DETERMINANTS OF MEDICATION ADHERENCE AMONG PATIENTS WITH TUBERCULOSIS: A STUDY AT SOKOTO METROPOLIS, NIGERIA

BY

ZAYYANU SANI
(10702768)

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DECLARATION

I, Sani Zayyanu hereby pronounce that, this research report is the finding of my original study. The study was conducted under the supervision of Dr. Cecilia Eliason of the University of Ghana, School of Nursing and Dr. Gladys Dzansi Ag HOD Adult Health Department, School of Nursing and Midwifery, University of Ghana, Legon. The whole or part of this write up has not been presented to any institution for any award of any degree or certificate. All references used in this dissertation have been duly acknowledged.

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ZAYYANU SANI DATE

(STUDENT)

We certify that the dissertation that is being summited for examination was carried out under our guidance and supervision.

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DR.(MRS) CECILIA ELIASON DATE

(SUPERVISOR)

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DR. GLADYS DZANSI DATE

(SUPERVISOR)

DEDICATION

I devote this research to my lovely family who endured my absence and friends who in one or the other assisted me in achieving this successful journey.

ABSTRACT

Adherence to tuberculosis (TB) medication has a paramount significance to the management of patients with tuberculosis. Researchers have considerably developed an interest to explore various aspects that yielded information about TB medication adherence. Determinants of TB medication adherence are considered factors that could prevent or enable patients to either adhere or default to the treatment. This study, therefore, sought to explore the determinants among patients with TB at Sokoto metropolis, Nigeria. The outcome measures include knowledge about TB, perception of TB treatment, level of adherence to TB medication, relationship among these variables and predictors of the medication adherence.

A quantitative cross-sectional research method was employed to collect data by distributing structured questionnaires to 137 patients with TB. The data were analysed by means of Chi-square, Pearson's correlation test and Binary logistic regression analysis using STATA version 15. The result established that majority of the respondents had poor knowledge about TB; more than half of patients sampled wrongly perceived TB treatment, and more than one-third did not adhere to TB medication. The findings also identified positive significant relationship between patients' knowledge about TB and their perception of TB treatment. Being employed, acquiring information about TB from family and friends, poor perception of TB treatment and poor knowledge about TB were the predictors of the respondents' non-adherence to TB medication. Meanwhile, unemployment, media source of information about TB, good knowledge about TB and good perception of TB treatment were the enablers of TB medication adherence.

In conclusion, it is important to intensify direct observed treatment strategy (DOTS) and comprehensive health education through the media to address the barriers and improve adherence to the medication.

Key words: Determinants, Patients, Tuberculosis, Medication, Adherence, Perception, Knowledge, Direct observed treatment strategy (DOTS).

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AOR: Adjusted Odds Ratio The such as TB care

AIDS: Acquired Immune Deficiency Syndrome

ATS: American thoracic society

CI: Confidence Interval

COR: Crude Odds Ratio

DOT: Directly Observed Therapies

DOTS: Direct Observed Treatment Short course

GAA: Global Aid for Africa

HIV: Human Immune Deficiency Virus

HREC: Health Research and Ethical Committee

IHV: Institute of Human Virology

NGO: Non-Governmental Organizations

MDR-TB: Multi-drug Resistance TB

RR-TB: Rifampicin-Resistant TB

SD: Standard Deviation

SHS: Specialist Hospital Sokoto

TB: Tuberculosis

WHO: World Health Organization.

CHAPTER ONE

INTRODUCTION

"The chapter encompasses background of the study, problem statement, research purpose, specific objectives of the research, research questions and hypotheses, significance of the study and operational definition of terms".

1.1 Background of the Study

Tuberculosis (TB) is an infectious but preventable and curable disease, caused by a bacterium called *Mycobacterium tuberculosis*. The microorganism is transmitted through the air or consumption of unpasteurized milk or meat from infected cow (Bovine TB). Infected people can spread the disease to others via droplet infections, when they sneeze, talk or cough (Yousuf, 2017). About one-third of people have latent TB worldwide. They harbour the bacteria but are yet to fall ill with the disease and cannot transmit it, nevertheless 10% of them have a lifetime risk of falling ill (World Health Organization, 2018a).

However, the World Health Organization report attests that immunocompromised hosts such as patients with Human Immunodeficiency Virus (HIV), diabetes and malnutrition, as well as smokers have a higher tendency of falling ill. The report indicates that HIV patients are 16-27 times more vulnerable to contracting TB than those without HIV infection (World Health Organization, 2017). Moreover, the dual epidemic is greatly recorded in sub-Saharan Africa accounting for about 86% of all deaths from HIV associated TB in 2016 (World Health Organization, 2017). The patient with active TB presents symptoms such as fever, cough, night sweating, weight loss and can infect about 10-15 susceptible people yearly upon close contact with them (Yousuf, 2017).

Tuberculosis (TB) is listed among the top ten causes of death globally, and it is rated as the leading cause from a single infectious agent (above HIV/AIDS) victimizing millions of people each year (World Health Organization, 2017). As estimated in 2017, 1.3 million death were reported among TB patients who were not HIV-positive which added to the death record of 300,000 TB/HIV co-infected patients worldwide. Moreover, 10 million new cases of TB were also estimated, which was comparable to 133 cases of TB per 100,000 population (World Health Organization, 2018a). The upsurge in TB incidence resulted in the development of a plan to stop TB globally by reversing its incidence. For this goal to be achieved some strategies need to be put into consideration which include the provision of good TB programmes to allow early discovery of TB cases and treatment, and by managing all patients living with TB on anti TB medications as well as ensuring that the medication regimen is completed (World Health Organization, 2017).

The global report in 2017 estimated the percentage of TB cases in different regions: Southern-East Asia, Africa and Western Pacific regions recorded the larger proportion of 44%, 25% and 18% respectively. While the regions of the Eastern Mediterranean, the Americas and the Europeans accounted for the smaller proportions of 7.7%, 2.8% and 2.7% respectively (World Health Organization, 2018a). In the above global record, 87% of all estimated incidence cases occurred in 30 high TB burden countries, with India (27%), China (9%), Indonesia (8%), Philippines (6%), Pakistan (5%), Nigeria (4%), Bangladesh (4%) and South Africa (3%) accounted for two-thirds of the global total (World Health Organization, 2018a).

In Africa, the 2017 World Health Organization report indicates that Nigeria and South Africa were ranked 6th and 8th positions respectively with regard to TB incidence among 30 high

burden countries. The report also asserts that about 0.9 million new TB cases are estimated among people living with HIV worldwide; 72% of whom live within Africa (World Health Organization, 2018a). South Africa has the largest number of HIV patients in Africa with more than 50% of them infected with TB (Meehan et al., 2018). Consequently, it recorded a higher level of lung problems before smoking and older age (van Kampen et al., 2018).

Since the year 2000, over 53 million persons have been diagnosed with TB and treated with standard anti-TB drugs (Hiatt & Nishikiori, 2014). For the TB-patient to be treated completely, the multiple drugs need to be taken for six (6) consecutive months (Horsburgh Jr, Barry III, & Lange, 2015). The full recovery could only be realised when the medications are provided and instructions are adhered to (Liu et al., 2014). Treatment and preventive measures are the only remedies to the epidemic which can account for the death of up to two-thirds of people ill with this ailment (World Health Organization, 2017).

Even though the treatment regimens of TB have a greater than 95% effectiveness in patients infected with *Mycobacterium tuberculosis* strains susceptible to first-line drugs, still, adherence to treatment becomes difficult to patients in most of the African countries such as Nigeria, Ethiopia, South Africa and Uganda (Vieira and Ribera, 2011). This is attributed to the missed appointment of patients who need to be reminded or even contacted to patronize the TB program (Liu et al., 2014). Thus, it contributes to the death of thousands of patients with tuberculosis every year (World Health Organization, 2018a)

It is reported that the patient's education on TB and proper counselling have a key role in increasing adherence to TB medication (Dara et al., 2015). Several studies across Africa indicate the effect of poor knowledge of TB among patients. A study conducted in Kenya shows in

adequate knowledge, herbal use, low income and alcohol abuse as factors influencing nonadherence to the treatment. Similar studies in Southern Mozambique report poor knowledge about TB and its management among not only the patients but also the healthcare workers as main contributors for defaulting (Noé et al., 2017).

In Eritrea, inadequate knowledge on TB, lack of social support and stigma loss of employment, long duration of treatment and medication side effects posed as barriers to treatment adherence (Gebreweld et al., 2018). Factors related to physical access to a treatment centre and lack of knowledge about direct observed treatment short course (DOTs) have been reported to affect medication adherence in Ethiopia (Shargie & Lindtjørn, 2007; Woimo, Yimer, Bati, & Gesesew, 2017). Moreover, a systematic review indicates that the key factors related to nonadherence to TB medication and loss to follow up in low-income countries are socio-economic, behavioural, and knowledge deficit about the treatment duration (Habteyes Hailu, Azar, Davoud, & Gholamreza, 2015).

Sub-Saharan Africa recorded a high rate of losses to follow-up of TB patients, which ranges from 11.3% to 29.6% (Castelnuovo, 2010; Habteyes Hailu et al., 2015), and mining has been rated as a major determinant of TB among sub-Saharan African nations (Stuckler, Basu, McKee, & Lurie, 2011). In Burkina Faso, poor medication adherence was attributed to failure to visit health facilities and consulting traditional healers for remedy (Méda et al., 2014). In Ghana, the health facilities report about 46,000 cases of TB yearly, a study conducted indicates financial problems as a major factor of nonadherence to TB medication (Danso, Addo, & Ampomah, 2015). Meanwhile in the northern region of the country, tobacco smoking, alcoholism, and other substance abuse were identified as contributors to the nonadherence (Eliasu, 2015).

Nigeria is ranked sixth among the countries that have the highest estimated total burden of TB incidence in the world. It is also one of the fourteen countries that featured in all the three high- burden countries list, with the highest burden of not only TB but also TB and HIV co-infection (TB/HIV), and multi-drug resistant (MDR-TB) (World Health Organization, 2018a). And indication has shown that TB incidence is expected to increase substantially not only in Nigeria but also worldwide in the next decade due to the interaction between TB and HIV epidemics and the emerging MDR-TB (Musa, Musa, Muhammed, Ibrahim, & Musa, 2015).

Moreover, Njepuome and Odume (2009) conducted a study in Gombe and the finding of the study propounds that patients affected with tuberculosis who were co-infected with HIV had a cure rate of 12.7% while those who presented with only TB recorded a cure rate of 31.8%. Another study conducted in Plateau state has revealed that patients' lack of knowledge on the duration of treatment, healthcare providers' attitude and distance as the significant factors of adherent to TB medication (Ibrahim et al., 2014). Both patient-related and health facility factors were affirmed to be the leading causes of non-adherence to anti-TB drugs in Osun (Ajao et al., 2014).

The Federal Ministry of Health reported that the Sokoto State had the highest estimated prevalence of TB in Nigeria with 127 TB cases per 100,000 persons in 2016. Research has indicated that Sokoto metropolis recorded higher TB cases as compared to other local government in the state (Fada, 2017).

World Health Organization (2017) recommends that to achieve proper management of active TB it will require daily administration of multiple drugs for at least 6 months. The medications whether the first-line or second-line often cause unwanted effected, which may

inversely lead to nonadherence to treatment (Habteyes Hailu et al., 2015). Recently, interventions have been made to improve adherence and the most widely and effective method is directly observed treatment (DOT) (World Health Organization, 2017).

Direct observed treatment is a program established by the WHO in 1993 to treat patients with TB and prevent the spread of the disease (Fogel, 2015). The program strategy highlighted five (5) major elements such as political commitment by government, provision of good-quality TB medication, enhanced services in laboratories, and provision of a standardized system to allow proper recording and reporting of the programme success and failure as well as ensuring effective case management through direct observation of treatment by a trained independent third party (Wright, Westerkamp, Korver, & Dobler, 2015). This strategy resulted to the treatment of more than 30 million TB patients, with the involvement of the third party for direct observation of treatment resulting in cure rates of greater than 80% and default rates of less than 10%. Thus, the aim of introducing DOTs has not been realised by achieving the treatment success of 85% and new cases detection rate of 70% (World Health Organization, 2017).

Furthermore, in 2015 WHO has set-up the latest target to attain a 95% reduction of TB related deaths and 90% reduction of TB incidence rate by 2035 (Sakajiki et al., 2018). This is also targeted to eliminate TB completely in low TB incidence countries (Lönnroth et al., 2015). Achieving this target could only be possible if, among other strategies, the TB medications are being adhered to (Getahun et al., 2015). Hence, adherence to TB treatment will prevent the patient from acquisition of chronic TB manifestations, MDT-TB/RR-TB (World Health Organization, 2018b), and reduce the rate of transmitting the disease to vulnerable individuals (Sakajiki et al., 2018).

However, non-adherence to TB medication has been presumed to be the major hindrance to TB eradication worldwide (Schito, Hanna, & Zumla, 2017). Non-adherent patients were those who failed to complete their prescribed medication. These patients affected with TB were potential for developing MDT-TB/RR-TB, as well as increasing the rate of new cases of TB which consequently increases TB related morbidity and mortality (Dheda et al., 2014). Therefore, to improve adherence, both incentives such as monetary support, free medication program and enablers such as improve access to facilities, creating awareness about TB should be intensified to yield the required positive outcome (Lutge, Wiysonge, Knight, Sinclair, & Volmink, 2015).

The Health Belief Model (HBM) adopted from Glanz et al., (2002) was used as the underlying framework to guide the study. The researcher used the model to help identify the knowledge, perceptions, and medication adherence among patients affected with TB at Sokoto metropolis.

1.2 Problem Statement

Sokoto Metropolis is the largest city of Sokoto State which is located in the North-Western zone of Nigeria. It has a tertiary hospital known as Specialist Hospital Sokoto (SHS) which serves as a referral centre for TB patients in the community. The centre registered the highest prevalence rate for TB in Sokoto, contributing 19.3% (1,524) of the total TB cases enrolled for treatment in Sokoto in 2017 (record from the facility). According to the hospital record of 2017, 294 patients were admitted mostly due to nonadherence to the medication which majority of them developed multiple-drug resistance tuberculosis. Sakajiki et al. (2018) reported that in the North-western zone of Nigeria which Sokoto is included, majority of patients with

rifampicin-resistant TB (RR-TB) and MDR-TB were emanated from susceptible TB patients who had defaulted as a result of dissuading factors of TB medication adherence.

Non-adherence to TB medication has a direct impact on cure rates which are currently below 85% amongst patients in Nigeria (World Health Organization, 2017). In 2008, a six (6) years retrospective study was conducted in Sokoto to investigate TB outcome among children of fifteen (15) years and below, the result reported 10.1% case fatality rate (Jiya, Bolajoko, & Airede, 2008). From 2008 to 2012, Sokoto reported the total TB cases of 445 and 2,614 respectively (Obasanya et al., 2015). Even though recent study regarding TB related mortality rate has not been found, the increase in the total TB cases (Obasanya et al., 2015) and MDT-TB and RR-TB patients in Sokoto (Sakajiki et al., 2018) may consequently result to high mortality rate.

There is the paucity of research on the determinants of medication adherence in Sokoto. Therefore, this research sought to assess the factors that determine adherence to medication among patients suffering from TB in Sokoto metropolis.

1.3 Purpose of the Study

The main aim of the study is to explore and describe the determinants of medication adherence among patients with TB in Sokoto metropolis.

1.4 Specific Objectives

The specific objectives of this study are to;

1. Assess the patient's knowledge about Tuberculosis.
2. Evaluate the patient's perception of TB medication.

3. Assess medication adherence among patients with TB.
4. Determine the relationship between the patient's perception of TB medication and medication adherence.
5. Determine the relationship between the patient's knowledge of TB and his perception of TB medication.
6. Determine the predictors of a patient's adherence to TB medication.

1.5 Research Questions

1. What is the patient's level of knowledge about Tuberculosis?
2. How does the patient perceive TB treatment?
3. Which behaviour does the patient have toward the TB medication?
4. What is relationship between the patient's perception and TB medication adherence?
5. What is the relationship between the patient's knowledge and his perception of TB medication?
6. What are the predictors of a patient's adherence to TB medication?

1.6 Hypotheses Statement

1. The patients have adequate knowledge about tuberculosis.
2. The patients perceive that anti-tuberculosis medications are very effective.
3. The patients adhere strictly to anti-tuberculosis medication.
4. There is positive significant relationship between the patient's perception and adherence to TB medication.
5. There is positive significant relationship between the knowledge about TB and the patient's perception of TB medication.

1.7 Significance of the Study

The finding of this study will contribute to the existing literature of TB by generating insight into the determinants of medication adherence among patients with tuberculosis. The study will also help in developing key strategies that will aim at:

• Improving the level of adherence to TB medications; and

• Reducing the rates of TB medication non-adherence and loss to follow up in TB treatment.

• Improving the prognosis of patients with TB

The results of this study will assist the Sokoto Ministry of Health and Sokoto metropolis to review their tuberculosis case holding policy in order to reduce the burdens of TB in the state. The outcome of this research will also improve the health status of citizens that will invariably contribute to the development of the nation. Finally, the results will encourage health personnel to exhibit positive therapeutic behaviours such as counselling, care and support for TB patients.

1.8 Operational Definitions or Definitions of Terms

Active TB patient: a person who harbour the bacteria, falls ill with the disease and can transmit it to another person.

Determinants: factors that influence the nature of something.

Medication: a process of using medicine to treat a person or disease.

Medication adherence: strictly accepting and implementing healthcare providers' recommendations regarding TB treatment.

Latent TB: the patients harbour the infection but do not get sick.

CHAPTER TWO

LITERATURE REVIEW

"This chapter contains information that provides support to the study as indicated by Grove, Gray, and Burns (2014). Literature review allows proper analysis, critical evaluation and synthesis of current knowledge that is relevant to the study of interest (Hart, 2018). The aim of this literature review is to analyze, critically evaluate and then synthesize available publications that are relevant to determinants of medication adherence among patients with TB. The theory that supported the study has been briefly overviewed".

Relevant studies were reviewed and the information was collected mostly from 2009 to 2019. However, some few studies preceding 2008 were included due to their importance to the study. The literature is utilized to achieve the aim of this study. Articles related to tuberculosis in Nigeria, sub-Saharan African, Africa and the world were harvested by searching different databases like Medline, Pub med, HINARI, Science direct, Google search and Google Scholar. Other publications that are relevant to the study were found via references cited in studies and reports. Moreover, during the searching process, Boolean logic was used to harvest relevant information by entering the key concepts of the study topic into database boxes. Each key concept and its synonymous were entered in separate database box, and each synonymous term was separated by the word 'OR' as follows: "Determinants" OR "Factors influencing" AND "tuberculosis medication" OR "tuberculosis treatment" OR "anti-tuberculosis drugs" AND "adherence" OR "compliance".

During the process of the review, the researcher was able to find a model that was designed by Glanz et., al 2002. The model was critically examined and then adapted to be used

in the study. Several literature that are related to patients' knowledge about tuberculosis (Krasniqi et al., 2017; Viney et al., 2014), patients' perceptions about tuberculosis medication (Albino et al., 2014; Muhammed, Nagla, & Morten, 2015; Putera, Pakasi, & Karyadi, 2015), different behaviour of medication adherence exhibited by TB patients and even various factors influencing adherence to tuberculosis medication have been reviewed (Dladla, 2013; Méda et al., 2014; Putera et al., 2015).

2.1 Research Framework

Several research frameworks on behaviour were reviewed and considered to guide this study, such as the Theory of Help- Seeking Behaviour, the Theory of Planned Behaviour and Theory of Health Belief Model. But the Theory of Help-Seeking Behaviour and the Theory of Planned Behaviour were not used because they do not contain all the constructs needed and therefore found misfit to the study objectives. Consequently, the Theory of The Health Belief Model was chosen to guide the study because it contains all the constructs needed and found fit to the study objective.

The Health Belief Model was used to guide the research work, that model was adopted from Glanz et al., (2002). According to Glanz, Rimer, and Viswanath (2008) the Health Belief Model was developed in the 1950s by social psychologists Hochbaum, Rosenstock and Kegel to explain and predict health behaviour. It was developed to look at the attitudes and beliefs of people in response to the failure in free TB health screening programme. The theory was initially comprised of four components (perceived threat and net benefit), then cues to action were added and then recently self-efficacy was added (Skinner, Tiro, & Champion, 2015).

Perceived seriousness concerns about the patients' beliefs about the disease itself (e.g., is the disease in question is life-threatening or may subject the patient to disability or pain) (Glanz, Rimer, & Viswanath, 2015). Perceived susceptibility refers to the subjective assessment of the risk of developing health problem. The combination of both perceived severity and perceived susceptibility mostly depends on the knowledge of patient about the disease. And the model assumed that a higher likelihood of engagement in behaviour is attributed to a higher perceived threat (Skinner et al., 2015).

Perceived benefits are described as an individual's assessment of the efficacy or value of engaging in health-promoting behaviour to decrease the risk of disease. If an individual believes that a particular action will decrease the seriousness of a health problem or reduce its susceptibility, then the individual is likely to engage himself in that behaviour regardless of objective facts regarding the effectiveness of the action (Glanz et al., 2015). Perceived barriers refer to the assessment of the obstacles of an individual to change behaviour (Glanz et al., 2015). Even if an individual has the perception that a particular health condition is threatening and has the belief that a particular action will effectively reduce the threat, the engagement in the health-promoting behaviour may be prevented by barriers. In other words, for change of behaviour to occur, the perceived barriers must be overshadowed by the perceived benefit (Skinner et al., 2015).

In this model, the health-related behaviour is being affected indirectly by modifying variables as a result of their effect on perceived susceptibility, seriousness, barriers and benefits (Glanz et al., 2015). The modifying variables include cues to action which postulates that a cue, or trigger, is necessary for prompting engagement in health-promoting behaviours, and self-

efficacy which refers to an individual's perception of his or her competence to successfully perform a behaviour (Skinner et al., 2015).

HEALTH BELIEF MODEL BY ROSENSTOCK AND KEGEL

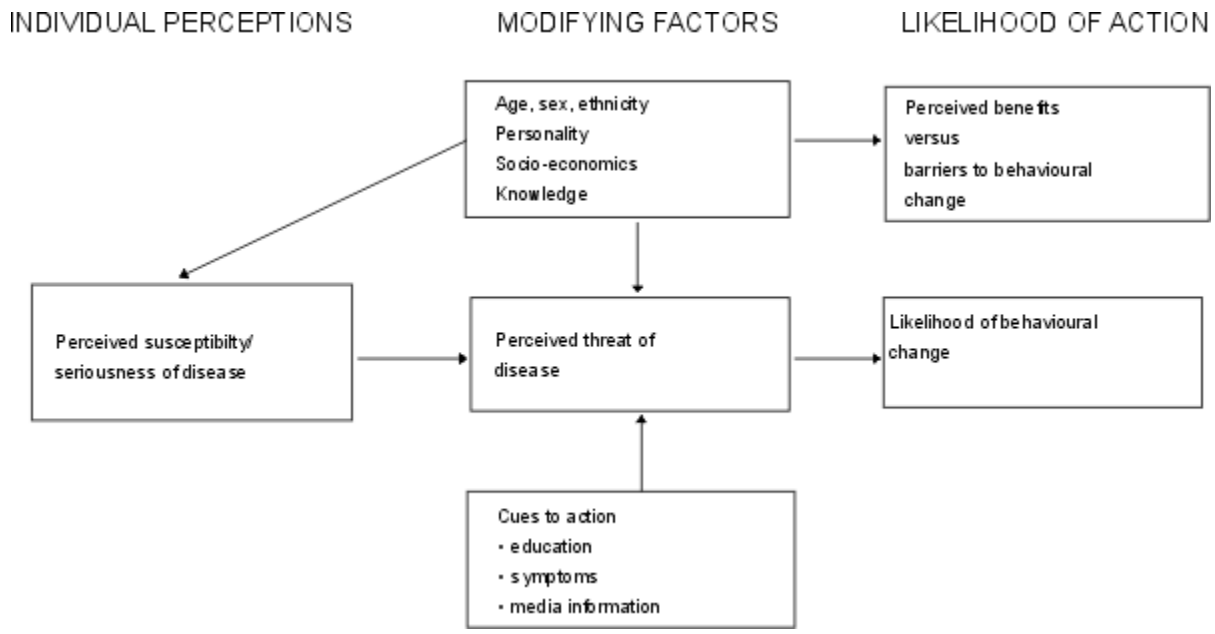

Figure 1: Conceptual Framework of Health Belief Model by Glanz et al, 2002, p. 52

The above model indicates that a patient's ability to adhere to TB medication can be influenced by his perception about TB treatment, and mostly it depends on his or her knowledge about the condition. Therefore, the patient's perception and patient's knowledge can influence adherence to TB medication.

2.2 Justification and Relevance of the Conceptual Framework of the Study

Several theoretical frameworks on behaviour were reviewed such as the Theory of Help-Seeking Behaviour, the Theory of Planned Behaviour and Theory of Health Belief Model.

The Theory of Help-Seeking Behaviour was drawn from the behavioural model of health service utilization by Anderson 1968, it was developed in 2006 by sociologists White, McQuillan and Greil to provide a framework for help-seeking and cognition process of symptoms (White, McQuillan, Greil, & Johnson, 2006). In this theory, some factors are believed to trigger help- seeking include life course factors, symptoms salience, individual and social cues, the perception of a problem and predisposing condition (Yun et al., 2016). Among the factors highlighted by this theory, attributing help-seeking behaviour to symptoms salience and enabling condition is not what the researcher intends to study. Therefore, this theory has not been selected to guide the study.

The second theory was the Theory of Planned Behaviour, this theory was developed from the initial theory of reasoned action by a social psychologist Ajzen in 1991. The theory projects how the behaviour of an individual is determined not only by attitude and subjective norm, but also perception toward control which is based on belief toward these control (Ajzen, 1991). The theory postulated the subjective norms to determine a particular health behaviour. This study, however, has no interest in the subjective norm aspect of medication adherence, hence found this theory a misfit.

The Health Belief Model is chosen to guide this study because the study is aimed at describing the reason for adhering or non-adhering to TB medication regimen and whether the patient's perception can influence his adherence to medication, and also determine whether

knowledge has any significant influence on the perception which consequently could affect adherence to TB medication. Therefore, this conceptual framework contains all the constructs needed and it is found fit to the study objectives.

2.3 Review of Related Literature

Adherence to medication is seen as the extent to which a prescribed medication is taken by the patient (Ahmed & Aslani, 2014). Similarly, other scholars describe adherence to TB medication as the regular intake of prescribed anti-tuberculosis drugs for six months (Adane, Alene, Koye, & Zeleke, 2013; Méda et al., 2014). World Health Organization (2017) also describes adherence to TB medication as a daily taking of multiple drugs for at least six months. These definitions emphasize the need for patients to cling with instructions provided to them by their healthcare providers, even though some patients encounter challenges in an attempt to abide by the recommendations.

Adane et al. (2013) conducted a study in Ethiopia, and the findings confirm that a lot of TB patients found it very difficult to adhere to treatment regimen due to several factors that influence medication adherence.

2.3.1 Knowledge about TB

Patients with TB have different religious, traditional or cultural beliefs and access to information and education that widely shaped their attitudes and knowledge about TB and its treatment (Smart 2010). The failure to identify the TB, cause, symptoms or inadequate knowledge about the condition can lead to healthcare seeking delay (Viney et al., 2014). Studies have indicated that patient's knowledge about the condition is associated with the adherence to TB treatment (Tachfouti, Slama, Berraho, & Nejjari, 2012; Woimo et al., 2017).

A cross-sectional study conducted in South Africa has discovered that the respondents' knowledge about TB is good (Naidoo et al., 2016). Equally, a mixed-method study involving 432 and 48 respondents for quantitative and qualitative studies respectively in Bangladesh reiterates that 99% of the respondent heard about TB and 53% had good knowledge regarding TB (Paul et al., 2015). This is attributed to massive campaign against TB by health care providers addressed as 'village doctors', they were believed to have good knowledge of TB prevention, transmission and signs and symptoms (Islam et al., 2014). Meanwhile, in the Pacific Island nation of Vanuatu, 98% of TB patients who attributed TB to non-bacterial cause were reported as having poor knowledge about TB (Viney et al., 2014). In addition, the study of Fatiregun and Ejeckam (2010) which was conducted in Ibadan Nigeria also reports that newly diagnosed TB patients poorly understood TB and its consequently delayed them from seeking treatment.

Regarding patients' understanding of the causes and ways of transmission of TB among patients in some countries, a systemic review that was conducted to assess the global cultural variations in attitudes, knowledge and health responses to TB stigma, it indicates that in the USA, Vietnamese were reported to attribute the cause of their TB to infection, similarly in Rwanda patients also said TB is caused by germs (Chang & Cataldo, 2014). In contrast, India, Malaysia, and Tanzania patients with TB indicate that TB is transmitted by air, while Kenya and Ethiopia report cold air as the cause of TB (Chang & Cataldo, 2014). In a like manner, Viney et al. (2014) indicate that respondents often identified alcohol, cigarettes, eating contaminated food and sharing utensils with TB patient as the causes of TB.

Many factors can influence patients' knowledge about TB. These factors may include the patient's age, educational level, marital status, ways of acquiring information about TB, household size and perception of treatment (Elmi et al., 2014).

Considering the age, Biya et al. (2014) conducted a study among newly diagnosed TB patients in Abuja (the capital of Nigeria), the findings reveal that majority 71 (44.4%) of respondents who had inadequate knowledge of TB were patients with the age ranging between 25-34. Additionally, Sagili, Satyanarayana, and Chadha (2016) conducted a community-based survey in 30 districts of India and the findings identify that majority of respondents with poor knowledge about TB were between the age of 35-54 years. Meanwhile, studies conducted in India (Jayachandran, 2014) and in Indonesia (Widjanarko, Gompelman, Dijkers, & van der Werf, 2009) report that poor knowledge about TB was higher among older age patients with 60 years and above. On the other hand, findings of Balogun et al. (2019) implies that an increase in the age of respondents predicted their good knowledge of TB in Nigeria. Patients' ability to access information about TB (Gebreweld et al., 2018) or patients' health status might possibly lead to the differences since some TB patient can present with other concurrent diseases such as dementia (Adane et al., 2013) and therefore escalate the situation.

Concerning educational level, Biya et al. (2014) report that 87 (54.4%) of patients with limited knowledge of TB had secondary-level education. In the same way, the study by Sagili et al. (2016) indicates that 65% of the TB patients with poor knowledge about TB in India were literate. Conversely, the study of Naidoo et al. (2016) reveals that better knowledge about TB was presented by those who completed higher school than those who did not; and those who

were employed than unemployed. As for the marital status, Biya et al. (2014) report that 50% of TB patients with poor knowledge about TB were married.

2.3.2 Perception about TB and TB treatment

Different people have different perceptions about TB and its medication. In studies conducted in Vietnam and Ethiopia (Chang & Cataldo, 2014), TB is believed to be a dirty disease which affects poor people. Similarly, a study in Brazil indicates that TB is misperceived to be difficult and isolating (da Silva de Souza, Guerreiro Vieira da Silva, & Schlindwein Meirelles, 2010). On the contrary, findings in other places like Pakistan, reveal that TB patients are ostracized rather than feared to make physical contact with (Mushtaq et al, 2011). Even though a systemic review identifies that TB patients were socially isolated in South Africa, Croatia, and Congo, in Malaysia, they were accepted socially by families and friends (Chang & Cataldo, 2014).

In regard to perception about the treatment, several studies were reported as to how TB patients perceived the treatment which most of the time are attached to the perceived cause of the disease. Samoans in the United States of America believe that only traditional herbal medication can cure their TB (Chang & Cataldo, 2014). Similarly, a study conducted in Ghana indicates that many patients beliefs herbal medicine as alternative to TB treatment, which was influenced by either the patient himself or the family members (Salifu, Eliason, & Mensah, 2016). Moreover, patients in Kenya, Tanzania, and China perceive that their TB treatments need to be started with self-medication before healthcare providers' prescriptions (Chang & Cataldo, 2014). In contrast, a study conducted in a Primary Health Care (PHC) in Campinas Sao Paulo, Brazil reveals that patients affected with tuberculosis have good perception of TB treatment as they read a lot of

information about TB in books and on internet, and also they are being encouraged to continue their medication by the healthcare providers (Beraldo et al., 2017).

Some studies elicit how patients' perceptions underpin healthcare providers to be consulted first. In China, patients believe that even less qualified health providers could be consulted in TB treatments (Zhang, Liu, Brumley & Tang, 2007). However, some patient with TB in India, and Bangladesh have the perception that they can only be treated well if they consult private healthcare providers first, while on the contrary, patients with TB perceive visiting public health providers first in Malawi (Weiss et al., 2008). The preference of health care providers may be due to background experience the patient had or heard about health care providers. Jayachandran (2014) admits that TB patients prefer private hospitals in Delhi, India because of their notion that TB medication which was available for free in public hospitals were not effective.

Other factors that may influence perception of TB treatment could be source of information about TB such as books, internet and healthcare providers (Beraldo et al., 2017), employment status which can deter patients from frequent visit to health facilities (Tachfouti et al., 2012), or knowledge about TB (van den Boogaard et al., 2012). In some facilities where e-health systems were adopted, the level of poor knowledge and misconception about TB which may consequently lead to non-adherence or developing MDR-TB can be tackled (Fraser et al., 2013).

2.3.3 Medication Adherence Among Patients With TB.

As indicated by WHO, TB treatment required intake of prescribed anti-TB drugs for the period six-month for susceptible TB. Different studies have measured patients' ability to adhere

to the medication (Adane et al., 2013; Hu et al., 2008; Woimo et al., 2017; Xu et al., 2017; Yin et al., 2012).

In a study conducted in Myanmar involving 170 respondents, Kyi, Aung, Oo, and Chongsuvivatwong (2019) report majority 127 (74.7%) of the patients with TB adhered strictly to TB treatment. In a like manner, Xu et al. (2017) conducted another study to detect low adherence to TB medication in China, the findings reveal that out of 358 respondents, only 124 (34.6%) had low adherence. Whereas, the study of Adane et al. (2013) report low adherence to the medication among patients with TB in Ethiopia.

However, some studies (da Silva Garrido et al., 2012; Kulkarni et al., 2013; Maruza et al., 2011; Woimo et al., 2017) identify patients' level of education to influence TB medication adherence. da Silva Garrido et al. (2012) implies that a lack of formal education among patients with TB deterred the adherence to TB medication in Brazil. Conversely, studies in South Ethiopia and Mumbai in India by Woimo et al. (2017) and Kulkarni et al. (2013) respectively contradict that patient who adhered to TB treatment had no formal education. In the South Ethiopia and India, the facilities might have strictly adopted an effective strategy which enabled even the uneducated patients to adhere to their treatment such as DOTS strategy.

Moreover, in other areas, employment status (Osei, Akweongo, & Binka, 2015), poor knowledge (Tachfouti et al., 2012; Woimo et al., 2017) and poor perception (Chang & Cataldo, 2014; Salifu et al., 2016) may play vital roles in TB medication adherence. This may be possible especially in low-income countries where health conditions are attached to spiritual causes and remedies to the condition are sought spiritually (Finnie et al., 2011). Additionally, the facilities are lacking both human and material resources to cater to the needs of their clients. However,

awareness about TB and its medication need to be created (Lei, Huang, Liu, Jie, & Tang, 2016) and adequate resources should be available such as e-health system (Fraser et al., 2013) to enable identification and communication to patients even at their workplaces.

2.3.4 Relationship between patients' perception of TB treatment and TB medication adherence

Patients with TB might have either good perception of TB treatment which in most situation attributed to high adherence to TB medication, or wrong perception of treatment which yielded to low adherence or even alternating TB medication to traditional herbs (Chang & Cataldo, 2014; Salifu et al., 2016). In a retrospective study conducted by Putera et al. (2015) among newly diagnosed TB patient in Indonesia, the finding reveals a significant relationship between respondent's perception of TB treatment and their adherence to TB medication. On the contrary, Jayachandran (2014) who conducted a study in Delhi indicates that TB patients prefer private hospitals than public hospitals because, they wrongly perceived public facilities that provide free health services as ineffective. Again, Bangladesh report implies that TB patients adhered strictly to the medication only if they consult private healthcare providers first (Weiss et al., 2008). Though they had the wrong perception about TB treatment, they still adhered strictly to their TB medication. This misconception may be converted through public enlightenment by healthcare workers (Islam et al., 2014; Tachfouti et al., 2012).

2.3.5 Relationship between patients' knowledge about TB and his perception of TB medication

Several studies establish a statistically significant relationship between patients' knowledge about TB and their perception of TB medication (Abebe et al., 2010; Beraldo et al., 2017; Uchenna & Ngozi, 2014; van den Boogaard et al., 2012). The relationship could either be positive (Abebe et al., 2010) or negative (Cramm, Finkenflügel, Møller, & Nieboer, 2010).

A study conducted by Beraldo et al. (2017) indicates a positive relationship between patients' perception of anti-TB drugs and general knowledge about TB. The study suggests that in Brazil respondents' good perception of TB treatment was significantly related to the seek for knowledge about the condition. Similar finding in Enugu Southeast Nigeria shows that 93.2% of patients affected with TB knew that the disease is infectious, and believed to be cured while adhered to TB medications (Uchenna & Ngozi, 2014). The results of Beraldo et al. (2017) and that of Uchenna and Ngozi (2014) have shown that good perception of the treatment influenced good knowledge about TB. Likewise, poor perception of TB medication could also influence poor knowledge about the condition. Findings of Abebe et al. (2010) reiterate that patients who had poor knowledge about TB in Ethiopia believed that TB was caused by spirit and witchcraft and it can be treated by traditional healers.

On the other hand, other variables may have strong negative relationship with either the knowledge about TB or perception of TB treatment. In their study conducted in Ethiopia among TB/HIV patients, Seyoum and Legesse (2013) report existence of strong relationship between the patients' low knowledge of their conditions and distance of greater than ten (10) kilometres from healthcare facility. In addition, the finding of Cramm et al. (2010) indicates that patients with TB in South Africa had good knowledge about TB but their non-adherence was related to misperception about DOTS volunteers, they believe that DOTS volunteers who deliver TB treatment at home made people to stigmatize against them in the community.

2.3.7 Other Predictors of TB medication adherence.

Several authors investigated different factors that result in nonadherence to TB medication in their contexts. In September 2018, World Health report that HIV, alcohol

consumption, smoking, and diabetes were believed to be the frontline determinants of nonadherence to TB medication worldwide (World Health Organization, 2018a). A study conducted in the western region of Ghana also highlights alcoholism and depression as major contributors of nonadherence to TB medication (Blankson, 2012). Moreover, HIV and TB co-infected patients indicate a higher level of nonadherence than patient with only TB (Adane et al., 2013; Méda et al., 2014).

Even though, the assertion made by WHO manifests in western Ghana, Ethiopia, and Burkina Faso, inversely this statement undermines some major factors that can also influence the adherence, because a study in East Nusa Tenggara in Indonesia found a lack of knowledge and patients' perceptions as determinants for defaulting (Putera et al., 2015). However, to include all the above factors, Dladla (2013) identifies demographic, client-related, healthcare provider-related, healthcare system and society-related factors as factors that influence TB medication adherence.

2.3.3.1 Demographic factors

This comprises the age, level of education, gender and marital status of a patient (Yin et al., 2012). Study at the Suhum Kraboa Coaltar District in Ghana confirms that aged TB patients adhered more to medication than the younger patients and the same study identified marriage as a factor for adhering to TB treatment (Danso et al., 2015). In Mumbai, India, among the 87 of TB patients who defaulted 48 (47%) are 30 years above (Bagchi, Ambe, & Sathiakumar, 2010). Equally, Maruza et al. (2011) report that majority 48 (56.5%) of non-adherent patients with TB/HIV co-infection in a prospective cohort study in Pernambuco state of Brazil were also

between 30 to 49 years. Meanwhile, Ifebunandu and Ukwaja (2012) argues that old age was found to independently predict the default of TB treatment in Nigeria.

Educational level of some patients play an important role in making the decision for adherence, a qualitative review of Medline database literature from 1970 – 2005 indicates that TB patients with low level of education have more trust to their physicians' instructions (Jin, Sklar, Oh, & Li, 2008). Inversely, another quantitative study which was conducted in Limpopo Province of South Africa reveals that there is no association between educational level and TB medication adherence (Dladla, 2013).

In respect to gender, men are reported to have more information about TB then women, but after the onset of signs and symptoms women (79.2%) tend to seek for healthcare than their counterparts (Wang, Fei, Shen & Xu, 2008). In a like manner, a cohort study in Morocco also indicate that males patients affected with TB had low adherence to medication than females (Tachfouti et al., 2012). Gebreweld et al. (2018) document a lack of social support as an important barrier to TB medication adherence in Eretria. Whereas, in a study conducted by Gebremariam, Bjune, and Frich (2010) in Ethiopia identify social support as a facilitator of adherence to TB medication.

With regards to employment status. In their study in Ghana, Osei et al. (2015) report employment as a major factor that resulted in the delay in seeking for intervention against TB. In the contrary, a systemic review on non-adherence to TB medication (Habteyes Hailu et al., 2015) indicates that lack of job in Nigeria (Ifebunandu & Ukwaja, 2012) and financial burden unemployment in Ethiopia (Tadesse, Demissie, Berhane, Kebede, & Abebe, 2013) were found to be deterrent to TB medication adherence.

2.3.3.2 Healthcare providers and healthcare system-related factors

These include health facility accessibility, attitude of healthcare providers while interacting with the patients. It has been indicated that access to health care facilities, health care providers' attitudes, and good communication encourage TB medication adherence (Gebreweld et al., 2018). With regard to health facility, the WHO/World Bank report of 2017 confirms the lack of access to facilities affect the health services of at least 50% of the global population (World Health Organization, 2018a). A study in Nigeria demonstrates that adherence success is reducing due to high transection costs encountered by the patient when accessing care, this is attributed to poor primary health care systems (Abimbola et al., 2015).

Moreover, healthcare providers also play important role in promoting adherence. A study that was conducted in 12 months to investigate adherence to TB medication and to detect factors associated with adherence failure among TB patients in Kosovo report that 85.5% of the patients adhere to their medications, and it is attributed to health education received during counseling (Krasniqi et al., 2017). In contrast, Naidoo et al. (2016) indicate that those who heard about TB from media adhered more to their TB treatment than those who were taught by health care providers. This may be due to the attitude presented by healthcare workers while interacting with their patients. Olefile (2016) mentions that most of the patients affected with TB who defaulted medications were dissatisfied with the health care workers' behaviour. It is therefore significant for healthcare providers to improve their relationship with patients at the TB centers.

2.3.3.3 Client-related and social factors

Limited knowledge, stigma, poverty, and lack of social support, emerged as important barriers for medication adherence (Gebreweld et al., 2018).

Poor knowledge of TB among patients impedes their adherence to medication, studies conducted in Moroccan and Ethiopia indicate that majority of defaulters lack knowledge about TB and the medication (Tachfouti et al., 2012; Woimo et al., 2017). Likewise, studies of Diefenbach-Elstob et al. (2017) in a remote area of Papua New Guinea and Mittal and Gupta (2011) in India reveal that lack of knowledge about TB predicted low adherence of TB medication among patients diagnosed with TB.

Moreover, patients' perception of TB (Naidoo et al., 2013) and misconception of TB treatment (Salifu et al., 2016) take a leading role in influencing TB medication adherence. A study on way of reducing non-adherence to DOTS in India suggests that misconception of TB treatment significantly decreased the success of the treatment even though DOTS strategy was observed (Mittal & Gupta, 2011). Similarly, Putera et al. (2015) also reveals both the knowledge and perception of TB as the predictors of default to anti-TB drugs in a retrospective study in East Nusa Tenggara, Indonesia.

In most cases, the knowledge of TB is dependent to the patient's source of information about TB. A qualitative study conducted in Eretria (Gebreweld et al., 2018) and another study in Nigeria (Abimbola et al., 2015) denote that participants who adhered to TB medication received information about TB from the healthcare providers. Similarly, Castelnuovo (2010) indicates that healthcare providers are the prominent agents for medication adherence among TB patients in Sub-Saharan Africa. This may be related to adequate knowledge of TB the health care providers possess and they were impacting the knowledge to the respondents.

2.3.3.4 Medication-related factors.

TB Medication is another factor that influences adherence. The medication whether the first-line or second-line cause an adverse reverse reaction which leads to the treatment nonadherence (World Health Organization, 2017). Some patients in Indonesia and Iran reported drug side effects and feeling better when they started the medication as the reasons for stopping the drugs, (Farazi, Sofian, Jabbariasl, & Keshavarz, 2014; Widjanarko et al., 2009). While others complaint of long treatment duration and non-availability of the direct observed treatment short course (DOTs) as their challenges in Ethiopia (Woimo et al., 2017). Similarly, (Gebreweld et al., 2018) reports that drug side effects and long treatment duration of TB medication prevented patients with TB in Asmara of Eritrea to strictly adhere to their TB medication.

2.3.4 TB and related conditions

There are many conditions that are associated with tuberculosis among which the following are briefly described.

2.3.4.1 HIV and TB

Human Immunodeficiency Virus (HIV) lowers the immune system of an individual and predisposes patients with HIV to higher risk of contracting TB. It has been indicated that, for the mycobacterium tuberculosis to multiply in human body and cause the disease, a favorable environment is required which low immunity provides (Yousuf, 2017). A study conducted on the incidence of TB and immunological profile indicates that persistent escalation of TB incidence in sub-Saharan Africa is associated with the increased number of HIV cases (Musa et al., 2015).

Hence, researches show that TB and HIV co-infected patients have the higher level of nonadherence to anti-TB drugs as compared with TB patients who are HIV negative, studies conducted in northern Ethiopia and Burkina Faso affirm this assertion (Adane et al., 2013; Méda et al., 2014)

2.3.4.2 Malnutrition and TB

According to Webster (2015) "malnutrition is an unhealthy condition that results from not eating enough or not eating healthy food." Several scholars established a strong relationship between malnutrition and TB (Anuradha et al., 2016; Samuel, Volkmann, Cornelius, & Mukhopadhay, 2016). Samuel et al. (2016), indicate that malnutrition and TB are both problems that interact with each other and are predominantly seen in underdeveloped regions of the world. The effect of malnutrition on an individual can consequently compromise the host's immune system and increase the risk of susceptibility to infection. And they emphasise that early restoration of nutrition and nutritional counselling is needed to improve the immune system of TB patients which could enhance the clearance of the organisms and reduce the infectiousness of the patients (Gupta, Gupta, Atreja, Verma, & Vishvkarma, 2009; Samuel et al., 2016).

2.3.4.3 Drug resistance TB

In 2016, 153 119 of TB cases were estimated, 87% of the patients benefited with the second-line regimen of anti-TB medication globally, but out of this number, 25% developed Multidrug resistance/rifampicin-resistant tuberculosis (MDR/RR-TB) in 2017 (W H O, 2018a). Most of the cases were as a result of nonadherence to medication which contributed to an upsurge in the amount of cases in 2017 (160 684) (World Health Organization, 2018a). This is a

clear indication of how drug resistance can play a key role in increasing the incidence of TB worldwide.

2.4 Summary and critique of the literature review

The literature review carefully analyzed relevant studies on factors influencing TB medication adherence articles and journals. Moreover, this study uses health belief model that was adopted by Glanz et al. (2002). The study utilizes only three constructs of the model, these include the perceived threats (the patient perception about the medication), the Modifying factor (the knowledge about TB) and the likely outcome/behaviour (the medication adherence).

Studies that indicate patient perception about TB and its medication which include negative perception about the condition and those affected by the disease were reviewed. Other studies that are related to the patient knowledge about the entire condition, its causes and ways of transmissions were also reviewed. Focused database online search was used to retrieve the studies even though some of the authors did not adopt theoretical frameworks or standardized scales to elicit their findings. Moreover, different factors influencing adherence to medications were explored such as demographic-related, healthcare system-related, healthcare providers-related, medication-related, client and society related factors.

Furthermore, some conditions that are related to TB were presented which include alcoholism, HIV, drug resistance, and malnutrition. Therefore, their effect on TB incidence and drug adherence were indicated. Judging from the literature review above, it is important to use a methodological approach that illuminates the real problems that affect adherence to TB treatment in the context of the patients for deeper understanding. Therefore, quantitative research method

using descriptive approach and cross-sectional designs are employed. In the ensuing chapter, the researcher presents the research of this study.

CHAPTER THREE

METHODOLOGY

The methodology employed to provide an understanding to the determinants of medication adherence among patients with TB is described. This chapter generates information on how the study was conducted indicating the theoretical basis and the reason for the choice of the techniques and method used. Moreover, it shows vividly the description of the research setting, the target population, the sample and the techniques employed to draw the sample from the population, the way sample size was calculated and how data was collected. This chapter indicates how the data was managed and later analysed after collection and how ethical protocols was also observed during the research process.

3.1 Study Design

A quantitative cross-sectional design was employed for this study. According to Polit and Beck (2014, p. 239), "Cross-sectional designs involve the collection of data at one point in time (or multiple times in a short time period), and the study is appropriate for describing the status of phenomena or for describing relationships among phenomena at a fixed point in time". In this study, the data were collected from the patients who meet the inclusion criteria in the month of May 2019 at the clinic on Wednesdays of the weeks, because the days are visiting days for registered TB patients who were taking their anti-TB drugs.

Data of the study were collected at one point in time (on Wednesdays of the weeks) at the TB clinic using structured and validated questionnaires to explore the patient's perception about TB medication, knowledge about the condition and adherence to TB medication. The cross-sectional study was considered because, it allowed the examination of multiple factors

influencing medication adherence among patients with TB in Sokoto metropolis and also allowed description of relationship among the predictors and the adherence to TB medication.

3.2 Research setting

Nigeria is a West African country which lies between latitudes 4° and 14° North of the Equator and longitudes 3° and 15° East. It shares a border with the Benin Republic on the west, the Chad republic and Niger on the north, Cameroon on the east and the Atlantic Ocean on the south (Esterhuysen, 2013). The country has six geopolitical zones which comprise 36 states including Abuja (the capital), each state has several local governments that are being headed by local government chairmen. The three-tier structure operates a democratic government using the federal system of administration and composed of three arms of government: the executives, the legislatives, and the judiciary (Ogundiya, 2010).

Sokoto state is among the northern states situated in the extreme northwest zone of the nation. In 2005, the state was estimated to have more than 4.2 million population with Sokoto metropolis as the capital of the state. The city is known to be an important place of Islamic learning in the country and has the slogan “the seat of the caliphate” because it was the seat of the former Sokoto Caliphate (Last, 2008). The Sultan who heads the Caliphate is considered the President-General of the Nigeria Supreme Council for Islamic Affairs (NSCIA).

Sokoto city has a land mass of approximately 25,973 square/kilometre with a population of 3,696,999 (Mimiko, 2006). The state has 23 local governments and is bordered to Zamfara and Kebbi states to the southeast and the Niger Republic to the north. The metropolis is composed of two local governments (Sokoto south and Sokoto north) and some part of Kware, Dange-Shuni and Wamakko local governments (Last, 2008). These areas are predominantly

inhabited by Hausa-Fulani ethnic group which primary activities were farming and cattle rearing. Apparently, Hausa were mostly farmers, but they also keep some cattle for fettering and daily milk production of yoghurt and butter for consumption (Fada, 2017). In 2016 the state was rated among the poorest states in Nigeria with high unemployment rate among the youth (Usman & Adam, 2017). These characteristics might attribute to the prevalence of TB in the area. As ingestion of unpasteurized milk and its product (Chigbu & Iroegbu, 2010) and poverty (Ortblad, Salomon, Bärnighausen, & Atun, 2015) predisposed most of developing countries to TB.

The state has two tertiary hospitals known to be the referral centres and they are all located in the metropolis (Specialist Hospital Sokoto and Usmanu Dan Fodiyo University Teaching Hospital), the State government established a centre for TB treatment and control in Specialist hospital to provide both preventive and curative management of TB cases in the metropolis, and also serve as referral centre of TB cases from various General hospitals across the state (Ahmad et al., 2018). The centre encompasses outpatients who visit TB clinic on Wednesday and some patients who are admitted at the chest ward for treatment and close observation.

However, establishing the TB center in the metropolis while the condition is predominantly affecting inhabitants of areas away from the metropolis, access to the center may be difficult which therefore prevent adherence to the medication. As indicated by WHO/World Bank report in 2017 that lack of access to facilities affect the health services of at least 50% (W H O, 2018a). Finding of Abimbola et al. (2015) suggested that high costs encountered by TB patients while accessing the clinic attributed to adherence failure. Similarly, Naidoo et al. (2013) mentioned poverty as a key factor to poor adherence to TB medication.

3.3 Study Population

The target population was all TB patients who were visiting TB centre from 31/12/2018 to 31/5/2019 in Specialist Hospital, Sokoto metropolis.

3.3.1 Inclusion Criteria

The patients who were included in this study were patients diagnosed with Non-drug resistant TB, Extrapulmonary TB, Drug-resistant TB who were visiting and receiving treatment at the Specialist Hospital in the Sokoto metropolis.

3.3.2 Exclusion Criteria

This encompasses patients who were not confirmed to have latent or active TB, TB patients who were on admission, those who have completed their anti-tuberculosis medications, and also children with TB (e.g. Age 13 and below) were excluded.

3.4 Sample Size

The sample size of the study was determined from the population using a 95% confidence level according to formula propounded by Cochran (1977). The population of patients with TB who met the inclusion criteria at Specialist Hospital in the Sokoto metropolis as at 31st May, 2019 were 213 TB patients (report from the facility). This formula was chosen for this study because, the population was a finite population and therefore the population size was known (213).

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

The above Cochran's formula considered n_0 as Cochran's sample size recommendation, which is 385(Cochran, 2007). N is the population size, and n is the new adjusted sample size.

Therefore,

$n_0 = 385$

N= 213

The population sample size(n) was calculated as follows:

n=385 / (1+(384 / 213)).

n=385/2.80281690140845

n = 137

However, at 5% margin of error and 95% confidence level, the sample size was 137.

P value would be used to determine the adherence factors that are statistically significant.

3.5 Sampling technique

Probability sampling technique using simple random sampling method was used to select the respondents. Sampling is the method of choosing study participants from a target population (Pilot & Beck, 2014). Since the population was 213 patients with TB registered during the period 01/9/2018 to 31/3/2019 and the sample size was 137, therefore, a sampling frame was used to select the study participants from the population. The TB Centre register was used to create the sampling frame, the register contains records of all patients with TB that are visiting the centre, and the register also has the record of the date of starting and stopping treatment.

Each patient had his/her TB registration number, the numbers were extracted and written on small piece of paper, a container was provided and then the numbers were placed in the container. Without looking, the sample was drawn by randomly picking a numbered piece of paper without replacement and then recording it on a separate sheet of paper for the respective patient to be among the participants. This process was repeated until the required number achieved.

3.6 Research Instrument

Structured questionnaires were adopted for the data collection (Appendix- A). The first one was developed and validated to measure knowledge about TB and perception about TB medication. This has been used in several studies including a cross-sectional study that was conducted at Malaysia (Elmi et al., 2014). While the other questionnaire was TB medication adherence scale which was initially developed by Morisky, and later adopted and used by Xu et al. (2017) to detect low adherence to TB medication in China.

The questionnaires were pretested at TB centre in UDUTH prior to the study to ascertain the appositeness and weakness in measuring the variables. The study questionnaire has four (4) major sections as follows:

Section A: The demographic and socio-economic characteristics.

Section B: The perception of TB treatment.

Section C: The knowledge of TB.

Section D: The TB medication adherence.

3.6.1 Section A: The demographic and socio-economic characteristics.

The first section of the questionnaire comprises the demographic and socio-economic characteristics, as well as the source of knowledge about TB. In this section, information related to the respondents' gender, age, marital status, and educational background were assessed. The respondent's average monthly income, employment status as well as occupation were evaluated. The number of TB treatment supporters and the numbers of supporters among family members were collated. For the source of knowledge about TB, the questionnaire elicited data of the respondents' first source of information about TB, source of effective information, and duration for taking anti-TB medication.

3.6.2 Section B: The perception of TB treatment.

The second section of the questionnaire reported the respondents' perception about TB treatment. It consists of ten items which measured two domains of patient's perception. The first seven items revealed data regarding aversion against treatment, while the last three items provided data about negative perception of TB treatment. The sub scale assessed the participants' perception by responding to a 5-point Likert scale with the choice ranging from *Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree* to *Strongly Agree*, and also the minimum to maximum scores for each item ranges from 1 to 5. Therefore, the respondents' scores were summed up and the average (mean) score was computed to indicate respondents' perception about TB medication. It had a reported Cronbach's alpha of 0.60

3.6.3 Section C: The Knowledge of TB

The third section of the questionnaire measured the respondent's knowledge about TB. The sub scale elicited respondent's data of four domains of knowledge, which included data on general awareness of TB; knowledge of the cause(s) of TB; mode of TB transmission; and prevention of TB. All the questions required the respondents to circle an option on a 5-point Likert scale ranging from *strongly disagree, disagree, neither agree nor disagree, agree* to *strongly agree*. Although, some of the questions were reverse coded, the sub scale was also numbered 1 to 5 with the strongly disagree coded as '1' and strongly agree coded as '5'. The respondents scores were summed up and average (mean) of the scores were used as an index to derive their total TB knowledge. It had a reported Cronbach's alpha of 0.79

3.6.4 Section D: The TB medication adherence.

This section of the questionnaire assessed the respondent's adherence behaviour. It indicated the level at which the respondents failed to adhere to anti-TB medication. The scale was initially developed and validated by Morisky. It was used as Morisky Medication Adherence Scale (MMAS-8) which comprises 8 items with Yes/No options except the last item (item 8) which was on a 5-point Likert scale. It asked the respondents "how often do you have difficult remembering to take all your medication?" with the choice ranging from *Almost always, Often, Sometimes, Seldom* to *Never*. In this Likert scale, only *never* was considered as 1, all other choices were coded as 0. Each item was able to measure a specific medication-taking behaviour of the respondents. Item 5 was reverse coded. Moreover, on the basis of the summated scores from the MMAS-8 ranging from 0 to 8, the scale has cut-points which was predetermined by

Morisky. He categorised adherence level as high (=8 points), medium (6 or 7 points) and low (<6 points) (Morisky, Ang, Krousel-Wood, & Ward, 2008).

However, TB treatment requires strict adherence to anti-TB drugs in order to avoid resistance (Tola, Tol, Shojaeizadeh, & Garmaroudi, 2015). Therefore, Xu et al. (2017) adopted and re-validated the MMAS-8 and renamed it as Morisky Medication Adherence Scale of Chinese version (C-MMAS-8), and then used it to measure the level of adherence to TB medication. In this study, the patients' responses were recoded as 'adherent' and 'not adherent' who ever scored 8 was considered 'adherent' while the medium and low scores were regarded as 'not adherent.' It had a reported Cronbach's alfa of 0.68

Table I. Domain measured and scale used in the study's questionnaire

Domain measured	Scale used	Number of items
Demographic and source of knowledge about TB		15
Perception of TB treatment Knowledge about TB	Knowledge of TB and perception of TB treatment scale by Elmi et al. (2014)	27
Adherence to TB medication	Morisky Medication Adherence Scale China version by Xu et al. (2017)	8
	Total	**50**

(Elmi et al., 2014; Xu et al., 2017)

3.7 Reliability and validity of the instrument

The instrument comprised of scales and were examined for face validity, content validity and internal consistency. Xu et al. (2017) conducted a sequence of in-depth interviews involving

adherence to TB medication to examine the validity of the scale. They further conducted pre-test for validity and reliability of the instrument with 4 experts from school of public health Shandon university china to enhance face and content validity of adherence scale, followed by a pilot study of 358 rural tuberculosis patients to refine it. The instrument is regarded to have strong construct validity and the internal consistency of the scale using Cronbach's alpha is .80

Moreover, (Elmi et al., 2014) also conducted similar in-depth interviews involving the knowledge of TB and perception of TB treatment.70 patients with TB were studied during the piloting to enhance it, and was also reviewed for face and content validity by 4 expert from School of Medical Science University of Sains Malaysia to improve face and content validity of the scale (Elmi et al., 2014). The two scales are regarded to have strong construct validity and the internal consistency of the variables using Cronbach's alpha is illustrated in table 2.

Table II Reliability test of variables as assessed by Elmi et al. (2014); (Xu et al., 2017)

Variable	Domains	Cronbach's alpha
Knowledge of tuberculosis	General knowledge about TB infection	.893
	Knowledge about TB cause	.552
	Knowledge about transmission	.701
	Knowledge about prevention	.729
Perception of TB treatment		.697
Adherence to TB medication		.80

(Elmi et al., 2014; Xu et al., 2017)

It indicated that all except perception of TB treatment has Cronbach's alpha value greater than equal to 0.701 which is acceptable reliability.

This study ensured reliability by conducting a pilot study on 30 patients with TB and also the content validity, clarity, coherence and other covert issues such as time of response were examined. This piloting assisted to eliminate some items which were irrelevant. Therefore, after reviewed with the supervisors, a total number of 50 items were adopted on the basis of face and

content validity. The internal consistency of the pilot study of the adopted scale was .78. According to Pallant (2013), Cronbach's alpha of .7 is acceptable reliability; however, values greater than .701 are preferable.

Table III indicates the Cronbach's alpha values of the domains used in this study.

Variables	Domains	Cronbach's alpha
Knowledge of TB	General knowledge about TB infection	.86
	Knowledge about TB cause	.69
	Knowledge about transmission	.75
	Knowledge about prevention	.72
Perception of TB treatment		.61
Adherence to medication		.68

Source: Field data.

All the domains but knowledge about TB cause, perception and adherence have Cronbach's alpha values greater than .71.

3.8 Data Gathering Procedure

Grove et al. (2014, p. 345), describe data collection as "Precise, systematic gathering of information relevant to the research purpose or the specific objectives, questions, or hypotheses of a study". Ethical approval was sought from Specialist Hospital Sokoto ethical review committee. Permission was granted to commence data collection. Then after the sampling process, two research assistants were recruited to assist in the data collection. They were trained on how to administer the questionnaire, how to introduce themselves to the prospective respondents and read through the individual respondent's consent form. Before the respondents

were interviewed after they had agreed to be included, the respondents were requested to sign or fingerprint a written consent. If they refused, they would not participate in the study.

After obtaining the written consent, the researcher entered the date and serial number of the questionnaire from the beginning to the end of the questionnaire using a language understood by the respondents. The researcher entered responses provided by the respondent by ticking and circling the appropriate response number and entering the same number in to the coding box. The researcher administered the questionnaires himself with the help of the assistants. Each questionnaire was completed within 45 minutes. This was done to ensure data quality. If the numbers were different it would not be a valid response. The researcher reviewed the questionnaires on a weekly basis to ensure that they were being completed correctly and any error was discussed with the research assistant to avoid them being repeated.

The process of data collection continued for two weeks when the required number of respondents in the sample had been exhausted.

3.9 Data Management

In order to maintain data quality, the researcher gave more attention to the research questions and hypotheses before adaptation, to make sure that all their elements were completely captured and reflected in each section of the questionnaire. The instrument was pre- tested and the outcome was further used to improve the questionnaire. Spelling mistakes and grammatical errors were identified and corrected. All questions remained unchanged.

The researcher and research assistants collected the data, the researcher ensured that every aspect of the questionnaire was completed by the respondents before collection. All were put together and verified manually to minimize errors. The filled questionnaires were numbered

and then transported for analysis in a sealed envelope. The questionnaires were coded and a spreadsheet was developed using MS Excel. All completed questionnaires were kept in a safe lockable cupboard in the researcher's locker which was accessible only to the researcher and supervisor for the duration of five years.

3.10 Data Analysis

Data obtained were carefully examined for error and completeness. Each item and options were coded using numbers or unique identifiers before entering on spread sheets of MS Excel. Few errors were identified and corrected. All the coded items were entered on the spread sheets and then exported to STATA (version 15). The data of each variable was critically examined for outliers by reviewing the data and computing descriptive analysis. No missing value was found in the data, therefore, all the data obtained from 137 respondents were used.

The researcher used both descriptive and inferential statistics (non-parametric test) to describe the study variables. The MS Excel and STATA (version 15) were employed to describe the data and identify any significant differences between the variables. The researcher summarized descriptive summary statistics and graphical in charts (bar, pie, cross-tabulations). And then computed the means, standard deviations, and ranges. The mean was used in this non-parametric test to check if the data are normally distributed. Scatter plot was analysed to examined linearity between the independent variables and the dependent variable. Pilot and Beck (2014) define scatter plots as "a diagrams to provide useful preliminary information about the nature of the relationship between variables".

Pearson's chi-square test, Pearson's r correlation coefficient test and binary logistic regression were used. The Pearson's chi-square and Pearson's r correlation tests were employed

to compare different proportions and associations between the independent variables and medication adherence (dependent variable). This test was chosen because the preliminary information about the relationship among variables indicated that the data was not normally distributed, the scatter plot did not revealed linearity between the independents and the dependent variable due to dichotomizing the dependent variable to two levels (adherent and not adherent). The 0.05 level of significance was used as the cut off for statistical significance

Binary logistic regression analysis was employed because the dependent variable (medication adherence) was a dummy variable, which was dichotomized and therefore, was coded as adherence (0) and nonadherence (1).

3.11 Ethical considerations

Ethics in research are important standards that the research strictly adhered to when conducting the study. The study proposal and Introduction letter from the school (Appendix-B) were summitted to the Specialist Hospital Health Research and Ethical Committee (HREC) seeking for ethical clearance and approval to conduct the study in their facility. The approval was granted (Appendix-C) with the condition of observing the ethical standard and avoid violating the right of the respondents. This entails ensuring the principles of autonomy, confidentiality, justice, beneficence and non-malfeasance (Grove et al., 2014).

In this study, the respondent's dignities were respected, the right to determine whether to refuse or agree to per take in the study without being prejudiced was assured by giving them detail explanation about the study in their local language. The explanation encompassed the nature and purpose of the research, the benefits, and their right to dropout at any stage of the study. Informed consents were obtained prior to data collection. The researcher's contact details

were made available to them in case of any question pertaining the study. Names and any other identifiers of the respondents were not required in the questionnaire to protect the respondents' identities and to ensure privacy and confidentiality. The respondents were assured that the electronic copy data will be secured electronically with a password known to only the researcher. While the questionnaire will be kept under lock and key for five years and if there is need to use the data, they will be consulted. The data will be destroyed after five years.

3.12 Summary of Research Methods

The chapter looked at the research methods for the study, the researcher used a quantitative cross-sectional design to assess the determinants of medication adherence among TB patients in Sokoto Metropolis in which patients affected with TB who were visit Specialist Hospital TB center were selected. Ethical clearance was obtained from Specialist Hospital Sokoto (Appendix-C). When permission was obtained, data was collected from randomly selected patients (137) out of 213 patients scheduled to take TB medication from 01/9/2018 to 31/3/2019. All TB patients who were not confirmed to have latent or active TB, TB patients who were on admission, those who have completed their anti-tuberculosis medications, and also children with TB (e.g. Age 13 and below) were excluded.

A standardized self-administered questionnaire (Appendix-A) was used to collect data, and voluntary participation, anonymity, beneficence, non-malfeasance and confidentiality were ensured throughout the process of data gathering with detail explanation of the research purpose, the importance, and risks before obtaining informed consent. All completed questionnaires were cross checked for completeness before collected.

CHAPTER FOUR

FINDINGS

This chapter presents the results of the data obtained from 137 patients diagnosed with TB who visited Specialist Hospital TB centre in Sokoto. The socio-demographic characteristics of the respondents are presented first, followed by other findings organised according to the research objectives. The researcher employed Pearson's Chi-Square test, Pearson's r correlation and binary logistic regression to examine the variables that explained differences in the dichotomized dependent variables.

4.1 Socio-demographic characteristics of the Respondents

This section presents the socio-demographic characteristics of 137 respondents involved in the study. As shown in Table IV below, the mean age of respondents was (*M*=35.7, *SD*=13.2) years. Persons aged between 20 and 39 years were in the majority contributing about 79 (57.7%) of the study sample. Only 7 (5.1%) of those respondents aged below 20 years. The majority 99 (72.3%) of the respondents were male and thirty-eight 38 (27.7%) were female. While about 53 (39%) of the respondents had a secondary education, 51 (37.2%) received no formal education. Only 14 (10.2%) of the TB patients had tertiary education. Among the respondents, 82 (59.8%) were married, 42 (30.7%) were single and only 4 (2.9%) were divorced.

While majority (n=92, 67.2%) of the study respondents were gainfully employed, while 45 (32.8%) had no employment. The median household size consisted of 8 persons (lower quartile = 5 and upper quartile = 11). The respondents earned on average about N 11,000 (lower quartile = N 6,000 and upper quartile = N 21,000). 116 (84.7%) of the study participants receive

monthly income below the minimum wage of N 30,000 per month, with only 21 (15.3%) of the respondents earning just the minimum wage or more.

Table IV: Socio-demographic characteristics of patients with TB (n= 137)

Variables		Frequency (n)	Percentage (%)
Age *(Mean ±SD)*	35.7 (13.2)		
Less than 20		7	5.1
20 – 39		79	57.7
40 – 59		43	31.4
60 or more		8	5.8
Gender			
Female		38	27.7
Male		99	72.3
Education			
No formal education		51	37.2
Primary		19	13.9
Secondary		53	38.7
Tertiary		14	10.2
Marital status			
Single		42	30.7
Married		82	59.8
Divorced		4	2.9
Widowed		9	6.6
Employment status			
Employed		92	67.2
Unemployed		45	32.8
Household size (Median, (LQ, UQ))	8 (5, 11)		
Less than 10 persons		91	66.4
10 or more persons		46	33.6
Monthly income (Median, (LQ, UQ))	11000 (6000, 21000)		
Less than N30000		116	84.7
N30000 or more		21	15.3

Source: Field data; SD=standard deviation, LQ=lower quartile, UQ=upper quartile

4.2 Respondents' level of knowledge on Tuberculosis

4.2.1 Sources of information of tuberculosis

The key sources of information on TB to respondents were from friends and family, healthcare workers, mass media and school. About half (n=68, 49.6%) of the respondents had information on TB from their friends and family. Other major sources were from health staff (n=36, 26.3%) and the media (n=31, 22.6%). Only 2 (1.5%) respondents had information on tuberculosis from school (See Figure 2).

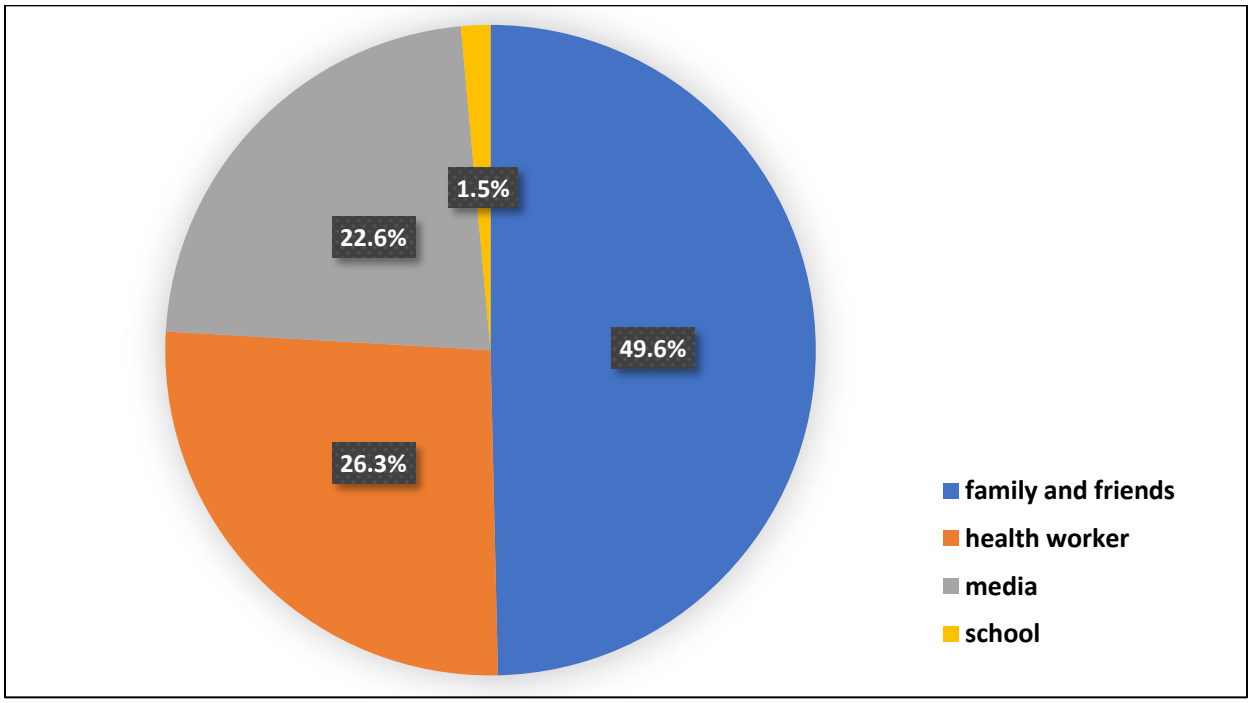

Figure 2: Sources of information on tuberculosis to TB patients

Among these sources of information, the respondents were asked to indicate the most effective information source. Out of 137 respondents, 117 (85.4%) indicated healthcare workers provided the most effective information on tuberculosis, 10 (7.3%) identified TB information

from family and friends as effective. Similarly, 10 (7.3%) respondents identified media as the effective source of information on tuberculosis. This is illustrated in Figure 3 below.

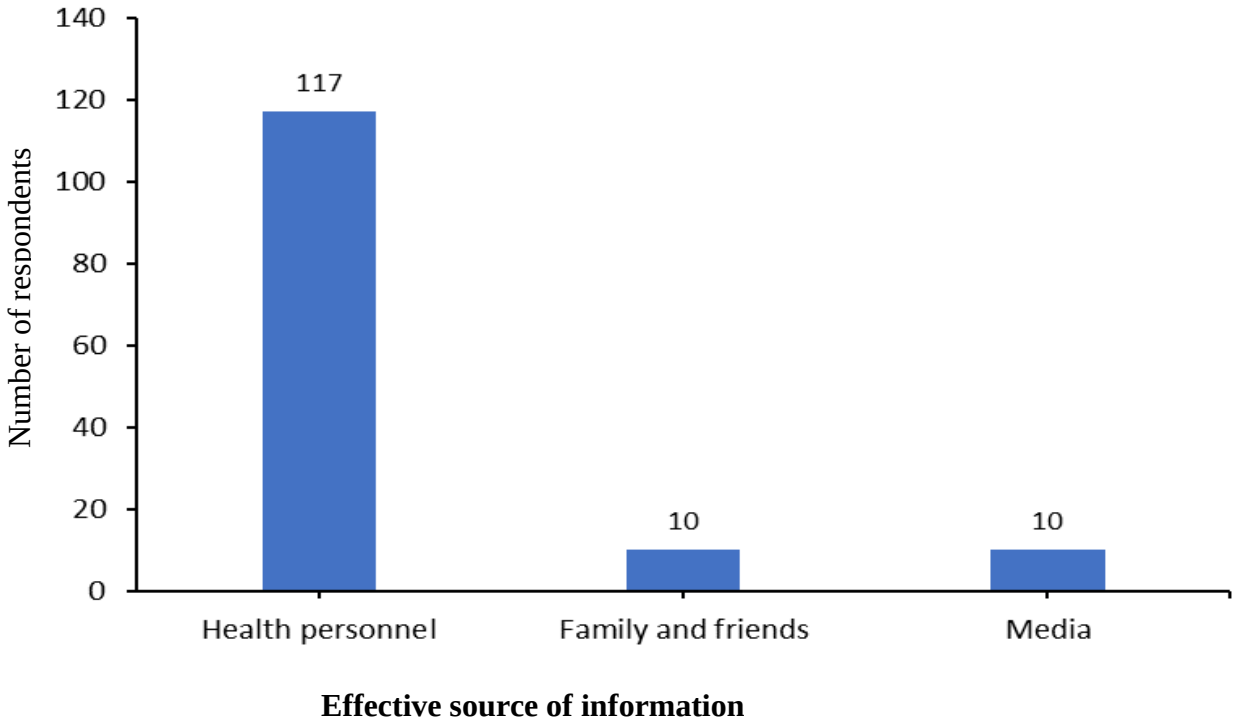

Figure 3: Effective source of information on tuberculosis to TB patients

4.2.2 Patients' knowledge level on tuberculosis

The knowledge level of respondents was assessed on a 5-point Likert scale of 17 questions. The average score of the respondents on the knowledge scale ranging from a minimum possible score of 17 and maximum score of 85 was computed. All the negatively worded statements were reversed so that higher scores depicted better knowledge level. The knowledge scale had strong reliability with Cronbach $\alpha = 0.80$. The mean knowledge score of the respondents is (M=16.0, SD = 1.6). The respondents with scores more than the mean score were classified as having good knowledge on TB. The minimum knowledge score was 12.3 while

highest score was 19.5. Overall, knowledge level of respondents was thus poor in more than half of the respondents (n=73, 53.3%). 64 (46.7%) were deemed to have good knowledge on TB. Figure 4 below shows the knowledge level distribution of the TB patients. In Table V below, we explored the factors that explained the variations in knowledge level of the respondents.

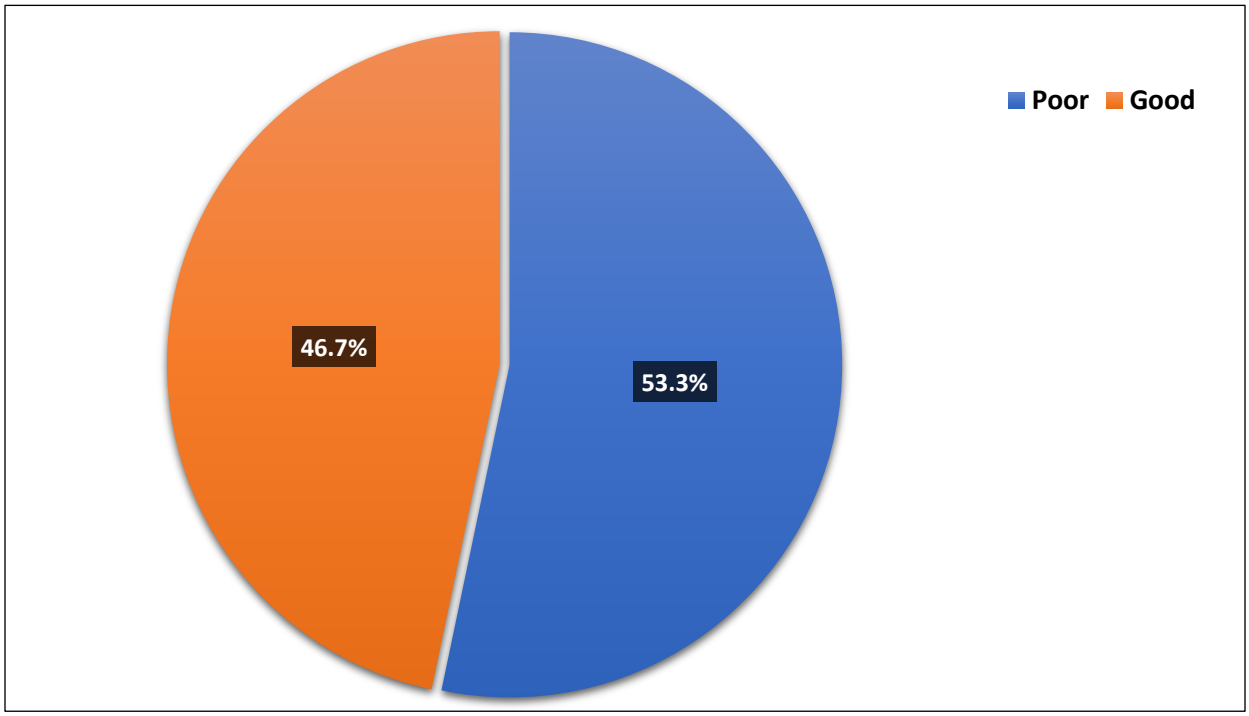

Figure 4: Knowledge level of respondents on tuberculosis

4.2.3 Factors that influence a TB patient's knowledge level on tuberculosis

As shown in Table V below, the TB patient's knowledge level on tuberculosis was significantly influenced by age, level of education attained, marital status, household size, source from which TB information was obtained, their perception and adherence to treatment regimen.

Table V below, illustrates a simple and multiple logistic regression analysis showing the strength of the relationship between the independent variables that significantly predicted the knowledge level of study participants.

Table V: Factors influencing the knowledge level of patient with tuberculosis

Variables	Category	Poor (n=73)	Good (n=64)	Percent of Category (%)	Statistical significance	
					Chi square	**P-value**
Age	Less than 20 years	4	3	5.1	10.457	0.013*
	20-39	33	46	57.7		
	40-59	30	13	31.4		
	60 years and above	6	2	5.8		
Highest level of education	No formal education	29	22	37.2	14.343	0.002*
	Primary	7	12	13.9		
	Secondary	35	18	38.7		
	Tertiary	2	12	10.2		
Marital status	Divorced	2	2	2.9	8.775	0.025*
	Married	49	33	59.8		
	Single	15	27	30.7		
	Widower	7	2	6.6		
Number in household	Less than 10 persons	56	35	66.4	7.417	0.006
	More than 10 persons	17	29	33.6		
Source of information on TB	Family and friends	42	26	49.6	15.275	0.001*
	Health care worker	23	13	26.3		
	Media	31	8	22.6		
	School	2	0	1.5		
Adherence	Low adherence	40	7	34.3	29.585	<0.001*
	Medium adherence	2	6	5.8		
	High adherence	31	51	59.9		
Perception	Good perception	22	41	46.0	15.802	<0.001
	Poor perception	51	23	54.0		

Source: Field Data, 2019; *: Fisher's exact

As shown in Table VI below, as a respondents' age increases, the odds of having poor knowledge on tuberculosis increase incrementally ($p < 0.05$). In spite of this difference, the age groupings more than 20 years did not significantly differ from those less than 20 years of age. However, the respondents who had a tertiary education had an 87% reduction in the odds of having poor knowledge about TB compared to those with no formal education (COR= 0.13, 95% CI= 0.03 – 0.62 $p<0.05$). Similarly, the patients who reported being single also had 63% reduced odds of having poor knowledge on tuberculosis compared to those married [COR= 0.37 (95% CI= 0.17 – 0.81 $p<0.05$]. Additionally, the patients who resided in households with more than 10 persons also had reduced odds of having poor knowledge on TB. They were about 63% less likely to have poor knowledge when compared patient's resident in households with less than 10 persons.

Furthermore, as illustrated in Table VI, the patients who had information on tuberculosis from the media, were 80% of the time less likely, to have poor knowledge on tuberculosis as if they had the information from healthcare workers [COR = 0.20 (95% CI = 0.07 – 0.56), $p<0.01$].

Finally, the poor perception and non-adherence to treatment regimen had increased the odds of having poor knowledge. The patients who have a wrong perception about tuberculosis were 4 times more likely to have poor knowledge on TB as compared to those with good perception [COR = 4.13 (95% CI = 2.02 – 8.44), $p<0.001$]. Similarly, the odds of having poor knowledge on tuberculosis was 9 times as great if patients adhered poorly to their treatment regimen as compared to them being highly adherent [COR = 9.40 (95% CI = 3.75 – 23.6), $p<0.001$].

After adjusting for the patient's level of education, marital status, household size and information source on TB, their knowledge level on tuberculosis was significantly predicted by

the age, perception and adherence to treatment regimen ($p<0.001$). As the patient aged, the odds of having poor knowledge on TB increased two-folds, when we control for other predictors in the model [AOR = 2.21 (95% CI = 1.13 – 4.35, $p<0.05$]. The adjusted odds ratio of having poor knowledge when a patient is poorly adherent on his/her treatment regimen is 7.4 (95% CI = 1.72 – 31.6).

Table VI: Predictors of the knowledge level of patient with TB

	Unadjusted model		Adjusted model	
Variables	cOR (95% CI)	P-value	aOR (95% CI)	P-value
Age		0.0135		0.021
Less than 20 years	Ref		ref	
20 – 39 years	0.54 (0.11, 2.57)	0.437	0.43 (0.05, 3.47)	0.425
40 – 59 years	1.73 (0.34, 8.85)	0.510	0.35 (0.03, 4.09)	0.406
60 years and above	2.25 (0.25, 20.1)	0.468	0.60 (0.03, 11.7)	0.733
Highest level of education		0.0017		0.054
No formal education	Ref		ref	
Primary	0.44 (0.15, 1.31)	0.141	0.87 (0.19, 3.93)	0.860
Secondary	1.48 (0.67, 3.26)	0.337	2.75 (0.86, 8.82)	0.089
Tertiary	0.13 (0.03,0.62)	0.011	0.47 (0.06, .64)	0.471
Marital status		0.0297		0.847
Married	Ref		ref	
Widowed	2.36 (0.46, 12.1)	0.303	1.48 (0.16, 13.8)	0.732
Divorced	0.67 (0.09, 5.02)	0.700	0.06 (0.00, 0.73)	0.028
Single	0.37 (0.17, 0.81)	0.012	0.09 (1.19, 0.48)	0.004
Household size		0.0063		0.091
Less than 10 persons	Ref		ref	
More than 10 persons	0.37 (0.17, 0.76)		0.61 (0.20, 1.79)	
Source of information on TB		0.0013		0.203
Healthcare workers	Ref		ref	
Family and friends	0.91 (0.40, 2.11)	0.831	0.57 (0.18, 1.82)	0.339
Media	0.20 (0.07, 0.56)	0.002	0.15 (0.03, 0.71)	0.017
School	1	-	1	-
Perception		0.0001		0.032
Good perception	Ref		ref	
Poor perception	4.13 (2.02, 8.44)		2.25 (0.74, 6.84)	
Level of adherence		0.0000		0.009
High adherence	Ref		ref	
Medium adherence	0.55 (0.10, 2.89)	0.478	0.16 (0.02, 1.24)	0.079
Low adherence	9.40 (3.75, 23.6)	0.000	7.37 (1.72, 31.6)	0.007

cOR: crude odds ratio. aOR: adjusted odds ratio. ref: reference category. CI: confidence interval.

4.3 Patients' perception of tuberculosis treatment

The perception of TB patients was assessed on a 10-item 5-point Likert scale with a possible minimum score of 10 and maximum possible score of 50. The perception scale had good reliability in measuring the perception of the respondents $\alpha = 0.60$. The mean perception score of the study participants is (M=17.2, SD = 2.7); minimum score obtained = 10.5, maximum score obtained = 23.5. Of the 137 respondents, 74 (54%) had poor perception about tuberculosis treatment, while 63 (46%) respondents had good perception (See Figure 5).

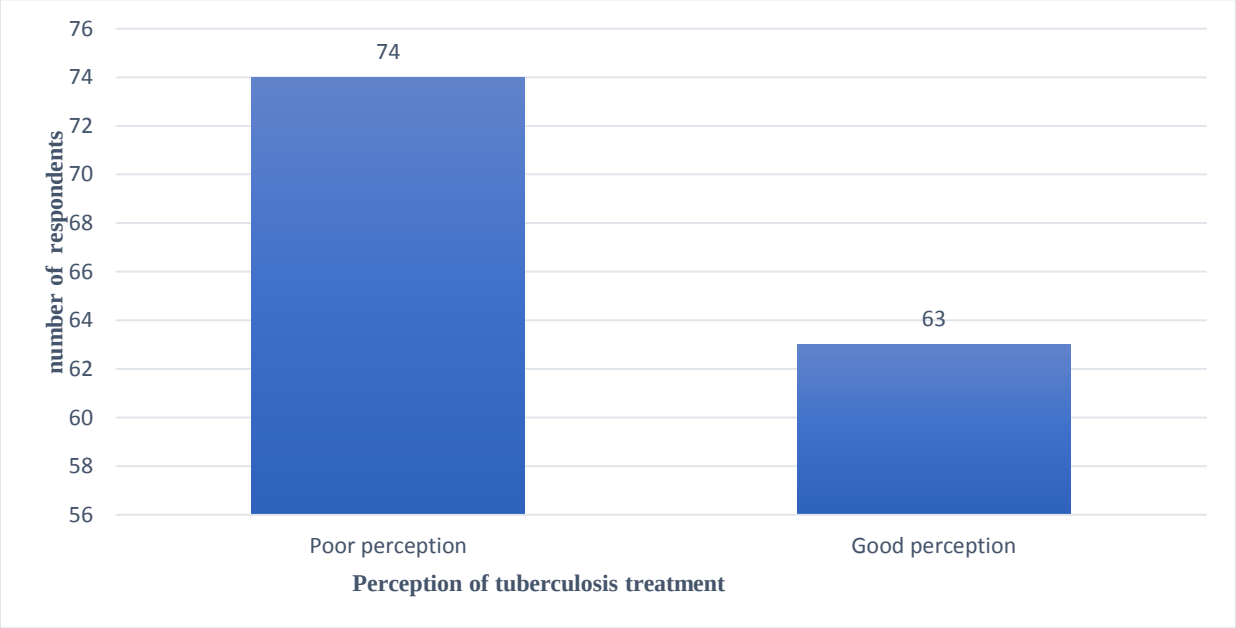

Figure 5: Patients' perception of tuberculosis treatment

In Tables VII and VIII, we explore the factors that influence the TB patient's perception about tuberculosis treatment. The perception of the patients was significantly influenced by employment status, information source, knowledge level and adherence to treatment regimen.

Table VII: Factors influencing the perception of patient on tuberculosis and its treatment

Variables	Category	Poor (n=74)	Good (n=63)	Percent of category (%)	Statistical significance	
					Chi square	**P-value**
Age	Less than 20 years	6	1	5.1	5.856	0.119*
	20-39	37	42	57.7		
	40-59	27	16	31.4		
	60 years and above	4	4	5.8		
Employment status	Employed	58	34	67.2	9.192	0.002
	Unemployed	16	29	32.8		
Marital status	Divorced	4	0	2.9	6.758	0.086*
	Married	44	38	59.8		
	Single	19	23	30.7		
	Widower	7	2	6.6		
Number in household	Less than 10 persons	50	41	66.4	0.094	0.759
	More than 10 persons	24	22	33.6		
Source of information on TB	Family and friends	38	30	49.6	13.038	0.003*
	Health care worker	25	11	26.3		
	Media	9	22	22.6		
	School	2	0	1.5		
Monthly income	< N30000	64	52	84.7	0.408	0.523
	N30000 and above	10	11	15.3		
Knowledge on TB	Good knowledge	23	41	46.7	15.802	<0.001
	Poor knowledge	51	22	53.3		
Adherence	Low adherence	39	8	34.3	26.134	<0.001*
	Medium adherence	5	3	5.8		
	High adherence	30	52	59.9		

Source: Field Data, 2019; *: Fisher's exact

As shown in Table VIII below, unemployed TB patients are 68% less likely to have wrong perception of tuberculosis treatment compared to those employed [COR = 0.32, 95% CI = 0.15 – 0.68, p<0.01). Similarly, respondents who heard about tuberculosis in the media were 82% less likely to have wrong perception of tuberculosis treatment compared to those who heard about tuberculosis from health personnel [COR = 0.18 (95% CI = 0.06 – 0.51), p<0.01].

The patients who had poor knowledge on tuberculosis were 4 times more likely to wrongly perceive tuberculosis treatment compared to those with good knowledge. In the same vain, TB patients with low adherence on their TB treatment regimen had 8 times the odds of having a wrong perception of tuberculosis treatment compared to patients highly adherent [COR= 8.45 (95%CI= 3.49 – 20.4), p<0.001].

After adjusting for the medium through which a tuberculosis patient had information on TB, the patient's employment status, level of knowledge on TB, and adherence to TB treatment regimen (p < 0.001). Compared to the patients who had employment, lack of employment was associated with a 68% reduction in odds of perceiving tuberculosis treatment wrongly, when we control for all other significant predictors of perception of tuberculosis [AOR = 0.32 (95% CI = 0.12 – 0.82), p<0.05].

The adjusted odds of wrongly perceiving tuberculosis treatment is about 3 times when TB patients have poor knowledge on tuberculosis as if they had good knowledge (AOR = 2.69, 95% CI = 1.06 – 6.82). Similarly, the odds of wrongly perceiving tuberculosis treatment is 5 times as great if respondents were poorly adherent on their tuberculosis treatment regimen as if they are highly adherent [AOR = 4.64 (95% CI = 1.58 – 13.6), p<0.01].

Table VIII: Predictors of the patients' perception of TB treatment.

	Unadjusted model		Adjusted model	
Variables	cOR (95% CI)	P-value	aOR (95% CI)	P-value
Employment		0.0023		0.030
Employed	Ref		Ref	
Unemployed	0.32 (0.15, 0.68)		0.32 (0.12, 0.82)	
Source of information on TB		0.0031		0.639
Healthcare workers	Ref		Ref	
Family and friends	0.56 (0.24, 1.31)	0.181	0.38 (0.14, 1.04)	0.058
Media	0.18 (0.06, 0.51)	0.001	0.26 (0.07, 0.89)	0.032
School	1	-	1	-
Knowledge on TB		0.0001		0.011
Good knowledge	Ref		Ref	
Poor knowledge	4.13 (2.02, 8.44)		2.69 (1.06, 6.82)	
Level of adherence		0.0000		0.002
High adherence	Ref		Ref	
Medium adherence	2.89 (0.64, 12.9)	0.166	2.05 (0.36, 11.6)	0.420
Low adherence	8.45 (3.49, 20.4)	0.000	4.64 (1.58, 13.6)	0.005

cOR: crude odds ratio. aOR: adjusted odds ratio. ref: reference category. CI: confidence interval**.**

4.4 Medication adherence among patients with tuberculosis

4.4.1 Sources of support to TB patients

As illustrated in Figure 6, more than ninety percent (n=125, 91.4%) of the respondents had less than 10 persons supporting them to adhere to the TB treatment regimen. Only 12 (8.8%) of the received support from more than 10 significant others in their tuberculosis treatment adherence.

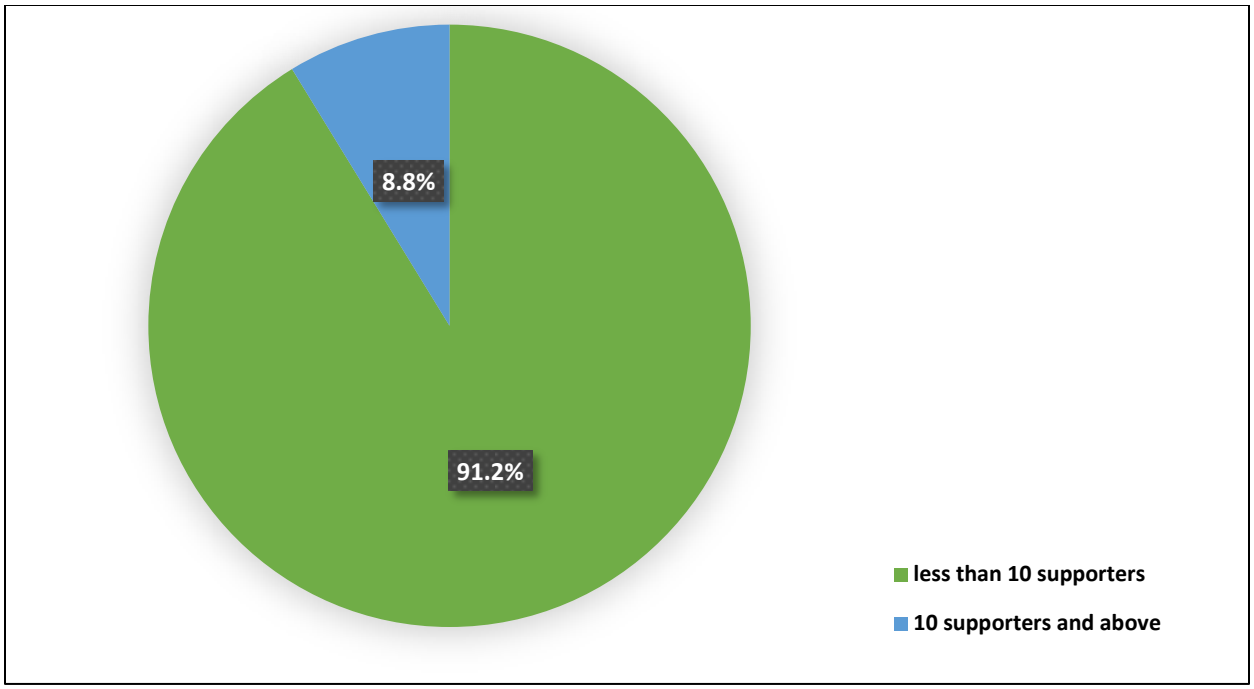

Figure 6: Number of support sources available to TB patients to facilitate adherence

4.4.2 TB patient's adherence to tuberculosis treatment

We categorized the patient's adherence to tuberculosis drugs based on Morisky's suggested approach. The patients who had perfect adherence scores of 8 were classified as highly adherent. 6 and 7 scores were regarded moderate adherence level while scoring less than 6 on the adherence scale was low adherence. As shown in Figure 7 below, majority of the respondents (n=82, 59.9%) were highly adherent to anti-TB drugs, 47 (34.3%) had low adherence level, with only 8 (5.8%) respondents having medium adherence to the TB medication.

We then categorized the respondent's adherence into two; patients who scored 8 were categorized as adherent and those with less than a score of 8 were categorized as non-adherent. We then explored the factors that explained the variations in the dichotomized adherence

variable using Chi square test and binary logistic regression analysis as illustrated in Tables IX and X.

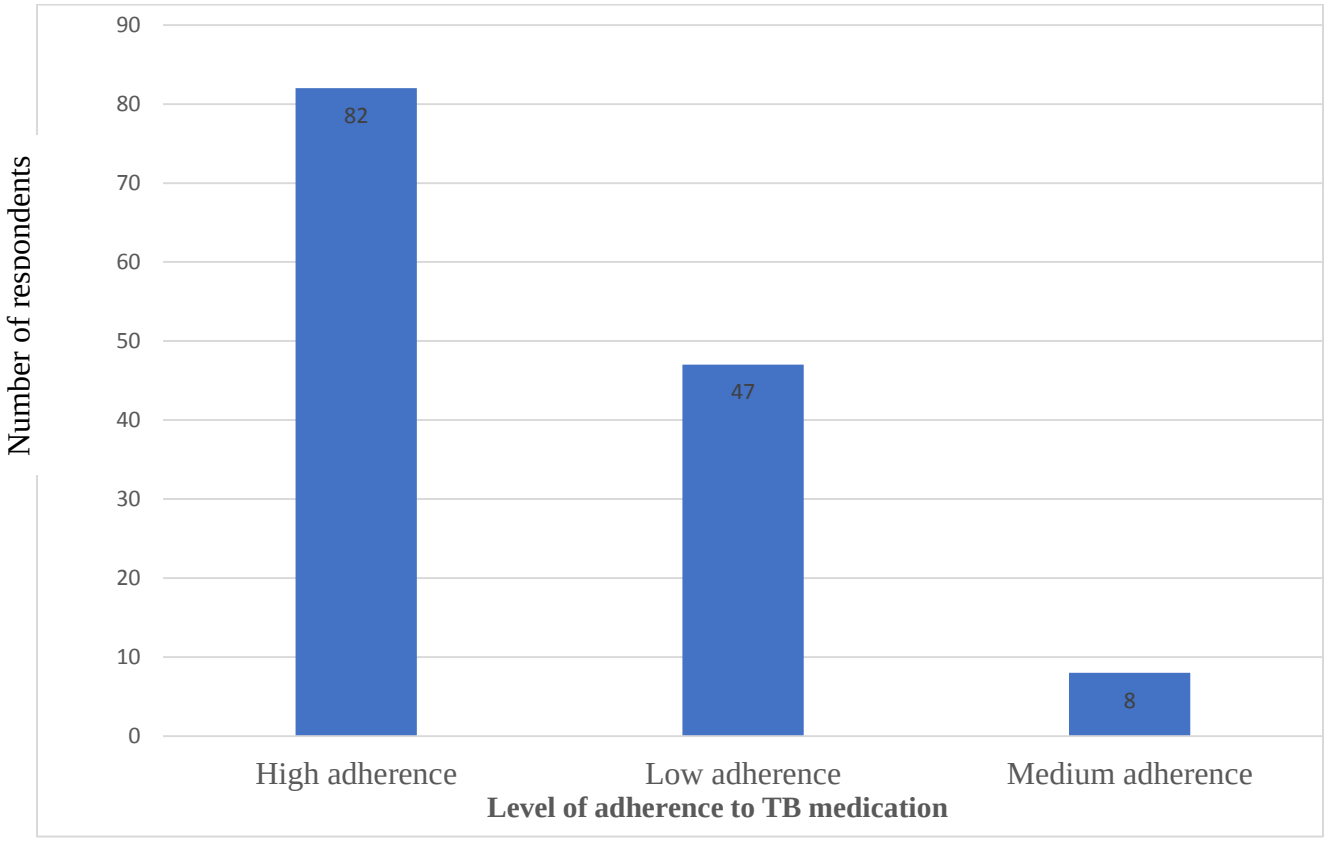

Figure 7: Levels of adherence of tuberculosis patients to anti-TB treatment

As shown in Table IX below, the patient's level of education, employment status, information source on tuberculosis, knowledge level and perception of tuberculosis treatment significantly influenced the patient's adherence to TB medication.

The respondents who had primary educational level were 70% less likely to default their tuberculosis treatment as if they have no formal education (COR = 0.30, 95% CI = 0.09 – 1.03). Similarly, patients who were unemployed had a 75% reduction in their odds of poorly adhering to tuberculosis treatment compared to the patients who were employed [COR = 0.25 (95% CI =

0.11 – 0.58), p<0.001]. Additionally, the patients who heard about tuberculosis from the media had 90% reduced odds of not adhering to their tuberculosis treatment compared to those patients who heard about tuberculosis from healthcare workers [COR = 0.10 (95% CI = 0.02 – 0.47), p<0.005].

Furthermore, the odds of adhering poorly to tuberculosis treatment is 7 times as great when patients perceived tuberculosis treatment wrongly as if they had good perception about tuberculosis treatment [COR = 6.93 (95% CI = 3.12 – 15.4), p<0.001]. Similarly, the odds of adhering poorly to anti-tuberculosis drugs is 5 times as great if the patient had poor knowledge on tuberculosis as if they had good knowledge on tuberculosis [COR = 5.32 (95% CI = 2.47 – 11.4), p<0.001].

Table IX: Factors influencing the adherence to TB treatment

Variables	Category	Not adherent (n=55)	adherent (n=82)	Percent (%)	Statistical significance	
					Chi square	**P-value**
Sex	Female	15	23	27.7	0.010	0.921
	Male	40	59	72.3		
Highest level of education	No formal education	24	14	37.2	15.858	<0.001*
	Primary	4	27	13.9		
	Secondary	27	15	38.7		
	Tertiary	0	26	10.2		
Employment status	Employed	46	46	67.2	11.318	0.001
	Unemployed	9	36	32.8		
Source of information on TB	Family and friends	38	30	49.6	23.031	<0.001*
	Health care worker	15	21	26.3		
	Media	2	29	22.6		
	School	0	2	1.5		
Monthly income	< N30000	49	67	84.7	1.383	0.240
	N30000 and above.	6	15	15.3		
Perception about TB	Good perception	11	52	46.0	24.980	<0.001
	Poor perception	44	30	54.0		
Knowledge on TB	Good knowledge	13	51	46.7	19.663	<0.001
	Poor knowledge	42	13	53.3		

Source: Field Data, 2019; *: Fisher's exact

4.5 The relationship between the patient's perception of treatment and medication adherence.

Table X. Indicated that the patient's adjusted odds of being non-adherent on tuberculosis treatment regimen is 5 times as great if patients perceived tuberculosis treatment wrongly as if they had good perception about tuberculosis treatment [AOR = 4.71 (95% CI = 1.55 – 14.3), $p<0.005$].

4.6 The relationship between the patient's knowledge and his perception of TB medication.

As shown in Figure 8 pairwise correlation indicated a statistically significant positive relationship between the patient's knowledge level of TB and perception of tuberculosis treatment, such that higher knowledge levels on tuberculosis were associated with good perceptions about tuberculosis treatment; $r = 0.41$ ($p<0.001$).

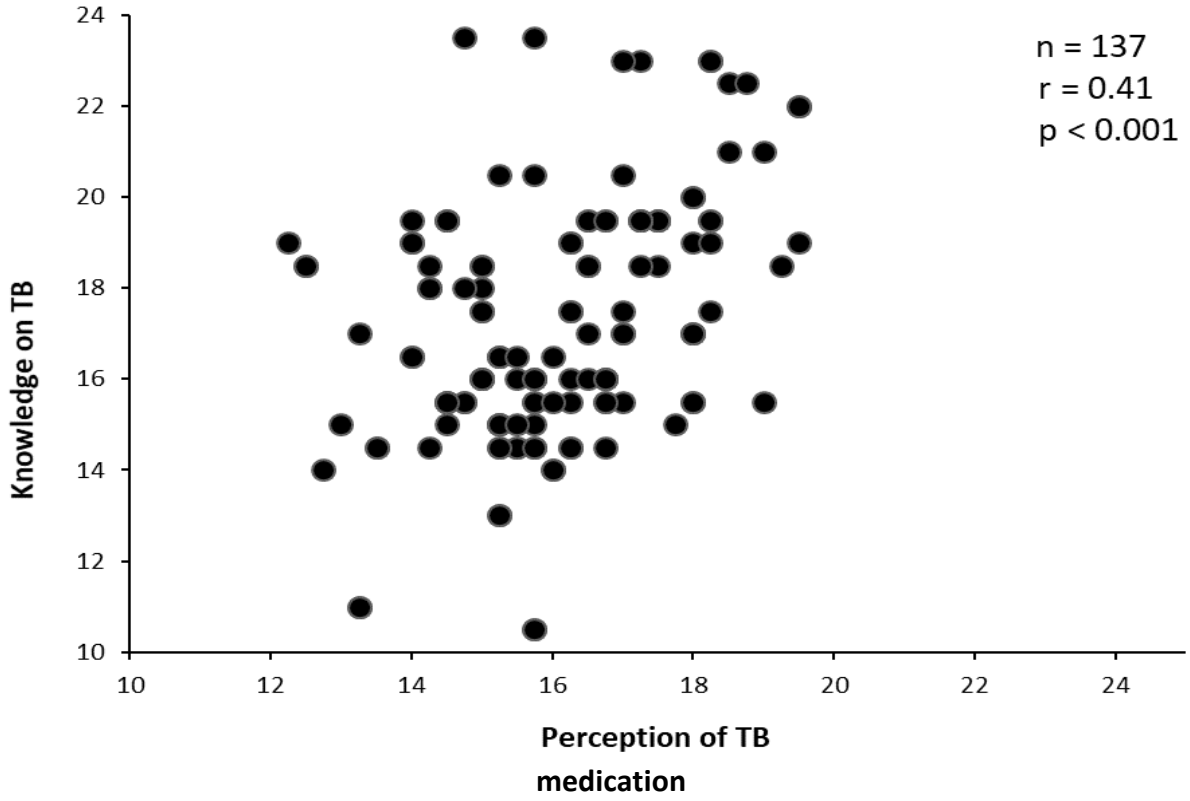

Figure 8. Correlation between the patients' knowledge of TB and the patients' perception of TB medication

4.7 The predictors of a patient's adherence to TB medication.

After controlling for a respondent's level of education, the patient's tendency to adhere to treatment regimen was significantly predicted by the patient's employment status, source of information, perception of tuberculosis treatment and knowledge level on tuberculosis. Table X below illustrates the strength of association between the independent variables and adherence of the respondents.

The adjusted odds ratio of adhering poorly to tuberculosis treatment is 80% less likely if patients were unemployed as if they are employed [AOR = 0.20 (95% CI = 0.07 – 0.59),

p<0.005]. When we adjust for all significant predictors of adherence, patients who heard about tuberculosis from friends and family were about 4 times more likely to be non-adherent on TB treatment compared to those who had information from health workers [AOR = 3.63 (95% CI = 1.23 – 10.7), p<0.05]. However, the patients who heard about tuberculosis from the media were 86% less likely to be non-adherent to anti-tuberculosis treatment compared to the patients who had information on tuberculosis from healthcare workers [AOR = 0.14 (95% CI = 0.03 – 0.81), p<0.05].

After controlling for other significant predictors of adherence, the patient's adjusted odds of being non-adherent on tuberculosis treatment regimen is 5 times as great if patients perceived tuberculosis treatment wrongly as if they had good perception of tuberculosis treatment [AOR = 4.71 (95% CI = 1.55 – 14.3), p<0.005]. In addition, the tuberculosis patient's adjusted odds of being non-adherent to anti-tuberculosis drugs is 3 times as great if they had poor knowledge on tuberculosis as compared to if the patient had good knowledge on tuberculosis [AOR = 3.44 (95% CI = 1.30 – 9.13), p<0.05].

Table X: Predictors of the medication adherence level of patient with TB

	Unadjusted model		Adjusted model	
Variables	cOR (95% CI)	P-value	aOR (95% CI)	P-value
Highest level of education		0.0608		0.322
No formal education	Ref		Ref	
Primary	0.30 (0.09, 1.03)	0.056	0.25 (0.05, 1.38)	0.113
Secondary	1.17 (0.54, 2.52)	0.692	0.88 (0.31, 2.50)	0.811
Diploma	1	-	1	-
Employment status		0.0005		0.002
Employed	Ref		Ref	
Unemployed	0.25 (0.11, 0.58)		0.20 (0.07, 0.59)	
Source of information on TB		0.0000		0.000
Healthcare workers	Ref		Ref	
Family and friends	1.77 (0.78, 4.02)	0.170	3.63 (1.23, 10.7)	0.020
Media	0.10 (0.02, 0.47)	0.004	0.14 (0.03, 0.81)	0.028
School	1	-	1	-
Perception of TB		0.0000		0.003
Good perception	Ref		Ref	
Poor perception	6.93 (3.12, 15.4)		4.71 (1.55, 14.3)	
Knowledge on TB		0.0000		0.013
Good knowledge	Ref		Ref	
Poor knowledge	5.32 (2.47, 11.4)		3.44 (1.30, 9.13)	

cOR: crude odds ratio. aOR: adjusted odds ratio. ref: reference category. CI: confidence interval**.**

4.8 Summary of the findings

The average age of respondents was (*M*=35.7, *SD*=13.2), majority of them (n=79, 57.7%) were at the age between 20 and 39. Among 137 respondents 99 (72.3%) were male. Respondents that had secondary school education contributed more 53 (38.7%) as compared to those with tertiary education 14 (10.2%). Meanwhile majority (n=82, 59.8%) of respondents were married, employed (n=92, 67.2%), with the median household size of 8 persons and they earned an average income of N11,000 which was the minimum wage of N30,000 per month.

The study findings indicated that respondents' major source of information of TB was family and friends (n=68, 49.6%) and 117 (85.4%) got effective information on TB from health workers. Based on a 5-point Likert of 17 questions knowledge scale, with strong reliability Cronbach α = 0.80, the average score of respondents' knowledge level was (M=16.0, SD=1.6). The respondents with score more than the average were categorized as having good knowledge while those with below the average were regarded as having poor knowledge about TB. In this study more than half (n= 73, 53.3%) of the respondents had poor knowledge about TB.

Significant factors which influenced the poor knowledge were aged 60 years and above, level of education of secondary category, and poor perception of TB treatment.

With regards to the perception of TB treatments, the respondents were assessed on a 5-point Likert scale, with the perception scale comprising 10 items which had reliability of α = 0.60, the scale was measuring the respondents' perception of TB treatment. The mean score of the study participants was (17.2, SD = 2.7). The minimum and maximum scores obtained in this study were 10.5 and 23.5 respectively. The study revealed that 74 (54%) respondents scored below the average and therefore had poor perception of TB treatment. The finding further indicated that being employed, poor knowledge of TB and poor adherence to TB medication influenced the respondents' poor perception of TB treatment.

Adherence to TB medication was measured adopting Morisky's medication adherence scale. The scale consists of 8 items with Yes or No options except item 8 which was on a 5-point Likert scale. The adherence level was categorised as high (=8 points), medium (6 or 7 points) and low (<6 points). The level was further classified in to adherent (8 points) and not adherent (<8 points). This study revealed that 82 (60%) of respondents adhered strictly to TB medication

while 55 (40%) defaulted. Factors that significantly influence the respondents' adherence were level of education, information source on tuberculosis, poor knowledge about TB and poor perception of TB treatment.

Logistic regression was employed to explain the relationship between adherence which was categorised (adherent and not adherent), and the respondents' perception of TB treatment. The study findings indicated that the patient's adjusted odds of being non-adherent to tuberculosis treatment regimen is 5 times as great if patients perceived tuberculosis treatment wrongly as if they had good perception about tuberculosis treatment [AOR = 4.71 (95% CI = 1.55 – 14.3), $p<0.005$]. Therefore, there is positive significant relationship between adherence to medication and patients' perception of TB treatment.

Furthermore, Pearson r' correlation was computed to examine the relationship between the patients' perception of TB treatment and the patients' knowledge of TB. The findings revealed positive relationship between respondents' perception of TB treatment and their knowledge of TB. Therefore, higher knowledge levels on tuberculosis were associated with good perceptions of tuberculosis treatment and vice versa; $r = 0.41$ ($p<0.001$).

Finally, logistic regression was also employed to determine the predictors of patients' adherence to TB medication. In this study, the predictors of non-adherence to TB medication were being employed [AOR = 0.20 (95% CI = 0.07 – 0.59), $p<0.005$], hearing about tuberculosis from friends and family [AOR = 3.63 (95% CI = 1.23 – 10.7), $p<0.05$], poor perception of tuberculosis treatment [AOR = 4.71 (95% CI = 1.55 – 14.3), $p<0.005$] and poor knowledge about tuberculosis [AOR = 3.44 (95% CI = 1.30 – 9.13), $p<0.05$]. Acquiring information of TB from

media, unemployment, good knowledge about TB and good perception of TB treatment were enablers of TB medication adherence.

CHAPTER FIVE

DISCUSSION

This chapter provides detail discussion of the study findings which sought to explore and describe the determinants of medication adherence among patients with tuberculosis. The discussion of the findings is conducted based on the objectives of the study. The objectives of the study were to:

- Determine the patients' knowledge about Tuberculosis.
- Determine the patients' perception of TB medication.
- Assess medication adherence among patients with TB.
- Factors influencing knowledge about TB and adhering behaviour

5.1 Patients' knowledge of tuberculosis

Knowledge about TB was evaluated based on the average score (M=16.0, SD=1.6) of the respondents' knowledge of the disease process and the outcome. The respondents were asked about people who can be infected with TB, the ways someone can contract TB, mode of TB transmission as well as the necessary measures needed to prevent the spread of TB.

The findings of this study reveal poor knowledge of TB among more than half of the respondents. This implies that more than half of the respondents had either agreed or strongly agreed with wrong statements about the people to be infected with TB. Majority of the respondents did not accurately relate the cause of TB to the inhalation of TB germs (pathogens). They also agreed that TB can be transmitted by eating food with an infected person or having

sexual intercourse with TB patients. Majority of the respondents agreed that covering nose and mouth when sneezing or coughing can prevent TB, but they disagreed that BCG vaccine can be used for prevention against TB. Though, majority of the patients accurately knew some of the strategies for TB prevention, their overall scores were below the average score of (*M*=16.0, *SD*=1.6).

The respondents who had poor knowledge were not able to differentiate between the risk factors that can lead to TB occurrence and the cause of TB, they lack knowledge on prevention and transmission of TB. These findings corroborate the findings in Vanuatu by Viney et al. (2014), which showed majority of respondents attributed TB to non-bacterial cause. They, however, indicated alcohol, cigarettes, eating contaminated food and sharing utensils with TB patient as the causes of TB. Meanwhile, findings of Paul et al. (2015) refuted the study finding and therefore reported that almost all TB patients in Bangladesh who responded heard about TB, and also majority of them had good knowledge about TB. The difference between the current findings and that of Paul et al. (2015) may possibly be due to the geographical location of the facility. The TB centre was located at the metropolis while majority of TB patients were found in the remote areas. This may have contributed to the observed difference. In Bangladesh, health care providers, who were referred to as 'village doctors' had better knowledge of prevention, transmission and manifestations of the condition accessed remote areas and thereby improve patients' awareness about TB (Islam et al., 2014). This indicated that enlightenment at community could improve awareness about TB.

5.2 Patients' perception of tuberculosis

The respondents' perception of medication was assessed based on the average perception score of (*M*=17.2, *SD* = 2.7) on a 5-points Likert scale. The respondents were asked about their perception of TB treatment such as being unpleasant and difficult, inability to cure TB, interfering with social life and taking the drugs for at least one year.

Findings show that majority of the respondents score below the average and therefore had poor perception of TB treatment. The finding implies that the respondents who had poor perception of treatment were afraid of people's comment as they visited the clinic for treatment, and they believed that TB medication could be alternated with traditional herbs. These could, however, make the patients patronize traditional healers for TB treatment in order to avoid social stigma. This finding corresponds the results of Chang and Cataldo (2014) which revealed poor perception of TB because, TB patients believed that the treatment had interfered with their social interaction, conveniences and confidentiality. On the contrary, Beraldo et al. (2017) reported that majority of patients with TB in Campinas Sao Paulo of Brazil had good perception of treatment. The difference between this particular finding and that of Beraldo et al. (2017) worth nothing as their study was conducted in a different context. In Ghana (a context similar to the current study area) patients' beliefs in traditional medicine hindered adherence to TB medication (Salifu et al., 2016).

5.3 Medication adherence among patients with TB.

Adherence to TB medication is the ability to strictly take multiple TB drugs for the minimum of six-months (Adane et al., 2013; Méda et al., 2014). Morisky's medication adherence scale was adopted and categorized as adherent and not-adherent to measure adherence level of

the respondents (Xu et al., 2017). This scale consists of items that assessed respondents' ability to stick to anti-TB drugs, and whether the patients often remember to take their medication even when they travelled. The result indicates that more than half of the respondents adhered strictly to TB medication. This finding is in consistence with the finding of a study conducted in Myanmar by Kyi et al. (2019), which pointed out that among 170 respondents 127 (74.7%) adhered strictly to TB treatment. These contravene the result of Adane et al. (2013) which reported low level of adherence to TB medication among patients in Ethiopia.

The percentage of non-adherence raises a great concern to this study in which more than one-third of the respondents had defaulted to adhere to the medication. This implies that the defaulters had sometimes felt hassled about sticking to TB medication plan or often forgotten to take their TB pills. Similar findings revealed that defaulters of TB treatment in Indonesia felt bored about sticking to their TB drugs (Widjanarko et al., 2009); and in South West Ethiopia TB patients sometime forgot to take their TB medication (Kebede & Wabe, 2012). Thus, families of TB patients need to be involved in their care. They should exhibit supportive behavior by encouraging and reminding patients with TB to take their medication regularly. Moreover, e-health need to be installed in the facility. It can enable tracking and reminding of the defaulters via text messages and phone calls (Fraser et al., 2013).

5.4 Factors influencing patients' knowledge about TB and adhering behaviour

The results of this study indicate that some statistically significant factors influenced the respondents' knowledge about TB and adhering behaviour of the patients.

5.4.1 Factors influencing patients' knowledge about TB

Findings reveal that respondents' age and perception of TB treatment significantly influenced their knowledge about TB.

5.4.1.1 Age

The result of the study indicates that poor knowledge was significantly influenced by ageing. It suggests that TB patients aged 60 years and above had more poor knowledge about TB than other respondents. In this study, aged people (60 years and above) were assumed to be the heads of every family, who are preoccupied with activities involving the family and community that might lead to forgetfulness. This finding corresponds with the findings in India and Indonesia (Jha et al., 2010; Widjanarko et al., 2009) which reported that forgetfulness in aging respondents attributed to poor knowledge of TB. Adane et al. (2013) also opined that age-related dementia contributes to forgetfulness in some aged TB patients. This might possibly have contributed to the increased poor knowledge among the older age patients. Contrary, finding in Abuja by Biya et al. (2014) argued that majority of the respondents who presented with poor knowledge of TB were aged between 25-34. The finding of Biya et al. (2014) further indicated that majority of respondence habitually consume unpasteurized milk called "nono" without knowing the implication to their health. This may possibly account for the age differences.

5.4.1.2 Perception of TB treatment

The study finding reveals the existence of positive significant relationship between respondents' perception of TB treatment and their knowledge of TB. This finding suggests that respondents who have poor knowledge of TB are likely to have poor perception of TB medication and vice versa. Due to the fact that majority of the respondents believed that TB

treatment could be alternated with traditional medicine, that could have discouraged them from seeking for knowledge about TB. This finding is in consistence with the findings in Ethiopia by Abebe et al. (2010) which expressed that the misconception about TB was cause by spirit (witchcraft) and the belief that traditional healers can treat TB deterred TB patients from acquiring knowledge about TB. Conversely, the finding of Cramm et al. (2010) in South African revealed negative relationship between the knowledge about TB and perception of treatment. The patients had good knowledge about TB but misperceived DOTS strategy of TB treatment. The respondents believed that healthcare workers who visited their home to supply TB medication and ensure adherence exposed their condition to the community, which consequently lead to stigmatization. The finding of Cramm et al. (2010) may possibly disagree with current study area because they conducted the study in a community health facility where DOTS was observed while the present study was conducted in a referral TB centre at a metropolis.

5.4.2 Factors influencing adherence to TB medication

In this study, unemployment, obtaining information about TB from family and friends, poor knowledge of TB and poor perception of TB medication were identified to be the predictors of non-adherence to TB medication. In the other hand, being employed, media as a source of information about TB, good perception of TB treatment and good knowledge about TB were found as enablers of adherence to TB medication.

5.4.2.1 Employment

Result obtained from this study gives an explicit impression that employment predicts adherence to TB medication. The finding indicates that non-adherent to tuberculosis treatment is less likely if patients are unemployed than if they are employed [AOR = 0.20 (95% CI = 0.07 –

0.59), p<0.005]. This suggests that respondent's employment prevented them from adhering to their TB treatment. Majority of the patients who defaulted had frequently forgotten to take their TB medication when travelling or going to work-places. This may be attributed to the work schedule which perhaps preoccupied patients from remembering about the medication and therefore deterred proper drugs adherence. This finding is in agreement with finding in Ghana (Osei et al., 2015) which reported employment as a major factor affecting treatment of TB. Tadesse et al. (2013) argued that unemployment of TB patients in Ethiopia prevented them from adhering to TB medication. In the study of Tadesse et al. (2013), the unemployment which resulted to financial constraints; and also lack of geographical access to TB healthcare facilities contributed to the poor adherence to TB medication in Ethiopia.

5.4.2.2 Source of information

Another predictor of the respondents' medication adherence was source of information about TB. The finding reveals that patients who heard about tuberculosis from friends and family were about 4 times more likely to be non-adherent on TB treatment compared to those who had information from health workers [AOR = 3.63 (95% CI = 1.23 – 10.7), p<0.05]. This finding suggests that acquiring information about TB from healthcare providers can allow TB patients to have effective and genuine information about TB, and this will therefore improve their treatment adherence. This finding is in consistence with a qualitative study conducted in Eretria (Gebreweld et al., 2018) where participants who adhered to TB medication admitted that they received information about TB from the healthcare providers.

This study also indicates that patients who heard about tuberculosis from the media were 86% less likely to be non-adherent to anti-tuberculosis treatment compared to the patients who

had information on tuberculosis from healthcare workers [AOR = 0.14 (95% CI = 0.03 – 0.81), p<0.05]. This finding reveals that media have contributed tremendously to TB medication adherence in the study area. Most of the TB patients who had good adherence to TB medication were exposed to TV, radio, and printed materials such as posters and brochures. This could be due to recent proliferation of FM radio stations in the study area. This finding corresponds the finding of Naidoo et al. (2016) which highlighted that TB patients who adhered to their TB medication in South Africa heard about TB from the TV, brochures and radio. Though, media was mentioned as the source of information which significantly influenced adherence, yet it was another means of creating awareness to the public by healthcare providers. Therefore, use of media to enlighten and educate public about TB should be intensified.

5.4.2.3 Patients' knowledge about TB

The study found poor knowledge about tuberculosis [AOR = 3.44 (95% CI = 1.30 – 9.13), p<0.05] as predictors of adherence failure. This finding implies that majority of the respondents who defaulted TB medication were significantly influenced by poor knowledge about TB. In this study patients presented poor knowledge about cause of TB and its mode of transmission. This knowledge deficit could adversely affect the medication adherence. This finding is in congruence with the findings in New Guinea and India (Diefenbach-Elstob et al., 2017; Mittal & Gupta, 2011) which indicated that lack of Knowledge about TB significantly influenced non-adherence to TB medication.

5.4.2.4 Patients' perception of TB treatment.

Finding of this study reveals that patients who wrongly perceived TB treatment are 5 times more likely to be not adherent to medication than those with good perception of the

treatment [AOR = 4.71 (95% CI = 1.55 – 14.3), p<0.005]. This suggests that majority of respondents who did not adhere to their TB medication misperceived TB treatment. Most of the defaulters also believed that traditional medicine can cure TB. This finding corresponds the findings of Salifu et al. (2016) which reported that TB patients in Ghana believed that herbal medicine can be used as an alternative to TB treatment thereby affecting adherence to medication adversely. Similar findings of Mittal and Gupta (2011) in India and Putera et al. (2015) in Indonesia emphasised that poor perception of TB treatment among TB patients was significantly related to adherence failure. This may be justified because, all the studies were conducted in areas where superstitions about TB affected patients' diagnosis and treatment of TB (Finnie et al., 2011). Thus, this prompts the need for creating awareness about TB and its medication. Lei et al. (2016) stated that educating patients with TB increases not only their knowledge of the condition but also health awareness which consequently improve the patient's health seeking behaviour.

CHAPTER SIX

SUMMARY, IMPLICATIONS, LIMITATION, RECOMMENDATION AND CONCLUSION

This study examines the determinants of medication adherence among tuberculosis patients. The study aimed to determine the patient's perception of TB medication, assess medication adherence among patients with TB, determine the relationship between the patient's perception and medication adherence, determine the relationship between the patient's knowledge and his perception of TB medication and determine the predictors of a patient's adherence to TB medication.

This chapter, therefore, summarises the entire study. This is followed with insight on the contribution of the study to the existing knowledge and its implications on nursing practice, research, education, and administration. The chapter furthermore presents the limitations of the study and provides recommendations to various stake holders for TB control, and finally draws a conclusion.

6.1 Summary of the study

TB is an airborne disease affecting millions of people globally. Even though, TB is curable but it requires strict adherence to prescribed anti-TB drugs for the minimum of six-months. Reviewed literature indicated that researches were conducted on TB in Sokoto but much has not been seeing on the patients' determinants of adherence to TB medication. Thus, this study examined the determinants of medication adherence among patients with tuberculosis at Sokoto metropolis.

Literature on factors influencing medication adherence were critically reviewed using Health Belief Model that was adopted by Glanz et al. (2002) to guide the review as well as the entire study. The study utilized only three constructs of the model, these include the perceived threats (the patient perception about the medication), the Modifying factor (the knowledge about TB) and the likely outcome/behaviour (the medication adherence). Administrative approval and ethical clearance (Appendix -C) were obtained from SHS upon the submission of introductory letter (Appendix -B) received from the school and the research proposal of the study. A quantitative cross-sectional design was employed using Cochrane sample size formula to determine the sample size. Simple random sampling method was adopted to draw 137 respondents from 213 target population who met the inclusion criteria from 31/12/2018 to 31/5/2019.

Data was collected using a standardized self-administered questionnaire (Appendix- A). Ethical standard was ensured by avoiding the violation of the respondent's rights in the process of data collection. All completed questionnaires were cross checked for completeness before collected, and then managed appropriately. The data was analysed using STATA version 15. Descriptive statistic was computed on the socio-demographic data and source of knowledge of the respondents. Inferential statistics were employed to answer the research questions. These include: Chi-square, Pearson's r correlation coefficient and Binary logistic regression.

The findings indicated that majority of the respondents had poor knowledge about TB. The inadequate knowledge was influenced by age of 60 years and above, and poor perception of TB treatment. The TB patients who had poor knowledge in Sokoto could not differentiate between the cause of TB and risk factors, they also need to be educated on the mode of

transmission and prevention of TB. Majority of the patients wrongly perceived anti-TB drugs. The misconception was found among patients who were employed, lack knowledge of TB and had poor adherence to TB medication.

The finding established significant positive relationship between the respondents' misperception of TB treatments and the lack of knowledge about the condition. And also, patients who wrongly perceived treatment had low adherence to the medication. This was because patients who did not know about TB could attribute TB to a non-bacterial cause which could have led to misconception of the treatment and consequently reduce the urge for the health seeking behaviour and adherence to TB medication. It is therefore important to intensify public awareness and educative programmes to change misconception and improve adherence to TB treatment.

More than half of the patients adhered to anti-TB drugs while about one-third of the patients defaulted. Majority of the defaulters were employees, patients who obtained information about TB from family and friends, those with poor knowledge of TB and poor perception of TB medication. The defaulters expressed that they often forgot to take their medication, and some indicated that they felt hassled about sticking to their treatment plan. These could be due to tight working schedules, and lack of reliable source of information to educate patients and also change their misconception of TB treatment. Meanwhile, respondents who adhered to their medication were unemployed patients, those who heard about TB on the media, good knowledge about TB and good perception of anti-TB medication were the enablers of TB medication adherence. These patients possibly remembered to take their treatment because they were not engaged in activities that could have distracted their attention from adhering to anti-TB drugs.

6.2 Insights Gained

This research has made the researcher to be acquainted with the process of undertaking an empirical study. Theories and statistics learnt during the program were put into practice. The process of literature review, data collection, data analysis and discussion of findings has been gained. Thought, the researcher encountered some difficulties as some of the respondents required interpretation of items of the questionnaire during the process of data collection because they could not read or write, but it was an enjoyable experience. The researcher has also gained more knowledge on tuberculosis particularly the determinants of TB medication adherence, and therefore, is willing to conduct more research work.

6.3 Implications of the Study

The findings of this study have implications for tuberculosis in nursing education, nursing practice, policy, and tuberculosis research.

6.3.1 Implications of the study to nursing practice

With reference to the findings of this study, the results imply that majority of TB patients had poor knowledge about TB, and the poor knowledge is high among those aged 60 years and above. This implies that the patients lack general knowledge about TB, which encompasses knowledge of the cause, mode of transmission and prevention. Therefore, it is imperative that nursing practitioners and TB supporters to address the knowledge deficit through enlightenment and creation of awareness. Elderly patients should be given special consideration as they may have other age-related condition such as dementia.

The findings also reveal that majority of the TB patients had poor perception of TB medication, and significant relationship between the perception of TB treatment and the

knowledge about TB are established. This implies that the patients' beliefs that traditional herbs can treat TB was influenced by lack of knowledge about TB. These consequently resulted to non-adherence to TB medication. Therefore, apart from the education and public enlightenment, nurses are anticipated to adopt peer to peer service approach by which treated TB patients who adhered to medication are introduced to TB patients to avert their misconception. Again, nurse should encourage family supports, and at least SMS text messages should be sent to TB patients to remind them on their therapeutic schedules.

6.3.2 Implications of the study to tuberculosis research

This study adds to the existing knowledge of tuberculosis literature more particularly the TB medication adherence literature in Nigeria. More nurses will be encouraged to conduct researches on tuberculosis. Even thought, a lot of studies were conducted on tuberculosis in Nigeria, limited literature was found regarding tuberculosis medication adherence. Consequently, this necessitate more research on adherence to TB medication. Therefore, further studies should consider to assess the experience of healthcare providers to deliver holistic care to TB patients. And also, identify the challenges TB patients may encounter while adhering to TB medication.

6.3.3 Implications of the study to nursing education

The finding of this study revealed that majority of TB patients who adhere to their medication acquire information about TB on media. This implies that the patients were exposed to TV, radio and printed materials. It is imperative to nursing training schools to teach students on how to maximize the use of media to disseminate information and also to equip students on how to effectively communicate to TB patients especially older age. These could improve

understanding of TB among large number of people and consequently increase TB medication adherence.

6.3.4 Implications of the study to hospital administrators

In this study findings, it was observed that being employed significantly influenced poor adherence to TB treatment. This implies that TB patients who are employed often forgot to take their medication. It could be due to tight work-place schedule. Therefore, hospital administrators should endeavour to install e-health system in the facility. This will allow health care workers to track defaulters to TB medication and improve their adherence through home visits, sending SMS messages or phone calls.

6.3.5 Implication of the study for policy

Finding indicates that majority of TB patients who had poor adherence to medication acquire information from friends and family members. This implies that to enhance TB medication adherence, Sokoto State Ministry of health need to adopt DOTS strategies that will incorporate patient's family in TB management. This will create more awareness among not only the family but also entire members of community. The policy makers and ministry of health should allocate adequate funding and logistics to TB program. This will enable health care providers to access remote areas and therefore provide adequate knowledge, free diagnosis and treatment to TB patients.

Ministry for higher education in collaboration with Nursing and Midwifery Council of Nigeria should review curriculum for nursing training to include DOTS program during their community clinical posting. This will make the students to become used to the program and thus ensure it after graduation.

6.4 Limitation of the Study

As limitation to this study, the researcher could not find any validated and well-structured questionnaire to measure the perceived benefits and barrier to behavioural change constructs of the adopted theory. This prevented the researcher from studying their relationships with other constructs. Moreover, a structured and closed ended questionnaire was used to collect data. This could have limited the respondents to express all their views regarding the determinants of TB medication adherence. Furthermore, the cross-sectional design employed in this study may not provide definite information about cause and effect relationship. It was however used because of the limited time available for the research. And also due to the fact that the study was conducted in the TB center of Specialist hospital: which is the largest referral health facility for TB cases, the findings cannot be generalized to all TB patients in other health facilities within the country.

6.5 Conclusion

Adherence to TB medication is the only strategy for ensuring full recovery from the menace of tuberculosis. This study underscores the determinants of medication adherence among patients with TB. More than one-third of patients who visited TB clinic in Specialist Hospital Sokoto from 31/12/2018 to 31/5/2019 did not adhere strictly to TB medication. The non-adherence to TB medication was influenced by poor knowledge about TB, poor perception of TB treatment, being employed and acquiring the information about tuberculosis from friends and family. Acquiring information of TB from media, unemployment, good knowledge about TB and good perception of TB treatment were found to be enablers of TB medication adherence. Therefore, media can be used to create awareness to public that will impact knowledge and reduce misconception about TB and its treatment. Further research is imperative to assess the

experience of healthcare providers to effectively educate and change the patients' misconceptions about TB and its treatment. And also, the challenges patients with TB encounter while struggling to adhere to the long duration TB medication and how to address these challenges can as well be examined.

6.6 Recommendations

Based on the research findings, the following recommendations are suggested to nurse clinicians, nurse educators, nurse researchers, SHS administrators, National TB and Leprosy Control Programme (NTBLCP), and Non-governmental organizations (NGOs)

6.6.1 Nurse Clinicians

The nurse clinicians should:

- Educate patients who are diagnosed with TB on the causes, transmission, prevention and possible complications of tuberculosis. This will enable the patients to know that TB is preventable, and can also be cured while the medication is adhered to.
- Introduce TB patients to successfully treated patients who adhered to their medication and certified free from the condition (peer to peer support). This may change their misconception and thus foster adherence to TB medication.

6.6.2 Nurse educators

The nurse educators should:

- Ensure effective implementation of DOTS strategy during lectures and community posting in the training schools to enable the students to acquaint with the program.

6.6.2 Nursing researchers

Nurses researchers should:

- Employ other approaches such as mix-method or qualitative approach to explore in-depth understanding about medication adherence in SHS TB center.
- Assess the experience of healthcare providers in providing holistic care to TB patients in Sokoto.
- Explore the challenges the TB patients are encountering while adhering to TB medication in Sokoto.

6.6.3 Hospital Administrators

The hospital administrators should:

- Train staff on how to effectively communicate and care for TB patients especially the aged who require more attention.
- Consider installation of e-health system to improve adherence by enabling interaction between healthcare providers and their patients.
- Encourage nurses in the TB center to conduct research on TB for evidenced-based care.

6.6.4 National TB and Leprosy Control Programme (NTBLCP)

The NTBLCP should:

- Intensify enlightenment about TB through mass-media to create more awareness on TB to the large number of audiences in Sokoto.
- Involve traditional and religious leaders in sensitization programs against TB, these can allow community members to understand the importance of TB programs and provide kin support to patients with TB as well as reduce TB related stigmatization.

6.6.5 Non-governmental organizations

The NGOs such as TB care, Institute of Human Virology (IHV), Global Aid for Africa (GAA), American thoracic society (ATS) etc. should:

- Collaborate with government to intensify awareness about TB
- Sponsor more researchers to elicit more strategies to enhance tracking of defaulters and improve medication adherence
- Develop strategic programs (training, provision of materials) that will enhance medication adherence.

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APPENDICES

Appendix- A: Consent Form and Questionnaire

Questionnaire number:

UNIVERSITY OF GHANA

Department of Adult Health

School of Nursing and Midwifery

Consent Form

Title: Determinants of Medication Adherence among Patients with Tuberculosis: A Study at Sokoto Metropolis

Principal Investigator: Sani Zayyanu

Address: Department of Adult Health, School of Nursing and Midwifery, University of Ghana, Mobile Number (+2347061582858); email: sanizayyanu7@gmail.com

General Information

You are being asked to participate in a study that is interested in investigating the determinants of medication adherence among patients with tuberculosis. If you agree to participate in the study, you will be asked to respond to some questionnaires. The duration of your participation in the study is approximately 20 minutes. Your participation in the research study is strictly voluntary.

Confidentiality

Any information obtained from you during the study will be treated confidential. The questionnaire is void of your name and other identifying information, meaning that you will not be identified individually in any way as a result of participation in this research.

Compensation

There is no compensation for participation in the study

Your rights as a Participant

This research has been reviewed and approved by the HospitalResearch and Ethical Committee (HREC). If you have any questions about your rights as a participant you can contact the HREC Office between the hours of 8am-4pm through the landline 060-232040/238385 or email address: shopitalsok@yahoo.com

VOLUNTEER AGREEMENT

I have read and understood the above information. I have been given an opportunity to have any questions about the research answered to my satisfaction. I agree to participate as a volunteer.

Date _____ Signature or Mark of Volunteer _____

1

Section A: Demographic and socio-economic characteristics of TB patients

Please mark (√) the following answer according to yourself situation.

1. Gender.

Male ( )

Female ( )

2. Age _____ years.

3. What is your marital status?

Single ( )

Married ( )

Widower ( )

Divorced ( )

Others ( )_____

4. How many people make up your household members? (Please indicate number) _____

5. What is your highest educational level?

No formal education ( )

Primary ( )

Secondary ( )

Diploma ( )

Degree and above ( )

6. What is your employment status?

Government employee ( )

Private employee ( )

Self-employed ( )

Housewife ( )

Unemployed ()

7. What is your occupation? _____

8. How much is your average monthly income? _____ in *Nigerian Naira* (NGN)

9. How many TB treatment supporters do you have? (Please indicate number)_____

10. How many of your TB treatment supporters are family members? (Please indicate number)_____

Sourceof Knowledge about TB

(Which one is the right answer choice for you)

11. Have you heard about tuberculosis?

A. Yes ( )

B. No ( )

12. Where was the first time you learned/heard about TB?

A. Radio ( )

B. TV ( )

C. Billboards ( )

D. Printed materials (Brochures, posters etc.) ( )

E. Health care workers ( )

F. Family, friends, neighbours and colleagues ( )

G. Religious leaders ( )

H. Others ( )_____

13. Did you acquire more information about TB?

A. Yes ( )

B. No ( )

14. Which one is your most effective source of information about TB?

A. Newspaper & Magazines ( )

B. Radio ( )

C. TV ( )

D. Billboards ( )

E. Healthcare workers ( )

F. Family, friends, neighbours and colleagues ( )

G. Religious leaders ( )

H. Others ( )_____

15. Do you know how long you must take your anti-TB medication to complete the course?

A. Yes ( )

B. No ( )

Section B: Perception of TB treatment among Patients Living with TB

For each of the questions below, circle the response that best characterizes how you fell about the statement, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree Nor Disagree, 4 = Agree, and 5 = Strongly Agree.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. I am afraid that I will be told I am TB Positive	1	2	3	4	5
2. I am afraid that people will talk about my visit to the clinic	1	2	3	4	5
3. I don't want to cough into the specimen bottle	1	2	3	4	5
4. I am afraid that TB treatment will interfere my social life	1	2	3	4	5
5. There are long queues at the clinic	1	2	3	4	5
6. I am afraid that I will lose my job/ income	1	2	3	4	5
7. I am afraid that TB treatment will be unpleasant and difficult	1	2	3	4	5
8. I perceive that TB treatment can take at least one year	1	2	3	4	5
9. I perceive that I can die from TB if I do not take my drug regularly	1	2	3	4	5
10. I perceive that there is no cure at present for drug resistance TB	1	2	3	4	5

Section C: Knowledge of TB among Patients Living with TB

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1 In your opinion who can be infected with TB?					
a.Only homeless people	1	2	3	4	5
b.Only alcoholic people	1	2	3	4	5
c.Only people who have been in prison	1	2	3	4	5
d.Only poor people	1	2	3	4	5
e. Only drug users	1	2	3	4	5
f. Only people living with HIV/AIDS	1	2	3	4	5
2 How Someone get TB?					
a. Shaking hands with someone with TB	1	2	3	4	5
b. Through touching items in public places (door knobs, handless in transportation)	1	2	3	4	5
c. Through Germs in the air when a person with TB coughs or sneezes	1	2	3	4	5
d. By inhaling TB germs in the Air	1	2	3	4	5
3. How TB can be Transmitted?					
a. Sharing food	1	2	3	4	5
b. Eating from same plate	1	2	3	4	5
c. By sexual intercourse with TB patients	1	2	3	4	5

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d. Sharing cigarette with infected TB	1	2	3	4	5
4 How can a person prevent TB?					
a. By having BCG Vaccination	1	2	3	4	5
b. Covering mouth and nose when TB patients is coughing	1	2	3	4	5
c. Covering mouth and nose when the TB patients sneezing	1	2	3	4	5

Section D: TB Medication Adherence Scale (TBMAS)

	Yes	No
1. Do you sometimes forget to take your pills?	0	1
2. People sometimes miss taking their medications for reasons other than forgetting. Thinking over the past two weeks, were there any days when you did not take your medicine?	0	1
3. Have you ever cut back or stopped taking your medication without telling your doctor, because you felt worse when you took it?	0	1
4. When you travel or leave home, do you sometimes forget to bring along your medication?	0	1
5. Did you take your medicine yesterday?	1	0
6. When you feel like your illness is under control, do you sometimes stop taking your medicine?	0	1
7. Taking medication every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your TB treatment plan?	0	1

8. How often do you have difficulty remembering to take all your medications?
   a. Almost always
   b. Often
   c. Sometimes
   d. Seldom
   e. Never

Thank you

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Appendix-B: Introduction Letter

UNIVERSITY OF GHANA
DEPARTMENT OF ADULT HEALTH
SCHOOL OF NURSING

SON/A.12

April 18, 2019

Ref. No.:.....

The Chairperson
Research and Ethical Committee
Specialist Hospital
Sokoto

Dear Sir/Madam,

LETTER OF INTRODUCTION

I write to introduce to you Zayyanu Sani, an MSc. student of the School of Nursing and Midwifery, University of Ghana, Legon.

The department has approved his research proposal: **"Determinants of Medication adherence among patients with tuberculosis: A study at Sokoto Metropolis".**

I will be grateful for your approval of the proposal to facilitate data collection.

Counting on your usual co-operation.

You may contact me on gdzansi@ug.edu.gh/ gladysgzansi@gmail.com
Tel. 00233-243059316 if you require any further communication on this subject.

Thank you.

Yours faithfully,

Dr. Gladys Dzansi
Ag. Head of Dept. Adult Health

COLLEGE OF HEALTH SCIENCES
• P. O. Box LG 43, Legon, Accra, Ghana. • **Telephone:** +233 (0) 302 513 250 / 0289 531 213
• **Email:** adulthealth.son@chs.ug.edu.gh • **Website:** www.nursing.chs.ug.edu.gh

Appendix- C: Ethical Clearance

SPECIALIST HOSPITAL SOKOTO

SULTAN ABUBAKAR ROAD
P.M.B 2133, Sokoto, Nigeria

HOSPITAL ETHICS AND RESEARCH COMMITTEE

CHAIRMAN
DR. BELLO U. TAMBUWAL
Chairman Medical Advisory Committee

MEMBER
DR. NASIRU ABDULLAHI
HOD Obs & Gyn.

MEMBER
DR. ALI A. YAROKO
Deputy CMAC/HOD ENT.

MEMBER
BELLO I. LADAN
HOD Health Record

MEMBER
BALA SAIDU
HOD Operating Theater

SECRETARY
USMAN M. MUH'D
Secretary Clinical Services

13th May, 2019

Zayyanu Sani,
College of Nursing Science,
Sokoto.

RE:-APPLICATION FOR ETHICAL CLEARANCE AND ADMINISTRATIVE APPROVAL

With reference to your application No SON/A/12 on the above subject dated 18th April, 2019 on research topic titled "**Determinants of Medication Adherence among Patients with Tuberculosis: A Study at Sokoto Metropolis**".

I hereby acknowledge its receipt and convey ethical committee approval to you.

The approval is given with the understanding that the data obtained would be used to substantiate the above topic.

Please ensure that the study is guided by the methodology presented in the project.

You should submit a copy of the research to the ethical committee after the study might have been completed.

Thank you.

Yours faithfully,

CMAC OFFICE
SPECIALIST HOSPITAL SOKOTO
DATE 17/05/19
SIGN

Usman M. Moh'd
Secretary Clinical Services