairperson) for more clarification.

Having agreed on the above information and being given the opportunity to ask questions, I voluntarily accept to provide my consent to participate in this study.

Signature of participant…… Date …../ …../2019

APPENDIX B: STUDY PLAN

TASKS TO BE COVERED	2018				2019			
	Feb to May	June to August	Sept. to Oct.	Nov. Dec	Jan. Feb	Marc. To May	June To July	August
1. Research Proposal preparation, presentation and submission	X	X						
2.Proposal correction and submission to IRB committee			X	X				
4. Ethical clearance and permission to do the work					X			
5. Requesting permission from selected study sites								
6. Pre-testing and finalizing research instrument								
7. Data Collection						X		
8. Data coding, and entry into computer						X		

9. Data analysis						X		
10. Report Writing						X	X	
11. Report Presentation							X	
12. Finalize Report Writing							X	X
13. Submission of Final Report								X
14. Feedback to the study sites								X

APPENDIX C: ESTIMATED STUDY BUDGET

NO	DESCRIPTION OF ITEMS	QUANTITY	UNIT PRICE(FRW)	TOTAL PRICE(FRW)
1	Pens	50 pens	150	7500
2	Papers	Two reams	4000	8000
3	Printing	1120 pages	50	56000
4	Typing	1120 pages	100	112000
5	Binding	7 books	500	3500
6	Lunch	40 lunches	2000	80000
7	Drinks	90 bottles	300	27000
8	Transport	9 times	9000	81000
9	Airtime	20 cards	1000	20000

10	Internet	90 days	500	35000
11	Data coding	-	-	100000
12	Data analysis	-	-	200000
13	Data discussion	-	-	150000
14	Report production	-	-	75000
15	Final activities	-	-	70000
	TOTAL	-	-	**1,025,000**

APPENDIX D: ETHICAL CLEARANCE

UNIVERSITY OF RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, 14/01/2019
Ref: CMHS/IRB/017/2019

NSANZAMAHORO Isaac
School of Nursing and Midwifery, CMHS, UR

Dear NSANZAMAHORO Isaac

RE: ETHICAL CLEARANCE

Reference is made to your application for ethical clearance for the study entitled "Factors influencing treatment adherence among patients with pulmonary tuberculosis at three selected sites of Rwanda"

Having reviewed your protocol and found it satisfying the ethical requirements, your study is hereby granted ethical clearance. The ethical clearance is valid for one year starting from the date it is issued and shall be renewed on request. You will be required to submit the progress report and any major changes made in the proposal during the implementation stage. In addition, at the end, the IRB shall need to be given the final report of your study.

We wish you success in this important study.

Professor Jean Bosco GAHUTU
Chairperson Institutional Review Board,
College of Medicine and Health Sciences, UR

Cc:
- Principal College of Medicine and Health Sciences, UR
- University Director of Research and Postgraduate studies, UR

EMAIL: researchcenter@ur.ac.rw P.O. Box: 3286, Kigali, Rwanda WEBSITE: http://cmhs.ur.ac.rw/ www.ur.ac.rw

APPENDIX E: PERMISSION LETTER OF DATA COLLECTION AT KIBAGABAGA HOSPITAL

NSANZAMAHORO Isaac
Kigali City
Kicukiro District

Phone: 0785491943
E-mail: isaacns2017@gmail.com

Kigali, 6th Feb, 2019

To: Director of KIBAGABAGA Hospital

Accord

Dear Sir,

RE: Request for approval of data collection at KIBAGABAGA Hospital

I have the pleasure to submit this request letter requesting for approval of data collection at KIBAGABAGA Hospital.

In fact, I am a student doing masters program in medical surgical nursing from University of Rwanda, College of Medicine and Health Sciences, in the School of Nursing and Midwifery. In order to fulfill the requirement of master's degree, the student must conduct the research project, and mine has the title of **''Factors influencing treatment adherence among patients with pulmonary tuberculosis at three selected health settings of Rwanda''.** This is the reason why I am humbly requesting your permission.

I am looking forward to hearing from you.

Yours faithfully

NSANZAMAHORO Isaac

APPENDIX F: PERMISSION LETTER OF DATA COLLECTION AT MASAKA HOSPITAL

REPUBLIC OF RWANDA

Masaka 01/03/2019
REF:224.../MSK/DH/2018

KIGALI CITY
DISTRICT KICUKIRO
HOPITAL MASAKA
B.P 3472 KIGALI
E-mail: masaka.hospital@moh.gov.rw

TO: Isaac NSANZAMAHORO

Re: PERMISSION TO CONDUCT DATA COLLECTION IN MASAKA DISTRICT HOSPITAL

Dear Sir,

Referring to the letter written on 8thFebruary2019 requesting tocollect data on « **Factors influencing treatment adherence among patients with pulmonary tuberculosis at three selected health settings of RWANDA** » the management of Masaka District Hospital is pleased to inform you that, you have authorization to conduct data collection in our Hospital from 25/03/2019 to 25/04/2019.

Sincerely

DISTRICT DE KICUKIRO - HOPITAL MASAKA

Dr.Marcel UWIZEYE
Director General Masaka Hospital

APPENDIX G: PERMISSION LETTER OF DATA COLLECTION AT REMERA HEALTH CENTER

NSANZAMAHORO Isaac
Kigali City
Kicukiro District

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Kigali, 8th Feb, 2019

To: Director of Remera Health Center

Dear Sir/Madam,

RE: Request for approval of data collection at Remera Health Center

I have the pleasure to submit this request letter requesting for approval of data collection at Remera Health Center.

In fact, I am a student doing masters program in medical surgical nursing from University of Rwanda, College of Medicine and Health Sciences, in the School of Nursing and Midwifery. In order to fulfill the requirement of master's degree, the student must conduct the research project, and mine has the title of **''Factors influencing treatment adherence among patients with pulmonary tuberculosis at three selected health settings of Rwanda''.** This is the reason why I am humbly requesting your permission.

I am looking forward to hearing from you.

Yours faithfully

NSANZAMAHORO Isaac

ACCord

MUSABYIMANA Emile

APPENDIX H: QUESTIONNAIRE ENGLISH VERSION

Instructions

This questionnaire is made up of threesections **A, B and C**

Use this sign (x) to choose an appropriate answer

This questionnaire is made up of closed ended questions only

SECTION A: DEMOGRAPHIC AND SOCIO-ECONOMIC FEATURES

Q1. Gender

Male ☐

Female ☐

Q2. Age of the participant

20-29 years ☐

30-39 years ☐

40-49 years ☐

50-59 years ☐

60-69 years ☐

From and above 70years ☐

Q3. Educational information

None ☐

Primary studies ☐

Secondary studies ☐

College/University ☐

Others: .....

Q4. Marital status

Single ☐ Married ☐

Widow ☐ Divorced ☐

Widower ☐

Q5.Occupation

None ☐

Farmer ☐

Office worker ☐

Busness ☐

Student ☐

Unable to work due to the disease ☐

Others to be specified …….

Q6. Where do you get your support currently?

Partner ☐ No where ☐

Family ☐

Friends ☐

Q7. How many people do you live together in the same house?

Myself ☐ Two ☐ Three ☐

Four ☐ Five ☐ More than five ☐

Q8. Who remind you to take your TB medications?

My partner ☐ Parents ☐ Children ☐

CHWs ☐ Co-workers ☐ Healthcare providers ☐

None ☐

Q9. How long time do you use to reach your nearest health facility?

Less or equal to 30 min ☐ 31-60 min ☐

1 hour to 2hours ☐ More than 2hours ☐

5. I don't know ☐

Q10. What type of transport do you use more frequently when you go to your health facility to take your medications?

By foot ☐

By car ☐

By bicycle ☐

By motorcycle ☐

Q11. Which category of UBUDEHE you are in?

First category ☐

Second category ☐

Third category ☐

Fourth category ☐

SECTION B: QUESTIONS REGARDING TB TREATMENT ADHERENCE (Perceived susceptibility)

Q12. Do sometimes forget to take your medications?

Yes ☐ No ☐

Q13. Do you ever stop your medications when you feel better?

Yes ☐ No ☐

Q14. Are your medications taken only when you feel sick?

Yes ☐ No ☐

Q15. The following factors motivate you to adhere to your TB treatment regimen (perceived benefits and action).

1. Health education Yes ☐ No ☐
2. Adequate family support Yes ☐ No ☐
3. Exercise Yes ☐ No ☐
4. Praying Yes ☐ No ☐

Q16. The following are the reasons that make you to stop your medications (Perceived barriers)

Items	**Yes**	**No**
Many of pills to take		
Away from your home		
Health facility is too far from home		
Fear of drug toxicity		

Having Taken an alcohol		
Busy with other things		
Shortage of money for transport		
Shortage of food		
Drugs are useless to take them		

SECTION C: FACTORS ASSOCIATED WITH TB TREATMENT ADHERECE

PATIENT RELATED FACTORS (Perceived susceptibility)

A. LCOHOL USE

Q17. Do you drink alcohol currently?

Yes ☐ No ☐

Q18. Did you use to drink alcohol?

Yes ☐ No ☐

B. SMOKING BEHAVIORS

Q19. Do you smoke currently?

Yes ☐ No ☐

Q20. Did you use to smoke?

Yes ☐ No ☐

C. ILLEGAL DRUGS USE

Q21. Did you use one of the following illegal drugs in your life?

Cocaine	Yes		No	
Cannabis	Yes		No	
Heroin	Yes		No	

D. EMOTIONAL STATUS (Perceived barriers)

Statements	**Strongly disagree**	**Disagree**	**I do not know**	**Agree**	**Strongly agree**
Q22. I feel tired everyday while I am suffering with TB.					
Q23. I experience nervousness while I take TB medications.					
Q24. I often feel hopeless when I take TB medications.					
Q25. I feel depressed sometimes due to TB medications.					
Q26. I often feel worthless in my daily life because of					

not knowing the outcome of the disease.					
Q27. I am scared of losing job because of TB.					
Q28. I feel restless after taking my medications.					

E. KNOWLEDGE ABOUT PULMONARY TUBERCULOSIS (Perceived barrier)

Q29. TB can be transmitted through:

1. Airborne Yes ☐ No ☐
2. Waterborne Yes ☐ No ☐
3. Sharing the same plates Yes ☐ No ☐
4. Sharing the same bed Yes ☐ No ☐
5. Singing Yes ☐ No ☐

Q30. What are the symptoms of active TB?

1. Weight loss Yes ☐ No ☐
2. Night sweats Yes ☐ No ☐
3. Loss of appetite Yes ☐ No ☐

Q31. These are the methods used to diagnose TB

1. Chest X- ray Yes ☐ No ☐
2. Sample of sputum Yes ☐ No ☐
3. Skin test Yes ☐ No ☐

Q. Does a person with TB eat together with the members of the family?

Yes ☐ No ☐

Q**28. Is it necessary to dispose the sputum in a covered container?**

Yes ☐ No ☐

Q29. Do you think wearing a mask will help to prevent spreading of TB?

Yes ☐ No ☐

Q30. All the people infected with TB will die without a treatment

Yes ☐ No ☐

Q31. Do households contacts need to be screened for tuberculosis

Yes ☐ No ☐

Q32. Is tuberculosis preventable and curable disease?

Yes ☐ No ☐

Q33. Are two months sufficient for curing pulmonary tuberculosis?

Yes ☐ No ☐

Q34. How many months are required to complete the treatment course of pulmonary tuberculosis?

1. 2 months Yes ☐ No ☐
2. 4 months Yes ☐ No ☐
3. 6 months Yes ☐ No ☐
4. Lifetime Yes ☐ No ☐

Q35. Is it good to stop the treatment before recommended period once you feel better?

Yes ☐ No ☐

Q36. Do you know the consequences that may occur if you stop your treatment early?

Yes ☐ No ☐

Q37. What are the complications of pulmonary tuberculosis if it is not well treated?

1. Hemoptysis Yes ☐ No ☐
2. Meningeal TB Yes ☐ No ☐
3. Pneumonia Yes ☐ No ☐

HEALTHCARE PROVIDER RELATED FACTORS

Questions	**Yes**	**No**
Q38. Did your healthcare provider tell you the possible side effects of each TB drugs you take?		
Q39. Did your healthcare provider tell you how to take your drugs?		
Q40. Did your healthcare provider tell you the expected duration of treatment?		
Q41. Is your healthcare provider available when is needed?		
Q42. Did your healthcare provider tell you the complications that may happen if you don't respect your treatment schedule?		
Q43. Are you generally satisfied with the support you receive from your healthcare provider?		

Q44. Have you received any guidelines regarding TB treatment?		

Thank you for your participations!