UNIVERSITY OF GHANA, LEGON COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

NON-ADHERENCE TO ANTI-TUBERCULOSIS TREATMENT AMONGST PATIENTS IN MONTSERRADO COUNTY, LIBERIA

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THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN APPLIED EPIDEMIOLOGY AND DISEASE CONTROL

DECLARATION

I, Alberta Berlynda Corvah, herewith declare that this research is my independent andoriginal work with the exception of the references made to other people's work which I have honorably acknowledged. I further declare that this dissertation neither whole nor part has been submitted for a degree to any institution or University.

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Date. 12th November 2021

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DEDICATION

I dedicate this work to God Almighty who has given me the strength and endurance to complete this research work. I further dedicate this work to Mr. and Mrs. Boie F.L. Corvah, my sibling Veronica Lue Corvah and my beloved daughter Chrispina D.H. Williams. They have all been a source of constant support and inspiration.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
AFENET	African Field Epidemiology Network
ART	Anti-Retroviral Therapy
BCG	Bacille Calmette-Guerin
CDC	Center for Disease Control &Prevention
CI	Confident Interval
DOT	Direct Observe Therapy
FDC	Fixed Dose Combination
GFELTP	Ghana Field Epidemiology & Laboratory Training Program
GTB	Global Tuberculosis Report
HRE	Isoniazid Rifampicin Ethambutol
HIV	Human Immunodefiency Virus
IRB	Institutional Review Board
LDHS	Liberia Demography Health Survey
MDR	Multi Drug Resistent
MMA	Morisky Medical Adherence
NLTCP	National Leprosy & Tuberculosis Control Program
SDG	Sustainable Development Goal
TB	Tuberculosis
UL PIRE Evaluation	University of Liberia-Pacific Institute of Research &
WAHO	West African Health Organization
WHO	World Health Organization

ABSTRACT

Background

Non- adherence to tuberculosis treatment which serves as one of the most substantial hindrances to TB control is an important barrier and is now influencing TB treatment failure, relapse and death. However, Liberia is amongst countries in the world where national prevalence of TB and non-adherence rate is unknown. Therefore, this study aimed to assess factors related with non-adherence to anti-TB treatment amongst patients in Montserrado County, Liberia

Methods

A facility based cross sectional study was conducted in four (4) health facilities in Montserrado County, 2019. We collected data using semi-structured questionnaire. We useda random number table which is the number between 1 and 7 was selected as a starting point. A skip interval of 6 was used. The Morisky Medical Adherence 8 item scale (MMAS-8) was used to assessed patients' non-adherence level. MMAS-8 is a self-reported assessment tool used to and measure medication-taking behavior. We defined non-adherence as an individual scoring < 6 points in the MMAS-8. Changes between variables were assessed using the chi- square test and Fisher's exact tests. Multiple logistic regression analysis was conducted on allfactors used to declare the independently associated predictors that were statistically significant at a confidence interval of 95% and P value $\leq$ 0.05

Results

A total of 317 TB patients participated in the study. Majority of participants were males and age group 30 to 39years accounted for 90 (28.4%). The overall non-adherence to anti-tuberculosis treatment was 25.9% (95%CI = 21.3 – 31.0%). Almost Half 49 (59.8%) of the non-adherents indicated they had ever missed their appointment. Nonadherence was found to be significantly associated with pill burden (cOR 4.00, 95%CI: 2.10 - 7.65), Changes in family/friends relationship (aOR 8.30, 95%CI: 2.40 - 28.73), longest period of time one failed to take TB medication (cOR 2.48, 95%CI: 1.02 - 6.07), and availability of food intake (aOR 82 ,95%CI:0.32
- 10.29) and patient ease of strictly following medication (aOR 0.051, 95%CI:
0.01 - 0.27)

Conclusion

Our findings proposed that non-adherence was high among TB patients. Non-adherence was higher in male respondents found within the age group 30-39 years. Patients who consumed at least 3-4 pills daily under the direct observation of treatment supporters were less likely to adhere to treatment plan. Family members' poor relationship with patients, lack of transportation and unavailability of drugs contributed to patients' non-adherence. Therefore, we recommended strengthening the health providers to provide constant health education to patients and their families, decentralize TB services and ensure regular supply of drugs for improved adherence.

CHAPTER ONE: INRODUCTION

1.1 Background

Tuberculosis is one key disease which has been contributing to the global problem of disease and is now a major focus recently, predominantly in countries that are still developing where it is closely associated with HIV & AIDS. (GBD Tuberculosis Collaborators, 2018). Usually, pulmonary TB is the one that in the lungs, with extra pulmonary tuberculosis affecting other parts of the body in a few instances (Perrin, 2015). The disease is spread through droplet nuclei. People with TB release droplet nuclei into the air by sneezing, coughing, and laughing(National Tuberculosis Control Program, 2017). Generally, the signs and symptoms include (cough, chills fever, loss of appetite, weight loss) and substantial enlargement of the finger may also occur (Nliwasa et al., 2016). Pulmonary TB patients that are tested positive with *Mycobacterium* tuberculosis by sputum smear- microscopy are at high risk of spreading the infection in the communities. (Uriyo et al., 2006).

In 2015, World Health Organization (WHO) estimated 10.4 million incident cases of TB worldwide of which, out of which almost 55% of the patients' co-mobility with Human immuno-deficiency Virus (HIV) and about 1.4 million deaths, (WHO, 2015). Aica and Asia were the two continents with the heaviest weight, 1.98 million of TB cases. The percentage of known HIV-positive TB patients on antiretroviral therapy (ART) was 78% globally.

According to WHO GTB report (2017), TB mortality rate in Liberia is high on a yearly basis and the incidence of tuberculosis is significantly increasing from year to year. In the year 2016, WHO projected additional number of TB in Liberia to be 14,000 cases (308 per 100,000); and estimated that people with co-mobilities of both HIV positive and TB cases was 2,200 cases (48 per 100,000) (LDHS, 2007). NLTCP has developed a well-structured guidelines and cost

plan for TB Infection Control. The guidelines have been rolled out in five health facilities that have constantly reported a high number of TB cases in Montserrado County.

In WHO plan to stop TB globally, reports showed that poor treatment has caused the growth of Mycobacterium tuberculosis and hence do not respond to the standard treatment of first-line TB medication (WHO, 2015). Tremendous efforts have been made by the global community to control tuberculosis such as BCG vaccination, anti-tuberculosis drugs and Direct observed treatment short course (DOTS) in order to control the adverse effects of non-adherence (Zumla et al., 2015). DOTS (directly observed treatment, short course) are the internationally recommendedcontrol strategy for TB. Globally, WHO has reported that more than 30 million patients with TB have been treated with its five-element DOTS strategy, resulting in cure rates of > 80% (WHO, 2011). Liberia is among countries implementing DOTS and emphasized that Treatment observation is not just to supervise swallowing of anti-TB medicines. It initiates services which ensures cure, protects patient's family and community, leads to community awareness and participation and helps in reducing stigma of TB. Although DOT is necessary because it is difficult to reliably predict which patients will be adherent, this must be done after discussion andagreement with the patient (NLTCP Guidelines, 2017)

There are challenges associated with adherence to Anti-TB treatment because the treatment duration is long and involves taking a number of medications which is accompany bycommon side-effects and the patient usually feels better long before treatment has been completed (Amuha, Kutyabami, Kitutu, Odoi-Adome, & Kalyango, 2009a). Almost half of TB patients do not complete treatment, which contributes to prolonged infectiousness, drug resistance, relapse, and death (S. A. Munro et al., 2007a).

1.2 Problem Statement

Globally, non-adherence to TB treatment is an important barrier and it is a factor immensely influencing low treatment success therefore, serving as the most significant obstacles to TB

control (Gebreweld et al., 2018). In sub-Saharan Africa, the rate of non-adherence range from 11 to 30% and is considered high among patients with TB (Castelnuovo, 2010). A retrospective unmatched case control study in Uganda revealed important factors hindering treatment success in a hospital background was low adherence to anti TB treatment (Namukwaya, Nakwagala, Mulekya, Mayanja-Kizza, & Mugerwa, 2011).

The burden of TB remains a serious problem in many countries including Liberia. Tuberculosis yearly death rate remains high. WHO GTB report (2017) revealed 60 out of every 100,000 populations died of TB among HIV negative TB patients while 21 per 100,000populations died among the TB/HIV co-infected patients in 2016. Despite progresses made towards achieving global targets for reductions in the heavy load of TB, the burden of HIV epidemic on TB control has influence on the outcome of treatment.

Liberia Tuberculosis Control program (NLTCP) was established in1976 with support from the government and international partners. The program had established DOTS and Microscopic centers for nationwide TB activities in all health facilities. However, the National Leprosy and Tuberculosis Control program recorded 7,180 all forms of TB cases notified, 7,105 (98.9%) were incident TB cases (New and Relapse); With incidence still high among the reproductive age. Treatment and retreatment success rate is < 80 % (Guidelines for the management of Tuberculosis in Liberia, 2017). According to WHO standards, TB patients' adherence levels are expected to be > 90% in order to enable a person to be cure. Treatment adherence is a difficultand active marvel with a wide range of interacting factors impacting treatment taking behavior. It poses a major threat to both the individual patient and public health which may increase the rates of spread, diseases and expenses of TB services (Zafar, 2013).

Tuberculosis (TB) is nearly always curable if patients are treated with effective, uninterrupted anti tuberculosis therapy. (Adane, Alene, Koye, & Zeleke, 2013a). Adherence to treatment is

critical for cure of individual patients, controlling spread of infection, and minimizing the development of drug resistance.

One known fact from a study conducted in Kenya proved that the level of income influences completion of tuberculosis treatment among patients; and most especially knowledge about tuberculosis influences the treat of medication adherence among patient (Ndwiga, Kikuvi, & Omolo, 2016). Patients are classified as non-adherent if they missed more than 20% of the prescribed doses during the treatment period recommended by WHO.

Montserrado County being densely populated hosting the industrial city Monrovia, has a total of 5282 patients in 2018, 755 defaulted and only 2814 out of the total number enrolled on the anti-TB treatment with treatment success rate 29%, despite the availability of treatment at no cost.

An evaluation was conducted on the performance of the Liberia National Leprosy and TB Control (NLTCP) outlined patient factors such as limited TB knowledge provided by health workers, lengthy stay at the hospital to access care, Hospital factors including poor health-provider relationship were some of the key issues obstructing tuberculosis services in Liberia. (Desta, Masango, & Nkosi, 2018a). Hence, Liberia is amongst countries in the world where national prevalence of TB and non-adherence rate is unknown and the accurate national TB burden may not be established (Desta et al., 2018a).

Improving case management and excellence of life for tuberculosis patients in Liberia,Ministry of health with support from partners should ensures that the drug treatment for tuberculosis is free at twenty-three (23) health facilities in Montserrado County.

Non- adherence to tuberculosis treatment seems as one of the most important hindrances to TB control thus serves as a factor influencing TB treatment failure (Karimy et al., 2014) . TB treatment non-adherence remains throughout the nations, and it stretched its possible penalties

such as early treatment failure and relapse, that can spread as more disease burden, mortality, extended transmission of the disease and growth of drug resistance of M. tuberculosis (Tola, Tol, Shojaeizadeh, & Garmaroudi, 2015). However, the corner stone to good treatment success depends on gaining adequate knowledge and provided intervention on related factors which influence TB patients' capability to encourage treatment non-adherence. Moreover, knowledge gain on related factors in the community, including family members and patients as well as the hospital, are very important to include in further research study. Therefore, this cross-sectional study is intended to determine the Non-adherence level to TB treatment among TB patients. Hence, the results from this study will provide information which will aid in minimizing the related factors outcome to enhance treatment adherence and treatment success in Liberia.

1.3 Justification

Adherence is one critical factor in determining treatment success. However, Cure and treatment success rate is poor in Liberia especially in Montserrado County which has not met the national set target 85%. Bagchi et al estimated low level (40%) of adherence among TB patients in developing Countries (Bagchi, Ambe, & Sathiakumar, 2010). Identifying patient related factors (Finlay et al., 2012), will aid decision makers and health authorities to develop policies in orderto minimize or solve the problem. For example, patients lack of knowledge on TB may contributeto increased level of non-adherence. In addition, policy making and health intervention planning are largely dependent on established knowledge. Understanding how socio-cultural related factors, for instance, unemployment and lack of family support, contribute to TB treatment non- adherence will help to strategically position the National Tuberculosis & Leprosy Control Program (NTLCP) to address the condition by adopting context specific approaches to treatment. Little is known about TB treatment non-adherence in Liberia hence, study to determine TB treatment adherence and risk factors associated is yet to be conducted. Knowledge gap on the non-adherence level still exists among TB patients and

care givers. (Desta, Masango, & Nkosi, 2018b) Therefore, limitations of such have the tendency to increase the prevalence of TB cases as well as shortening life span. Thus, this study which seek to determine non-adherence level among patients will be used as a baseline for Montserrado County in Liberia.

1.4 Conceptual Framework

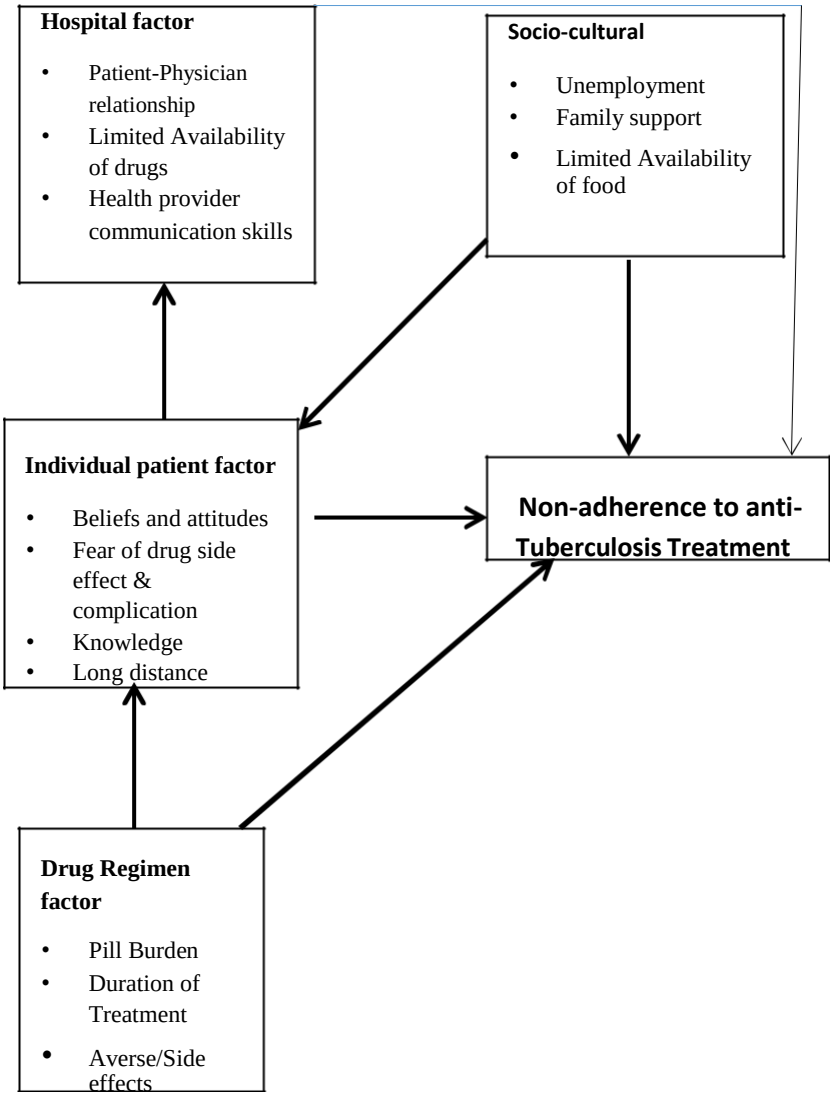

Figure 1: Conceptual Framework

The conceptual framework illustrates the factors that are related to the non-adherence of tuberculosis treatment among patients in Liberia, Montserrado County. This conceptual framework consists of hospital factors, socio-cultural factors, individual patient's factors and

drug regimen factors. These factors influence each other as they all are linked to the outcome (non-adherence).

1.4.1 Socio-cultural

Socio-cultural related factors may be associated with non-adherence such that stigmatization on oneself has an equal harmful effect on the psychological welfare of tuberculosis patients which may frequently lead to non-adherence. Patients' comfort and feelings while taking the treatment depends on their relationship between relatives and love ones and health provider. Other contributing factors like age, gender and unemployment can lead to low social support thereby hindering patients from getting their treatments. Patients may experience problems in accessing TB treatment considering the distance of the referral hospital. The linkage between the socio-cultural factors and the patient factors explains that due to the fact that patients may be unemployed and don't have money to transport themselves to the long-distance hospital to get their medication.

People with tuberculosis tend to be out of job and unable to fend for themselves and family member which may lead to lack of nutritional diet that would help boost and strengthen their immune system to help fight against the sickness. Conventionally, TB patients on medication usually have an aggrandized craving or hunger. Howbeit it a positive signal showing medical feedback, among people with limited access of food. However, insufficient food may pose a threat to treatment adherence. (Muture et al., 2011a)

Showing the relationship between patient factors and non-adherence, the conceptual framework also illustrates that the patient's attitudes and beliefs concerning how effective the treatment is and experiences with other diseases or therapies affect the degree of adherence to treatment. Most patients refuse to continue treatment after been diagnosed because of the denial or the willingness to accept their results. And due to the perception of some patients that tuberculosis is witchcraft or spiritual issues, the preference to use traditional medicine becomes

a solution therefore leading to non-adherence of the TB treatment. Patients may stop taking the treatment sometimes within the first 3 months if they feel a little better or even forget to take medication once away from home or involvement into some domestic activities. Hence making the need for a treatment supporter very important.

Hospital factors influencing patients' non-adherence shows that TB treatment involves a lot of interaction between patients and health care workers. Sometimes the hospitability received by health care workers including whether effective communication takes place and patient-provider relationship appear to have a major impact on patients' adherence. Thus, the unpleasant attitude of the health care worker makes patients feel unwelcome to go back at the facility to abandoning treatment. (Ibrahim et al., 2014)

Considering the aspect of confidentiality, some health workers tend to disclose the identity to other people instead of protecting the patients' records. With that, the patients break the trust and stop going to the hospital for treatment which leads to non-adherence.(Dodor, 2012) Inadequate drug distribution and the shortage of hospital beds leave the patients with no choice but to return home where he or she will not be directly observed by a health care worker to ensure completion of treatment.(Bagchi et al., 2010) The conceptual framework also indicates that hospital factors influence patient factors which explain that the good communication skills that health care workers possess enable them to provide the adequate knowledge to patients about TB, its sideeffects to treatment and also the long duration of treatment.

Failure on their part to communicate effectively with patients, the knowledge gap will exist and patients wouldn't know the importance of the TB treatment and may tend not to adhere to the prescribed treatment.

On the other hand, drug regimen Factors are also linked to non-adherence knowing the fact that the duration of the multiple pill treatment is long; some patients see it as a pill burden. Pill

burden can also cause meaningful side effects. Some mutual temporary side effects include: skin rash or itchiness, pain fatigue, nausea, weight loss, loss of appetite, numbness or tingling in the in the hands and feet. The frequency, timing and number of pills may also be inconvenient for them therefore leading patients into non-adherence to their TB treatment. The conceptual framework also shows a relationship between drug regimens related factors and patient related factors which explain that patients experiencing side effects of the TB drugs may fear that those effects may continue considering the long duration of the treatment. And also due to fear of drug side effects, patients may develop some traditional beliefs or attitude that the disease is as a result of witchcraft and may want to seek care at a herbalist therefore causing patients not to adhere to the medication.

1.5 Research Questions

1. What is the adherence level to anti-TB treatment among patients in Montserrado County, Liberia
2. What are the patient factors associated with non-adherence among TB patients in Montserrado County, Liberia
3. What are the drug regimen factors associated with non-adherence among TB patients in Montserrado County, Liberia
4. What are the hospital factors of non-adherence among TB patients in Montserrado County, Liberia
5. What are the socio-cultural factors associated with non-adherence among TB patients in Montserrado County, Liberia

1.6 Main Objective

- To assess factors associated with non-adherence to anti-treatment among patients in Montserrado County, Liberia

1.7 Specific Objectives:

1. To determine the level of non-adherence to TB treatment among patients in Montserrado County, Liberia
2. To determine patient related factors associated with non-adherence among TB patients in Montserrado County, Liberia
3. To identify socio-cultural related factors associated with non-adherence among TB patients in Montserrado County, Liberia
4. To identify drug regimen related factors associated with non-adherence among TB patients in Montserrado County, Liberia
5. To identify hospital related factors associated with non-adherence among TB patients in Montserrado County, Liberia

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Tuberculosis (TB) is considered one of the major public health threats affecting people of all ages and sex and seems to be competing with the human immunodeficiency virus (HIV)(Woimo, Yimer, Bati, & Gesesew, 2017). Although observations over the last decade shows decline in the trend of TB incidence and prevalence, globally efforts made to reduce TB required enormous resource investment which seems to be out of reach (Woimo, Yimer, Bati,
& Gesesew, 2017). Tuberculosis is a disease which is associated to poverty excessively disturbs the poor, susceptible and marginalized clusters of population anywhere it arises (WHO, 2017).

In 2018, World Health Organization (WHO), estimated about 10 million TB cases worldwide. Majority of the cases were from Africa including other developing countries. According to the report on TB statistics Worldwide, Africa and South East Asia have the highest TB burden (WHO, 2013).

The prevalence of sputum smear positive TB during the same period was 2.7 million in Africa and 4.8 million in South East Asia compared to less than a million new infections in both Europe and the Americas (WHO, 2013).

Amongst the countries with highest burden worldwide, China has one of the greatest amounts of Tuberculosis cases following the “Stop TB Strategy” by WHO, active medication seems important to regulate TB progress and growth (Gong et al., 2018). TB medication requires long duration therefore; patients are most likely to adhere. Globally, most recent data shows rising trend in the of new cases of TB because of the increased and floating population, the increased incidence leads to drug-resistant TB, latent infection, and the AIDS epidemic (Ragonnet, Trauer, Denholm, Marais, & McBryde, 2017). There was a slow decline in the number of new TB cases worldwide from 1997 to 2001, with an increase in 2001 (due to the rising number of cases amongHIV-infected patients in Africa) (WHO, 2013). In 2015, the case fatality rate of

Tuberculosis varied from country to country which range from less than 5% to above 20% in most countries in the WHO African Region (World Health Statistics 2017). This points out the more inequities that are fixed in access to high-quality testing and treatment services, extensive poverty, non-adherence and minimum protection (World Health Statistics 2017). Generally, the world is progressing in achieving the sustainable development goal (SDG) of reducing total deaths due to TB by half and ending TB epidemic by 2030. (GTB, 2019).

2.2 Anti-Tuberculosis Treatment

There are consistent anti-TB treatments endorsed and approved by WHO include the first two month regimen two months (intensive phase) isoniazid, rifampicin, pyrazinamide, and ethambutol and then continuation of the other drugs; isoniazid and rifampicin with (HRE) or without (HR) ethambutol where there is high resistance (continuation phase for four (4) months (WHO, 2016). The long duration of the treatment can impact patients' adherence unpleasantly (Zumla 2014).

A fixed-dose combinations (FDCs) of drugs was recommended by WHO to be used for the treatment of all TB patients. Numerous advantages of FDC s over specific medicines (or single-drug formulations) have been identified and these include a high likelihood of prescription errors being less frequent, and patients having to swallow fewer tablets which may encourage adherence to treatment (WHO, 2016). Adherence to tuberculosis treatment has been discovered to be a driving force and one of the best the strongest factor of improved treatment outcome.

In Liberia, patients are bein diagnosed as having TB, by the physician and the appropriate treatment regimen is prescribed according to the categories, depending on the history of previous treatment and results of investigation. The treatment strategy for TB is based on standardized Directly Observed Treatment Short course (DOTS). Appropriate patient center and convenient DOT provider should be identified for treatment and follow up of the TB patient that are Drug Susceptible and Drug resistant. Patient organized grouping and registration

enables health workers to assign medications. This process is used for recording and reporting. This process distinguishes new from old patients who had prior treatment. Each patient groups æ registered based on the outcome of their prior treatment course such as failure, relapse and loss to follow up. The NLTCP has recommended the Six (6) and Twelve (12) months regimens for treating patients with drug susceptible TB (DS-TB) in Liberia. They include:

- Six (6) month regimen for Adult or children with all types of Tuberculosis other than Tuberculosis Meningitis and extra-pulmonary Tuberculosis
- Twelve (12) month regimen for treating Adult and children with TB Meningitis and TB of the bone and joint

Tuberculosis treatment consists of two phases namely: an intensive phase and a continuation phase and the number of drugs varies in each phase according to the classification ofcategory: Intensive Phase (shorter duration consisting of 2-month duration of four drugs) and continuation phase (longer duration consisting of only two drugs).

2.3 Definition

The definitions of adherence vary from research to research. WHO defines adherence to treatment as the level to which a one's medication-taking attitude matches with arranged prescription given by health care providers. This means that a patient has agreed to strictly go by the prescribed medications for the suggested length of time. Non adherence is failure or refusal of the patients to take the prescribed TB medication. Patients may be non-adherent during different stages of their treatment process

2.4 Concept and level of Adherence and non-adherence

In the situation concerning tuberculosis treatment, adherence and compliance are sometimes used interchangeably for illness which requires long term treatment but they may impose different views. But adherence to treatment involves the patient's consent and obligations to the recommended treatment. Furthermore, it is also thought that patients have a good

partnership with health providers. The rate of adherence to long-term TB treatment in developing countries are lower than the average 50% as compared to developed countries (WHO, 2016). There is also an undeniable fact that many patients experience difficulties to strictly follow treatment procedures.

Patients' ability to follow treatment plans in an appropriate way is most often endangered by barriers, frequently associated to different parts of the problem including social and economic factors, health care team/system, and characteristics of the disease, disease therapies and patient-related factors. It is necessary to solve the problems related to each of these factors if there's a need to improve patients' adherence to TB treatment. More than 90% level of TB treatment adherence to is required for patients with TB in order to achieve treatment success (Gube et al., 2018).

The various stages of adherence to treatment varied among populations and locations. However, several studies done in Africa show low level of non-adherence. Non-adherent level was shown to be 30% among TB patients from a study conducted in Ndola, Zambia. (Ubajaka, 2015). Study in Uganda showed one (1) in every four patients was non-adherent to TB treatment (Amuha et al., 2009a). In China, patients not adhering to TB treatment was of 34% (Tang et al., 2015). Patients rural China non-adherence level were assessed using the Moisky Medical Adherence (MMAS-8) scale for the first time. (Xu, Markström, Lyu, & Xu, 2017).

There is limited data on peoples' opinions on factors associated with good adherence in Liberia, hence the need to assess factors associated with non-adherence to TB treatment. Information gained from this will serve as springboard for further studies in this field of research as well as enhance the prevalence of TB treatment among patients in Montserrado County, Liberia.

2.5 Factors associated with non-adherence

Factors depend on acceptability and receptiveness of the health care and nature of treatment. These factors are discussed below under four main headings: patient related, health system related and socio-cultural factors. According to the national TB guidelines, all detected old and new TB cases that are susceptible to Rifampicin should be treated with the 6- or 12- months regimen as appropriate.

2.6 Patient related factor associated with non-adherence

2.6.1 Knowledge

In Liberia, TB treatment strategy is based on standardized Directly Observed Treatment Short course (DOT). Patients with personal illness struggle to meet up with medication schedules, and most often financial burden associated with the expenses in covering long distances to seek care. Patients' awareness, behavior and views about TB long duration of treatment can filter information and care provided by the health services. Patients may interpret disease conditions differently from health (S. A. Munro et al., 2007a). If the health professionals do not have the adequate knowledge about the disease and its side effects, they may not be able to provide the appropriate information for patients. For example, studies conducted in Ethiopia showed that poor patient-provider relationship was significantly associated with non-adherence to TB treatment (Mekonnen & Azagew, 2018).

Stigma and forgetfulness play are major factors associated with non-adherence (Adane,Alene, Koye, & Zeleke, 2013b). Study conducted in Uganda explained that patients tend to have inadequate TB knowledge and consult traditional healers which leads to poor adherence to Tuberculosis treatment

2.6.2 Forgetfulness

Patients sometimes forget to take medications most especially when away from home. In Liberia, patients are placed on returned schedule to refill their medications. Patients missed their doses of treatment because they wait for all the medication to finish and forget to return

to the health facility to refill. (Kebede & Wabe, 2012) Studies conducted in Baringo-Kenya, revealed forgetfulness as one of the main reasons for interruption of treatment and non-adherence.

A systematic review conducted in Ethiopia presented that patients who forget to take their treatment had a higher risk of non-adherence to TB treatment (Zegeye et al., 2019). In consistency with studies conducted in separate districts of Ethiopia previously, a study highlighted a strong association between forgetfulness and tuberculosis treatment non-adherence. An increased level of patients' forgetfulness positively affects patients' non-adherence to treatment. (Awole, Gebre-Selassie, Kassa, & Kibru, 2003). Forgetfulness was discovered to be the key cause of increase in patients' non-adherence to tuberculosis treatment in an Ethiopian cross-sectional survey (Adane, Alene, Koye, & Zeleke, 2013).Other studies conducted reviewed that habitual alcohol intake (alcohol abuse) give rise to forgetfulness and prevent patients from sticking to their medication and subsequent non- adherence (Muture et al., 2011a).

2.6.3 Fear of drug side effect/complications and denial

According to investigations previously conducted, two major factors in rural Pakistan affecting patients' adherence were found to be inherited fears and supernatural beliefs (Bagchi et al., 2010). Side effects were mentioned as one of the factors for non-adherence by participants in one study. Patients' fear that the danger in the side effect of the drugs always make them feel tired therefore they discontinue taking the TB medication. Common themes across some other studies are fear and diagnosis denial. In another study, Khan et al explained that patients frequently frowned against disclosure of illness while having difficulty accepting their diagnosis (A. Khan, Walley, Newell, & Imdad, 2000).

2.6.4 Beliefs and attitudes

Some TB patients believe that tuberculosis is a spiritual disease that needs to be treated by spiritual or traditional healers. Gugssa et al found that patients' traditional belief for curing TB was associated with non-adherence to TB treatment. In this study, more than half of the patients admitted using to traditional medicine during and after TB treatment in order to ease their body discomfort as well as cover up for the drug side effects (Gugssa Boru, Shimels, & Bilal, 2017). Traditional healers and their practices are common in South Africa. Finlay et al. (2002), argued that reliance and use of herbal treatment impeded treatment completion. Other study explained that patients preferred consultation with traditional healers as compared to health care givers atthe health facilities (Edginton, Sekatane, & Goldstein, 2002). In this study, new patients were more likely to default if they consult traditional healers during TB treatment. Delay in rapid diagnosis have been defined in numerous reports as a result of patients consulting traditional healers for care. This negatively influence morbidity and mortality from tuberculosis (Finlay et al., 2012), Non-adherence to treatment may also be influenced by patients own behavior and lifestyles. In India, alcohol consumption by patients while on treatment was discovered as one of the risk factors associated with non-adherence (Bagchi et al., 2010).

A study finding explained that alcoholism was a major issue contributing to tuberculosis patient non-adherence receiving DOTS treatment in Denver, Colorado, USA.

2.6.5 Long Distance to facility

The authors in Ethiopia revealed that patients were approximately three times more likely to abandon treatment if they need financial assistance paying for transportation cost (Gugssa Boru et al., 2017). When there is a difficulty in accessing a health facility, patients may see it as a constraint in going for refill of their medication which may in turn lead to break in treatment of non-adherence to treatment. A tuberculosis clinic was located within 6–10 km for 44% of patientsin Pakistan, while 27.7% patients had to travel a distance of 11–20 km before reaching atuberculosis clinic. In some (5%) cases, the nearest tuberculosis clinic was 30 km far away,

or more (WHO, 2006). In Liberia, especially Montserrado County, there are twenty-three (23) health facilities detecting and reporting tuberculosis but twelve of those health facilities (not centrally located) are administering tuberculosis treatment.

Therefore, patients may live far away from a referral treatment facility. This contributes to non-adherence to the tuberculosis treatment.

2.7 Hospital factors associated with non-adherence

2.7.1 Inadequate drug supply

Some health system factors can directly or indirectly affect patients' adherence to treatment. Hospital factors such as lack of health workers training and supervision contributes to patient behavior in treatment adherence. (Jaiswal et al., 2003). In Liberia, a performance-based evaluation was conducted and indicated that the reports from facilities and respondentsshowed that one major problem considered in providing services to patients is the shortagesof anti-TB drugs (Desta et al., 2018b). Limited drug supply at the hospital and patients not supervised to take their drugs may be associated to non-adherence to treatment. Bagchi found that inadequate drug supply was absolutely associated with non-adherence among TB patients (Bagchi et al., 2010). According to Bagchi et al, 8% of patients interviewed, who missed their treatment dose was non-adherent due to non-availability of drugs.

2.7.2 Health Provider Communication skills

In treatment adherence, lack of health workers training and supervision contributes to patient behavior (Jaiswal et al., 2003). Health provider should directly observe patients while on treatment by visiting the patients' home to conduct counseling on treatment and prevention of TB. In order for health provider to conduct effective counseling, their skills may be dependent on the appropriate use of treatment guidelines (Mala, Moser, Dinant, & Spigt, 2014).

The national TB control program guidelines emphasize that TB treatment observation is not just to supervise swallowing of anti-TB medicines but it ensures adherence, cure, protects

patient's family and helps in reducing stigma of TB. (NLTCP Guidelines, 2017). One major challenge in South Africa is DOT implementation which created a situation where patients complained supervision were not provided for them by health provider when they took their TB treatment (Finlay et al., 2012).

2.7.3 Patient-Physician relationship

The communication between health care providers and the patients is vital to treatment adherence. Limited flexibility from health care provider to patients can also affect the adherence level. For example, sometimes, health providers tend to scold patients for improper behavior such as coughing and spitting in public without covering their mouths with cloth or mask.

This explains why Dodor & Afenyadu, (2005) pointed out that the cordial relationshipbetween patients and health providers encourage patients to complete treatment.

This serves as one major contributing factor to patient adherence to treatment. Patients become uncomfortable and afraid of being stigmatized when waiting time at the health facilities is prolonged due to delay in laboratory test result, drug assess or misplaced folders (Segagni Lusignani et al., 2013). Studies found that failure by healthcare provider to establish good relationship with the lead to significant levels of non-adherence.

Creating a conducive environment provide comfort for patients and might also help the them to express their feelings during the course of treatment to health care providers. But on the contrary, patients might feel worse about their ill condition as if they are hopeless. Health workers' attitude towards patient's happiness has been emphasized in few studies (Roy et al., 2015)(Vijay et al., 2010). Some studies outlined poor communication as a barrier between patients and providers. And this situation was being linked to poor adherence (Mishra, Hansen, Sabroe, & Kafle, 2006). Lack of good communication quality might expose the position of the relationship between the patient and health provider and also impact patient conducts, whether

good or bad (S. Munro, Lewin, Swart, & Volmink, 2007). Health workers' unfriendly attitudes, to patients have a tendency to discourage patients from seeking treatment or meeting appointed schedules. Study conducted in Ghana explained that most patients depreciated the attitudes and behaviors exhibited by professionals towards them. Furthermore, such attitudes affect their confidence and their relationship to others in the community (E. A. Dodor, 2012).

2.8 Drug Regimen related Factors associated with non-adherence

2.8.1 Duration of treatment

In Liberia, Tuberculosis treatment duration last for six (6) months which consists of two phases: Intensive phase and continuation phase and the number of drugs varies in each phase according to the classification of category (NTLP, Guidelines, 2017). The long duration of the drug embarrasses patients and affects the patients' lifestyle thereby experiencing side effects and influencing non-adherence. A systematic review revealed that current long-term drug regimen and increased number of tablets per dose were important factors for TB treatment non-adherence (S. A. Munro et al., 2007a). Hence, patients must be educated on thedrug side effects and counseled regarding the burden of pill taken in order to maintain a good adherence to treatment.

2.8.2 Side/Adverse Effect

According to Mkopi et al. (2013), possible side effects of tuberculosis include vomiting, severe headache, limp pains, rashes, swollen feet and reduced visual capacity. Patients are more likely to abandon treatment when they are not informed of drug side effect and how to manage them (Munro et al., 2007). The same study explained that some healthcare providers pay no attention to patient's complaints on drug side effect. A study report in Kenya findings showed significant association between occurrence of medication side effects and non- adherence to tuberculosis treatment (39% vs 31% $p<0.005$). The frequency of the drug side effects reported in one study showed more non-adherence to tuberculosis treatment duringthe early phase (intensive phase) (Tola et al., 2016).

2.8.3 Pill burden

A study conducted in India, people with TB were less likely to take their medication because of the numerous pill and various associated adverse effects. World Health Organization (WHO) recommends at least six months as a duration for TB patients to take prescribed dosages of their treatment on a daily basis (WHO, 2017). During the first phase of treatment, four (4) pills are taken every day. Patients in the second phase (continuous) had an increased odds of non-adherence to their treatment as compared to those in the first phase (intensive) (Amuha et al., 2009a). In Uganda, similar findings were observed in a study conducted showed an increased odds of non-adherence among patients in the continuous phase oftreatment compared to those in the first phase (Adisa, Ilesanmi, & Fakeye, 2018). Jaiswal etal found a significant effect of pill burden on the level of adherence to medication among Tuberculosis patients (Jaiswal et al., 2003).

2.9 Social-cultural related factors associated with non-adherence

2.9.1 Unemployment

A good financial or employment status may influence adherence level among TB patients. When patients migrate due to occupational reasons other and domestic problems makes a case to become non adherent (Health Rai, 2007). Another studies identified, unemployment as a predictor of treatment non-adherence (Furlan, Oliveira, & Marcon, 2012). A cross-sectional study in Brazil indicated unemployment contributes to a poorer economic condition which in turn may be a reason for treatment non-adherence. Moreover, in the same study, homeless and unemployed people may have the tendency to be more vulnerable to TB, also showing more risk of non-adherence because of poor living conditions and the use of legal or illegal drugs (Heck, da Costa, & Nunes, 2011).

2.9.2 Family Support

An Indian study indicated that family and social support given to patients needs to be both practical and emotional (Pandit & Choudhary, 2006). In 2018, a study conducted in Kenya found that patients with treatment supporters had higher rate of non-adherence level to TB treatment (38% vs 31 vs: p<0.005%). Sometimes family tend to be the source of inspiration and comfort for those ill patients who feels discouraged about their condition. In Liberia, most times to help improve the successful outcome of the treatments, patients are requestedto bring along a close family relation who serves as a treatment support in the course of medication. The reality is that TB patients are often weak and need support and motivation tobe able to continue treatment. Moreover, some patients are likely to discontinue treatment due to lack of family support. (Cele, Knight, Webb, Tint, & Dlungwane, 2016)

2.9.3 Limited Availability of food

Limited food most often an increased amount of non-adherence (41%: p<0.041) (Report, 2018). Therefore, patients who are financially challenged and can't afford to buy food may feel discouraged to adhere to the treatment. In Addis-Ababa, a study emphasized factors that enables treatment adherence such as more provision of food and limited financial support (Gebremariam, Bjune, & Frich, 2010). In this study, the results further explained patients' beliefs that the less intake of food makes it difficult to tolerate the drugs. Patients with inadequate income stated that lack of food affects their treatment. Patients also mentioned that it is harmful to take medicine on empty stomach, therefore, it is preferable to eat a full meal before taking the drugs. Report in Kenya explained that the relationship between insufficient food for persons with TB and non-adherence emphasizes the need to integrate TB care with other patient support programs.

CHAPTER THEE: METHODS

3.1 Study Design

This research was a cross sectional study that employed a quantitative data collection approach. This study method was used by the researcher to identify factors that affecting the adherence level of patients on tuberculosis treatments.

3.2 Study area

The study was conducted in Montserrado County which is one of the 15 counties in Liberia. It is located southwest Liberia bordering three other counties (Margibi, Bong and Bomi). Geographically, Montserrado County is made up of urban Monrovia, Greater Monrovia, and rural Montserrado. Monrovia and Paynesville Cities are the only urban areas of Montserrado County. The rest of the county (85%) is rural. Montserrado has seven (7) health districts and 351 health facilities including 23 tuberculosis treatment and 18 gene-experts testing centers with Monrovia being its capital. Montserrado is the smallest county by size at 1,909 square kilometers (737 sq mi), but largest by population at 1,293,349 or approximately 33% of Liberia's total population. The population density is 599.7 inhabitants per square kilometer (1,553/sq mi), the highest in Liberia.

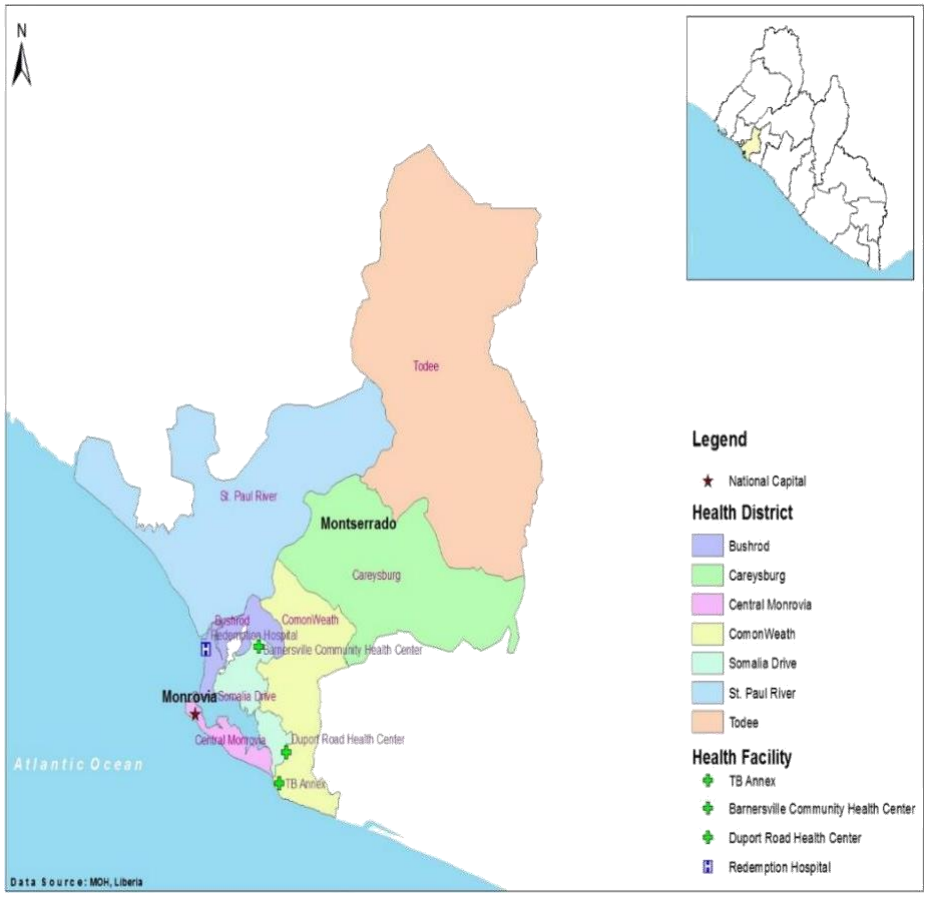

Figure 2: Geographical locations of Study area; source: Author's construct, 2019

3.3 Variables

3.3.1 Dependent Variables

- Non-adherence to anti-tuberculosis treatment among patients in Montserrado County, Liberia

3.3.2 Independent Variables

- Drug regiment factors (pill burden, side effect, duration of treatment), Individual patient factors (fear, beliefs and attitude, knowledge, socio demographics), hospital factors (patient-physician relationship, availability of drugs), socio-cultural factors (family support, unemployment, availability of food).

Table 1a: Operational definition of the demographic characteristics

Variable	**Operational definition**	**Scale measurement**	**Source of data**
Age	Age as at last birthday	Continuous (years)	Questionnaire
Sex	Male or female	Binary	Questionnaire
Occupation	Respondent's occupational status	Categorical	Questionnaire
Educational status	Highest formal education achieved • No education • Primary school • Junior high school • Senior high school • Tertiary/university	Ordinal	Questionnaire

Table 1b. Operational definition on reasons for self-medicating with antibiotics

Variable	Operational definition	Scale of measurement	Source of data
Time spent	Spends long hours at the hospital • <1 hr • 1-2 hours • 2-3 hours • >3 hours	Categorical	Questionnaire
Cost	High cost of hospital fees	Binary (yes/no)	Questionnaire
	Previous successful use Relative/ friend's recommendation		
Distance	Hospital is farther away from where patient is	Binary (yes/no)	Questionnaire
	From home to hospital _____hours _____mins _____km	Categorical	Questionnaire
Relationship	Patient and physician relationship	Ordinal Very good Good	Questionnaire
	Health provider communication skills	Fair	
Drug	Treatment time too long	Binary (yes/No)	Questionnaire
	Pills too plenty Ill feeling from pill		
Support	Employed or unemployed	Binary (yes/No)	Questionnaire
	Availability of food Treatment supporter		
Knowledge	(family)	Binary (yes/No)	Questionnaire
	Informed about illness		

3.4 Study Population

The study target population included all sputum smear positive pulmonary tuberculosis patients

> 18years of age who have started treatment regimen and expected to complete treatment.

The study also targeted those patients seeking treatment care at three (4) treatment centers.

3.5 Sampling

Sampling Size Determination

The minimum size was determined using the estimated prevalence of 25% non-adherence among sputum smear positive TB patients found in an Ugandan study. (Amuha et al., 2009a) The sample size was calculated here using the Cochran formula at desired level of 10% precision non-response rate and 95% confidence interval.

$$n = \frac{(Z)^2 \times P\,(1-P)}{(d)^2}$$

n=minimum sample size

p=prevalence of non-adherence (p 25% =0.25)

d= margin of error (5%)

Z= value for confidence interval

$$n = \frac{3.8416 \times 0.25\,(1-0.25)}{(0.05)^2}$$

$$n = \frac{0.7203}{0.0025}$$

$$n = \frac{288.12}{}$$

n=288.12

Non- response rate 10%

10×100/10=0.1

0.1×288.12=28.8

288.12+28.8=**317**

3.6 Inclusion criteria

1. Sputum smear positive pulmonary TB cases registered
2. Clients who were expected to complete treatment and also transferred in cases
3. patients ≥18

3.7 Exclusion criteria

All patients seriously ill and admitted, extra-pulmonary cases (TB outside the lungs), transferred out patients to other facility. Exclusion criteria was determined based on health facility records.

3.8 Sampling Method

The health facilities reporting the maximum number of TB cases reported for 2018 were selected. All 23 health facilities reporting and treating TB in the seven health districts of Montserrado County were included to determine the non-adherence to anti TB treatment among patients. Health facility was randomly sampled (Simple random) in order to have a true representation of patients on treatment in each health facility to be interviewed. Samples were then proportionately assigned to four of those health facilities based on their estimated annual data on smear positive pulmonary TB patients on treatment.

3.9 Participants Selection

The study employed a systematic random sampling method to select study participants in the four health facilities. We calculated the sampling interval to be 7. We used a random number table which is the number between 1 and 7 was selected as a starting point. A skip interval of 6 was used Health records was reviewed by the researcher at the health facilities to obtain information of patients that are sputum smear positive. Patients' details were abstracted including their medication schedules. All patient meeting the criteria who visited the private and governmental health facilities on the appointed medication dates, were randomly selected. Patients whose medication schedule was outside of the data collection period were contacted through a phone call. And selected participants who could not be reached or traced were replaced by the next available patient.

Table 2: Study sites and sample population

Health facilities	# of TB patients on Treatment	Proportional sample
National TB & Leprosy Hospital	718	106
Duport Road Health Center	607	90
Barnersville Health Center	412	61
Redemption Hospital	402	60
Total	**2139**	**317**

nx=Nx/N*n

nx- number of patients required Nx- number of

patients on treatment in each hospital N- total

number on treatment in all selected facilities n-

study sample size

3.10 Data Collection procedures and tools

The data was collected in four health facilities over a period of three (3) months. The four health facilities were selected based on higher number of TB cases reported. The National Leprosy and TB control informed the facilities to be used. The research collected data by interviewing patients using semi structured questionnaires. The questionnaires were formulated using the Morisky Medical Adherence scale. In order to meet the objectives, the questionnaires included all variables to provide quantitative data. Patients' records were reviewed in selected health facilities using checklist to document socio demographic characteristics, geographical locations and medication schedules.

3.10.1 Interview

The sampled patients were interviewed to focus on exploring how patients, health system, social cultural and drug regimen factors are associated with non-adherence to TB treatment. Firstly, the researcher visited the health facilities to know the schedules for patients visits. The

interview was conducted person to person (wearing N-95 mask), one-to-one with patients as they went to the facility for medication. This measure ensured the interviewer's safety from contamination. Each interview section was conducted during the morning hours at the various selected health facilities for at least 20mins. The researcher explained to them the objectives of the study and ask for the patients' permission to participate through a written informed consent form. The consent form was read out loud to study participants individually. Upon consent to participate, the interviews were conducted.

3.10.2 Data Quality and Control

This included training research assistants to conduct interviews/collect data and extract data from the patients' registers and perform data entry. Therefore, research assistants weretrained based on set criteria that the assistant must be a health-related graduate, have knowledge on the disease and regard patients' confidentiality. The principle researcher cross checked the collected data on a daily basis to identify errors and/or omissions and corrective actions was made. All the data was backed up with external storage device.

3.11 Pretest

In order to enhance reliability, the researcher randomly select two (2) health facilities which were different from the study facilities/sites to pretest the data collection tools.

3.12 Data management and Analysis

Data collected was cross-checked on a daily basis using completed questionnaires, entered into excel and validated. Data will be exported to STATA version 13 for analysis. Firstly, descriptive analysis was done to run for frequencies and proportions to determine the variations in the data. Age as a continuous variable was summarized into mean, median and range.

In order to assess patients' non-adherence level, the Morisky Medical Adherence scale (MMAS-8) was used. Generally, the Morisky Medical Adherence scale is an evaluation and measurement tool for patients' behavior on how they take their medication. It consists of 8

questions to measure the non-adherence when on treatment (Xu et al., 2017). The consistency and validity of the MMAS-8 are also calculated in other vernaculars extensively among different people, locations, and diseases (Al-Qazaz et al., 2010), (Sakthong, Chabunthom, & Charoenvisuthiwongs, 2009). The 8 items of MMAS have a scoring scheme; the first seven items of "yes" = 0 and "no" = 1 and a 5-point likert scale which responding options includes "never," "once in a while," "sometimes," "usually," and "always." The values on the Likert scale range from 0 to 1 with specific interval 0.25. "never=0", "always =1" (Gube et al, 2018). The non-adherence level was determined by summing all the scores from the correct answers to the total of eight (8). Based on the total scores which range from 0 to 8, the non- adherence standards were attained and grouped as high adherence (=8 points), medium (6 or 7) and low adherence (<6) (Morisky, Ang, Krousel-Wood, & Ward, 2008). In this study analysis, non-adherence scores were re-categorized into two. Such as, high and medium were considered as adherent using a score of $\geq$6 and low adherence level was also considered as non-adherent using a score of $\leq$6. A bivariate regression analysis was conducted to determine whether long distance, patients' knowledge and high cost of treatment is associated to tuberculosis treatment non-adherence to and also to examine the presence of crude association and select the significant variables. The calculations that was also included in a bivariate regression analysis is to determine social-cultural factors including availability of treatment supporters and employment status associated with non-adherence and significant variables. Changes between variables were assessed using the chi- square test and Fisher's exact tests. Multiple logistic regression analysis was conducted on all factors included in previous model to declare the independently associated predictors that were significant at 95% CI and P value < 0.05 at the bivariate level of analysis. P-value $\leq$0.05 was regarded as a stopping point for statistical significance in the final model. During this, both odds and adjusted odds ratios were obtained. Results were presented in graphs & tables to display crude, adjusted odds ratio, 95% confidence interval and p-value.

3.12.1 Operational Definition for non-adherence

Non-adherence to TB treatment was defined as an individual who scores below 6 in the MMA-8 (Gube et al., 2018)

3.13 Ethical Consideration

The study proposal was submitted to UL-PIRE IRB for approval of ethical clearance and approval was also sought from the Ministry of Health precisely the manager of National leprosy and TB Control Program in Liberia prior to data collection process. Written informed consent was given to ensure participants have comprehensive understanding of the study. Permission was sought from the selected health facilities authority/administration; patients were assured of the confidentiality, safety and appropriate usage of the collected data or information. They were informed that there was no risk involved for using the data and participants were allowed the opportunity to refuse to participate in the study given the fact that participation was voluntary andalso to withdraw at any point in the course of the interview.

All information was treated as confidential. In order to ensure confidentiality, the data files hard copies were locked up in cabinets and softcopy was saved and stored and access was limited to the principal researcher, research assistants and supervisors.

CHAPTER FOUR: RESULTS

4.1 Socio-demographic characteristics of participants

Out of the 317 participants, males were 191 (60.3%). Age of participants were between 18 to 85 years with mean age of 35.5 ± 13.6 years. Majority of participants 90 (28.4%) were within the age group 30 to 39years. Majority of participants 166 (52.4%) were single. Of the 317 participants, only 51 (16.1%) were employed and out of this number, majority 19 (37.3%) were business entrepreneurs. Participants with no formal education were 80 (25.2%) while those with secondary/vocational education being the highest level of education were 122 (38.5%) as shown in table 3

Table 3: Socio-demographic characteristics of participants

Variables	Frequency N=317	Proportion (%)
Sex		
Male	191	60.3
Female	126	39.7
Age group		
< 20 years	34	10.7
20 - 29 years	89	28.1
30 - 39 years	90	28.4
40 - 49 years	53	16.7
50 - 59 years	32	10.1
≥ 60 years	19	6
Marital status		
Single	166	52.4
Married	75	23.7
Separated/Divorced	2	0.6
Co-habiting	63	19.9
Widowed	11	3.5
Highest level of education		
No formal education	80	25.2
Primary	45	14.2
Secondary/vocational	122	38.5
College/tertiary	70	22.1
Occupational status		
Employed	51	16.1
unemployed	266	83.9
Employment type		
Government	13	25.5
NGO/Private entity	12	23.5
Business entrepreneur	19	37.3
Farmer	5	9.8
Driver	2	3.9

4.2 Patients' Non-adherence to anti-tuberculosis treatment

As shown in table 4 below, only 59 (18.6%) of the 317 respondents indicated they sometimes forget to take their medication. Of the 317 respondents, 41 (12.9%) indicated that at least at one point in time, they stopped taking their medications without informing their health providers. A day before the day of interviewing respondents, minority 55 (17.4%) did not take their medications. When asked if respondents sometimes stopped taking their medications

when they felt better, only 8 (2.5%) answered yes. In a Likert scale, 14 (4.4%) of the 317 respondents indicated they always had difficulty remembering to take all their medications. Overall, 82 (25.9%) had an adherence score < 6. Non-adherence to anti-tuberculosis treatment was therefore 25.9% (95%CI = 21.3 – 31.0%) (Fig 2)

Table 4a: Anti-tuberculosis treatment non-adherence

Variables	Frequency (%)
Sometimes forgetting to take medication	
Yes	59 (18.6)
No	258 (81.4)
Skipping medication any day in the past 2weeks	
Yes	37 (11.7)
No	280 (88.3)
Reason for skipping	
Stock out of medications at health facility	5 (13.5)
No medications at home	4 (10.8)
Other reasons	28 (75.7)
Ever stopped taking medication without informing healthcare provider	
Yes	41 (12.9)
No	276 (87.1)
Reason for stopping	
Felt sick	4 (9.7)
Stock out of medications at home	7 (17.1)
Traveled	20 (48.8)
Other reasons	10 (24.4)
Traveled or left home without medication	
Yes	55 (17.4)
No	262 (82.7)
Reason for leaving medication behind	
Feeling better	1 (1.8)
Stock out of medications	5 (9.1)
Just forgot	11 (20.0)
Other reasons	38 (69.1)
TB medications taken yesterday	
Yes	262 (82.7)
No	55 (17.4)
Reason for not taking medication yesterday	
Stock out of medications	45 (81.8)
Health facility closed	4 (7.3)
Feeling unwell	1 (1.8)
Other reasons	5 (9.1)

Table 4b: Anti-tuberculosis treatment non-adherence

Variables	Frequency (%)
Stop taking medication when feel well	
Yes	8 (2.5)
No	309 (97.5)
Feel bothered about sticking to treatment plan	
Yes	121 (38.2)
No	196 (61.8)
Frequency of difficulty remembering taking all medication	
Never/Rarely	179 (56.5)
Sometimes	123 (38.8)
Usually	1 (0.3)
Always	14 (4.4)

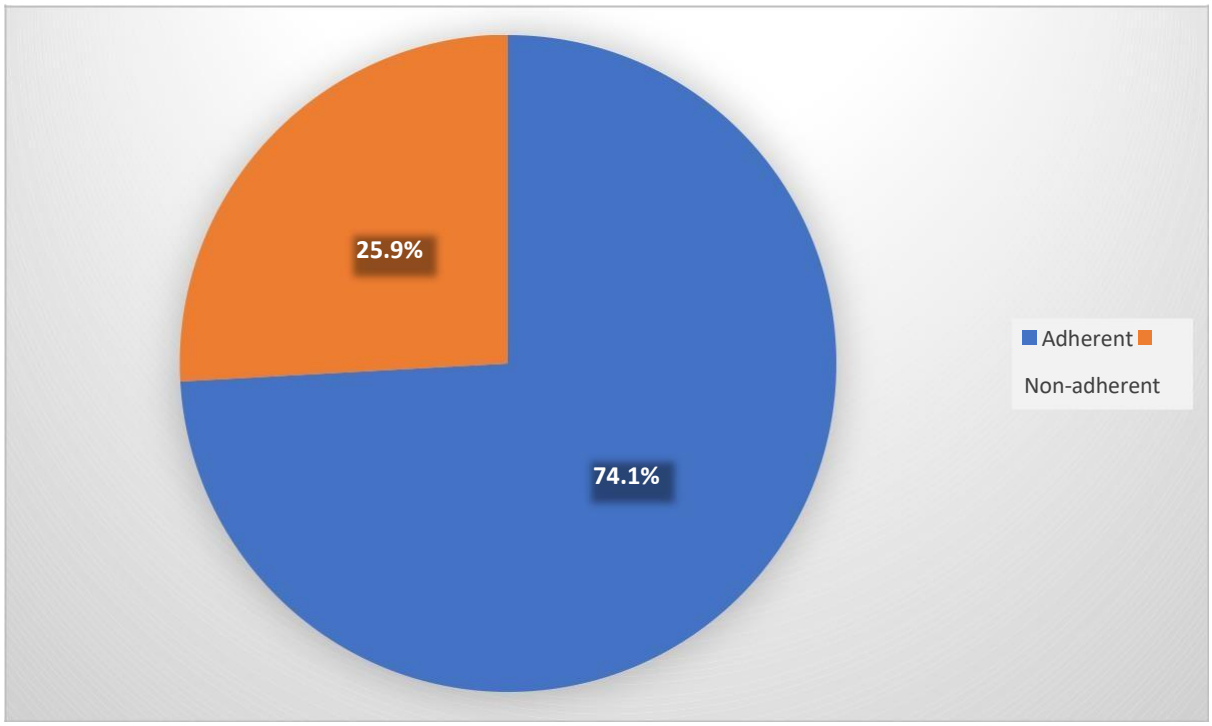

Figure 3: Anti-tuberculosis treatment non-adherence

4.3 Individual patient factors

Association of patient's knowledge on tuberculosis with anti-tuberculosis treatment non-adherence

Only 1 (0.4%) of the 235 respondents who were adherent to their tuberculosis treatment thought TB was not a serious disease. All 82 non-adherent respondents thought TB was a serious disease. There was no statistically significant association between thinking TB is a serious disease and non-adherence to anti-tuberculosis treatment (p-value = 0.741). Of the 235 respondents who were adherent, only 1 (0.4%) did not know TB could be cured while 2 (2.4%) of the 82 non-adherent respondents did not also know TB could be cured. Knowing TB could be cured has no association with non-adherence to anti-tuberculosis treatment (p- value = 0.165). Among the adherent and non-adherent respondents, majority, 223 (94.9%) and 57 (69.5%) respectively knew TB required longer duration of treatment in order to be cured and this was statistically significant (x^2 = 37.99, p-value < 0.001). Out of the 235 adherent respondents, 228 (97.0%) knew taking anti-koch's can cure TB while 80 (97.6%) of the non-adherent respondents also knew same. There was however no association between having knowledge that taking anti-koch's can cure TB and tuberculosis treatment non-adherence to (p-value = 0.576) (Table 5)

Table 5: Bivariate analysis of patient knowledge on Tuberculosis for non-adherence to anti-

tuberculosis treatment

Variables	Non-adherent N= 82(25.9%)	Adherent N=235(74.1%)	X^2	P-value
Think TB is serious disease				0.741†
Yes	82 (100.0)	234 (99.6)		
No	0 (0.0)	1 (0.4)		
Know TB can be cured				0.165†
Yes	80 (97.6)	234 (99.6)		
No	2 (2.4)	1 (0.4)		
Know TB treatment required longer duration to be cured			37.99	**<0.001***
Yes	57 (69.5)	223 (94.9)		
No	25 (30.5)	12 (5.1)		
Know taking TB treatment can cure TB				0.576†
Yes	80 (97.6)	228 (97.0)		
No	2 (2.4)	7 (3.0)		

†Fisher's exact test; *Significant (p<0.05) using chi-square test

4.4 Association of patients' attitude/beliefs towards tuberculosis with anti-tuberculosis treatment non-adherence

Out of the 235 respondents who were adherent, majority 190 (80.9%) indicated they had never missed an appointment schedule with their health providers. Of the 82 non-adherent respondents, majority 49 (59.8%) indicated they had ever missed an appointment schedule with their health providers. There was significant associationbetween ever missing an appointment schedule with health provider and non-adherence to anti-tuberculosis treatment (x^2 = 48.05, p-value < 0.001). Giving reasons for missing scheduled appointment, majority 13 (28.9%) of the 45 adherent respondents who had ever missed an appointment had no reason for missing scheduled appointment while majority 11 (22.5%) of the 49 non-adherent respondents who had ever missed an appointment indicated they travelled.

No association was found between reason for missing scheduled appointment and non-adherence to anti-tuberculosis treatment (p-value=0.068). Majority 148 (63.0%) and 39 (47.6%) of adherent and non-adherent respondents respectively indicated they did not know the causes of TB. Only 2 (0.9%) of adherent respondents had excellent knowledge about the cause of TB as they could give 2 or more causes of TB. Association was found between perception about the cause of TB and non-adherence to anti-tuberculosis treatment (p-value = 0.03). Majority 184(78.3%) and 52 (63.4%) of adherent and non-adherent respondents respectively indicated they were never/rarely convinced by family or friends to choose traditional medicine instead of anti-koch's. There was statistically significant association between being convinced by family or friends to choose traditional medicine instead of anti-koch's and non-adherence to anti-tuberculosis treatment (p-value < 0.033). Out of the 235 adherent respondents, 220 (93.6%) said strictly adhering to TB drugs comes with some benefits. Of the 82 non-adherent respondents, 65 (79.3%) indicated there were benefits in adhering strictly to TB drugs and this was statistically significant (x^2 = 13.79, p-value < 0.001). Majority 225 (95.7%) and 39 (47.6%) of adherent and non-adherent respondents respectivelyindicated it is easy to strictly follow TB medication. There was statistically significant association between ease of strictly following medication and non- adherence to anti-tuberculosis treatment (x^2 = 60.76, p-value < 0.001). When views about what will help TB patients to achieve strict adherence were sought after, majority 113 (48.1%) of adherent respondents believed patients continuously taking the medications against all odds is the surest way maintain adherence while majority 19 (23.2%) of non-adherent respondents said they did not know of any strategy to ensure adherence.

Thoughts about what will help achieve strict adherence was associated with non-adherence to anti-tuberculosis treatment (p-value <0.001). When respondents were assessed on the longest period of time they failed to take their TB medications, majority 157 (66.8%) of the 235 adherent respondents could not recall. Majority 27 (32.9%) of the 82 non-adherent respondents however indicated <3days. Association between longest period of time a patient failed to take TB medications and non-adherence was significant ($x^2 = 93.04$, p-value < 0.001) (Table 6)

Table 6a: Bivariate analysis of patients' attitude/beliefs for non-adherence to anti-tuberculosis treatment

Variables	Non-adherent N=82(25.9%)	Adherent N=235(74.1%)	χ^2	P-value
Ever missed appointment schedule			48.05	**<0.001***
Yes	49 (59.8)	45 (19.1)		
No	33 (40.2)	190 (80.9)		
Reason for missing scheduled appointment				0.068†
Busy or was late to report at the facility	6 (12.2)	3 (6.7)		
Health facility not working on that day	5 (10.2)	4 (8.9)		
No transportation	9 (18.4)	10 (22.2)		
Traveled	11 (22.5)	1 (2.2)		
Forgot the appointment date	4 (8.2)	7 (15.6)		
Health workers not at post	5 (10.2)	4 (8.9)		
Was sick	1 (2.0)	3 (6.7)		
No reason	8 (16.3)	13 (28.9)		
Perception on cause of TB				**0.03†***
Don't know	39 (47.6)	148 (63.0)		
Poor	27 (32.9)	39 (16.6)		
Good	11 (13.4)	31 (13.2)		
Very good	5 (6.1)	15 (6.4)		
Excellent	0 (0.0)	2 (0.9)		
Convinced by family/friends to choose traditional medicine instead of TB drugs				**0.033†***
Never/rarely	52 (63.4)	184 (78.3)		
Sometimes	23 (28.1)	40 (17.0)		
Always	7 (8.5)	10 (4.3)		
Usually	0 (0.0)	1 (0.4)		
Any benefits of strict adherence to TB drugs			13.79	**<0.001***
Yes	65 (79.3)	220 (93.6)		
No	17 (20.7)	15 (6.4)		
Examples of benefits of strict adherence to TB drugs			0.14	0.706
Helps patient to get well	37 (56.9)	131 (59.6)		
Don't know	28 (43.1)	89 (40.4)		

†Fisher's exact test; †*Significant (p<0.05) using Fisher's exact test; *Significant (p<0.05) using chi-square test

Table 6b: Bivariate analysis of patients' attitude/beliefs for non-adherence to anti-tuberculosis treatment

Variables	Non-adherent N= 82(25.9%)	Adherent N= 235(74.1%)	X^2	P-value
Ease of strictly following your medication			60.76	**<0.001***
Easy	51 (62.2)	225 (95.7)		
Difficult	31 (37.8)	10 (4.3)		
Thoughts about what will help achieve strict adherence				**<0.001†***
Don't know	19 (23.2)	81 (34.5)		
Availability of food	8 (9.8)	2 (0.9)		
To continue taking the medications	18 (22.0)	113 (48.1)		
When the medications are always available	12 (14.6)	11 (4.7)		
Committed treatment supporter	3 (3.7)	1 (0.4)		
Detailed counselling	2 (2.4)	5 (2.1)		
Good treatment from health workers	2 (2.4)	9 (3.8)		
Money	0 (0.0)	1 (0.4)		
Reminder	17 (20.7)	10 (4.3)		
When the medications make one feel better	1 (1.2)	2 (0.9)		
Longest period of time you failed to take TB medication			93.04	**<0.001***
≤3days	27 (32.9)	41 (17.5)		
5days	19 (23.2)	14 (6.0)		
7days	12 (14.6)	12 (5.1)		
≥14	18 (22.0)	11 (4.7)		
Can't recall	6 (7.3)	157 (66.8)		

†*Significant (p<0.05) using Fisher's exact test; *Significant (p<0.05) using chi-square test

4.5 Association of patients' proximity/distance to treatment centre with anti-tuberculosis treatment non-adherence

Of the 235 respondents' adherent to TB treatment, 139 (59.2%) resided closed to their treatment centers while 50% of the 82 non-adherent respondents also lived close to their treatment centers. There was no association between residing close to the treatment centers and non-adherence ($x^2 = 2.07$, p-value = 0.15). Majority 146 (62.4%) and 46 (56.1%) of adherent and non-adherent respondents respectively took less than 1 hour to get to the treatment center from home.

No association was found between duration taken from home to get to treatment center and non-adherence to anti-tuberculosis treatment (p-value = 0.761) (Table 7)

Table 7: Bivariate analysis of patients' proximity/distance to treatment center for non-adherence to anti-Tuberculosis treatment

Variables	Non-adherent N=82(25.9%)	Adherent N=235(74.1%)	x^2	P-value
Resides close to treatment facility			2.07	0.15
Yes	41 (50.0)	139 (59.2)		
No	41 (50.0)	96 (40.8)		
Duration from home to treatment centre				0.761†
< 1hour	46 (56.1)	146 (62.4)		
1 - 2hours	22 (26.8)	53 (22.7)		
2 - 3hours	13 (15.9)	32 (13.7)		
> 3hours	1 (1.2)	3 (1.3)		

†Fisher's exact test

4.6 Drug regimen Factor

Association of drug regimen related factors with anti-tuberculosis treatment non-adherence

Of the 235 respondents' adherent to TB treatment, 213 (90.6%) did not express burden in the multiple drugs they take while 58 (70.7%) of the 82 non-adherent respondents also expressed same. There was statistically significant association between pill burden and non-adherence to anti-tuberculosis treatment ($x^2 = 19.42$, p-value < 0.001). Majority 188 (80.0%) and 73 (89.0%) of adherent and non-adherent respondents respectively were taking 3 to 4 tablets daily. No association was found between numberof tablets taken daily and non-adherence to anti-tuberculosis treatment (p-value =0.121). Of the 235 respondents who were adherent, majority 131 (55.7%) had not experienced any side effect of the TB medication.

On the contrary, majority 44 (53.7%) of respondents who were non-adherent had experienced side effect of TB medication. There was no association between side effect of TB medication and non-adherence to anti-tuberculosis treatment (p-value = 0.206).

Of the 101 adherent respondents with history of ever experienced side effect, joint pains were indicated in 33 (32.7%) and this constituted the majority. Joint pain was also indicated in 9 (20.5%) of the 44 non-adherent respondents who had ever experienced TB medication side effect. There was no association between how medication made patients feel and tuberculosis treatment non -adherence (p-value = 0.055) (Table 8)

Table 8: Bivariate analysis of drug regimen related factors for non-adherence to anti-tuberculosis treatment

Variables	Non-adherent N= 82(25.9%)	Adherent N=235(74.1%)	χ^2	P-value
Pill burden			19.42	**<0.001***
Yes	24 (29.3)	22 (9.4)		
No	58 (70.7)	213 (90.6)		
Number of tablets taken a day				0.121†
1 - 2 pills	4 (4.9)	30 (12.8)		
3 - 4 pills	73 (89.0)	188 (80.0)		
> 4 pills	5 (6.1)	17 (7.2)		
number of times tablets taken a day				0.741†
Once	82 (100.0)	234 (99.6)		
Thrice	0 (0.0)	1 (0.4)		
Time for taking tablets				0.276†
Morning	80 (97.6)	233 (99.2)		
Evening	2 (2.4)	2 (0.8)		
Side effect of medication				0.206†
Yes	44 (53.7)	101 (43.0)		
No	37 (45.1)	131 (55.7)		
Don't know	1 (1.2)	3 (1.3)		
How medication makes you feel				0.055†
Diarrhoea and vomiting	4 (9.1)	5 (5.0)		
Skin rash	5 (11.4)	18 (17.8)		
Headaches	6 (13.6)	21 (20.8)		
Numbness	8 (18.2)	13 (12.9)		
Painful joints	9 (20.5)	33 (32.7)		
Yellow eyes	0 (0.0)	2 (2.0)		
Other	12 (27.3)	9 (8.9)		
Current intake of other medicines			0.25	0.617
Yes	15 (18.5)	49 (21.1)		
No	66 (81.5)	183 (78.9)		

4.7 Hospital related Factors

Association of health facility related factors with anti-tuberculosis treatment non-adherence

There was statistically significant association between frequency of collecting TB medicine from health facility and non-adherence to anti-tuberculosis treatment (x^2 = 8.35, p-value = 0.039). Majority, 196 (83.4%) and 58 (70.7%) of the adherent and non-adherent respondents respectively spent less than 1 hour at health facilities for TB medicine refill. There was statistically significant association between time spent at health facility for TB medicine refill and non-adherence to anti-tuberculosis treatment (p-value = 0.004).

There was statistically significant association between TB treatment stock out at healthfacility and non-adherence to anti-tuberculosis treatment (x^2 = 33.7, p-value < 0.001). Association between frequency of TB treatment stock out and non-adherence to anti- tuberculosis treatment was statistically significant (p-value < 0.001). There was statistically significant association between caregivers' responses to questions and non-adherence to anti- tuberculosis treatment (p-value < 0.001). Of the 235 respondents who were adherent to anti- tuberculosis treatment, 140 (59.6%) classified attitude of caregivers as excellent while 1 (0.4%) said it was worst. Of the 82 respondents who were non-adherent to anti-tuberculosis treatment, majority, 37 (45.1%) classified attitude of caregivers as good while 2 (2.4%) said itwas worst. There was statistically significant association between attitude of caregivers and non-adherence to anti-tuberculosis treatment (p-value < 0.001).

Majority, 181 (77.0%) and 50 (61.0%) of the adherent and non-adherent respondents respectively indicated it was easy to access health facility. Association between easy access to health facility and non-adherence to anti-tuberculosis treatment was statistically significant ($x^{2=}$7.92, p-value = 0.005). Majority, 213 (90.6%) and 64 (78.1%) of the adherent and non-adherent respondents respectively were comfortable with waiting time at health facility for TB medicine refill and this was statistically significant (x^2 = 8.74, p-value < 0.01) (Table 9)

Table 9a: Bivariate analysis of health facility related factors for non-adherence to anti-tuberculosis treatment

Variables	Non-adherent N= 82(25.9%)	Adherent N=235(74.1%)	χ^2	P-value
Collector of TB medicines				0.085†
Self	74 (90.2)	187 (79.6)		
Treatment supporter	8 (9.8)	44 (18.7)		
Other	0 (0.0)	4 (1.7)		
Frequency of collecting TB medicine from health facility			8.35	**0.039**
Daily	11 (13.4)	23 (9.8)		
Once a week	57 (69.5)	158 (67.2)		
Once a month	8 (9.8)	48 (20.4)		
Other	6 (7.3)	6 (2.6)		
Time spent at health facility for refill of Medications				**0.004†***
< 1hour	58 (70.7)	196 (83.4)		
1 hour to <2hours	18 (22.0)	37 (15.7)		
2hours - 3hours	5 (6.1)	2 (0.85)		
> 3hours	1 (1.2)	0 (0.0)		
TB treatment stock out at health facility			33.7	**<0.001***
Yes	50 (61.0)	60 (25.5)		
No	32 (39.0)	175 (74.5)		
Frequency of TB treatment stock out at health facility				**<0.001†***
Can't recall	23 (46.0)	10 (16.7)		
Once	1 (2.0)	9 (15.0)		
Twice	9 (18.0)	3 (5.0)		
Sometimes	14 (28.0)	34 (56.7)		
Many times	3 (6.0)	4 (6.7)		

†Fisher's exact test; †*Significant (p<0.05) using Fisher's exact test; *Significant (p<0.05) using chi-square test

Table 9b: Bivariate analysis of health facility related factors for non-adherence to anti-tuberculosis treatment

Variables	Non-adherent N= 82(25.9%)	Adherent N= 235(74.1%)	X^2	P-value
Confidentiality maintained by caregivers				0.579†
Yes	80 (97.6)	230 (97.9)		
No	2 (2.4)	5 (2.1)		
Caregivers' response to questions				**<0.001†***
Inappropriately	2 (2.4)	2 (0.9)		
Appropriately	60 (73.2)	111 (47.2)		
Professionally	20 (24.4)	122 (51.9)		
Attitude of caregivers				**<0.001†***
Excellent	28 (34.2)	140 (59.6)		
Very good	15 (18.3)	6 (2.6)		
Good	37 (45.1)	88 (37.5)		
Worst	2 (2.4)	1 (0.4)		
Easy access to health facility			7.92	**0.005***
Yes	50 (61.0)	181 (77.0)		
No	32 (39.0)	54 (23.0)		
Aware of TB treatment herbalist				0.762†
Yes	4 (4.9)	10 (4.3)		
No	78 (95.1)	225 (95.7)		
Pay to receive TB treatment				0.741†
Yes	0 (0.0)	1 (0.4)		
No	82 (100.0)	234 (99.6)		
Comfortable with waiting time at health facility for medicine refill			8.74	**0.003***
Yes	64 (78.1)	213 (90.6)		
No	18 (21.9)	22 (9.4)		

†Fisher's exact test; †*Significant (p<0.05) using Fisher's exact test; *Significant (p<0.05) using chi-square test

4.8 Association of socio-cultural related factors with anti-tuberculosis treatment non-adherence

No association was found between sex and treatment non-adherence (X^2 = 2.99, p-value = 0.084). Highest level of education among participants showed no association with non-adherence (x^2 = 6.24, p-value = 0.1). Of the 38 adherent respondents employed, 21 (55.3%) express no fears of losing job if their TB status becomes known to others. However, of the 13 non-adherent respondents employed, majority, 11 (84.6%) were afraid of losing job should their TB status become known. There was statistically significant association between being afraid of job loss for being a TB patient and non-adherence to anti-tuberculosis treatment (p-value = 0.022). Out of the 235 respondents who were adherent, 187 (79.6%) were paying for transportation to reach the health facility while 60 (73.2%) of the 82 non-adherent respondents were paying for transportation to reach health facility. Association between paying for transportation to reach health facility and TB treatment non-adherence was not significant (x^2 = 1.45, p-value = 0.229).

Of the 235 respondents who were adherent, only 22 (9.4%) did not have treatment supporter. Likewise, 15 (18.3%) of the 82 non-adherent respondents lacked treatment supporter. Statistically, the association recognized between availability of treatment supporter and non-adherence to anti-tuberculosis treatment was significant (x^2 = 4.7, p-value = 0.03). Only 29 (12.3%) of respondents who were adherent experienced changes in friends/family relationship after knew the TB status of respondents while 32 (39.0%) of the 82 non-adherent respondents suffered same and a significant association was found with tuberculosis treatment non-adherence (x^2 = 27.9, p-value < 0.001). Of the 235 respondents who were adherent, only 14 (6.0%) lacked food to support TB drug intake while 24 (29.3%) of the 82 respondents who were non-adherent lacked food to support TB drug intake and this was significantly associated with non-adherence to anti-tuberculosis treatment (x^2 = 31.31, p- value < 0.001) (Table 10)

Table 10a: Bivariate analysis of socio-cultural related factors for non-adherence to anti-Tuberculosis treatment

Variables	Non-adherent N= 82(25.9%)	Adherent N= 235(74.1%)	x^2	P-value
Age group			2.25	0.814
< 20 years	7 (8.5)	27 (11.5)		
20 - 29 years	24 (29.3)	65 (27.7)		
30 - 39 years	27 (32.9)	63 (26.8)		
40 - 49 years	13 (15.9)	40 (17.0)		
50 - 59 years	6 (7.3)	26 (11.1)		
≥ 60 years	5 (6.1)	14 (6.0)		
Sex			2.99	0.084
Male	56 (68.3)	135 (57.5)		
Female	26 (31.7)	100 (42.5)		
Marital status				0.337†
Single	44 (53.7)	122 (51.9)		
Married	14 (17.1)	61 (26.0)		
Separated/Divorced	1 (1.2)	1 (0.4)		
Co-habiting	20 (24.4)	43 (18.3)		
Widowed	3 (3.7)	8 (3.4)		
Highest level of education			6.24	0.1
No formal education	19 (23.2)	61 (26.0)		
Primary	6 (7.3)	39 (16.6)		
Secondary/vocational	39 (47.6)	83 (35.3)		
College/tertiary	18 (21.9)	52 (22.1)		
Employment status			0.005	0.946
Employed	13 (15.9)	38 (16.2)		
unemployed	69 (84.2)	197 (83.3)		
Employment type				0.202†
Government	5 (38.5)	8 (21.1)		
NGO/Private entity	1 (7.7)	11 (29.0)		
Business entrepreneur	6 (46.2)	13 (34.2)		
Farmer	0 (0.0)	5 (13.2)		
Driver	1 (7.7)	1 (2.6)		

†Fisher's exact test; †*Significant (p<0.05) using Fisher's exact test; *Significant (p<0.05) using chi-square test

Table 10b: Bivariate analysis of socio-cultural related factors for non-adherence to anti-Tuberculosis treatment

Variables	Non-adherent N= 82(25.9%)	Adherent N= 235(74.1%)	x^2	P-value
Afraid of job loss for being TB patient			xxx	**0.022†***
Yes	11 (84.6)	17 (44.7)		
No	2 (15.4)	21 (55.3)		
Pay for transportation to reach health Facility			1.45	0.229
Yes	60 (73.2)	187 (79.6)		
No	22 (26.8)	48 (20.4)		
Availability of treatment supporter			4.7	**0.03†***
Yes	67 (81.7)	213 (90.6)		
No	15 (18.3)	22 (9.4)		
Relationship with treatment supporter				0.059†
Spouse	21 (31.3)	72 (33.8)		
Parent	19 (28.4)	76 (35.7)		
Sibling	17 (25.4)	32 (15.0)		
Son or daughter	5 (7.5)	22 (10.3)		
Other	1 (1.5)	9 (4.2)		
Informed friends/family of your TB status			0.01	0.923
Yes	48 (58.5)	139 (59.2)		
No	34 (41.5)	96 (40.9)		
Changes in friends/family relationship after knowing patient's TB status			27.9	**<0.001***
Yes	32 (39.0)	29 (12.3)		
No	50 (61.0)	206 (87.7)		
Mal-treatment of TB patients in your community/home				0.38†
Yes	3 (3.7)	4 (1.7)		
No	79 (96.3)	231 (98.3)		
Availability of food to support TB drug Intake			31.31	**<0.001**
Yes	58 (70.7)	221 (94.0)		
No	24 (29.3)	14 (6.0)		

†Fisher's exact test; †*Significant (p<0.05) using Fisher's exact test; *Significant (p<0.05) using chi-square test

4.9 Multiple logistic regression analysis for factors associated with non-adherence to anti-tuberculosis treatment

Multiple logistic regression analysis was conducted on all factors that were statistically significant at 95% CI and P value < 0.05 at the bivariate level of analysis. Out of these 21 variables, only 6 were statistically significant and had an association with non-adherence to anti-tuberculosis treatment in the multiple logistic regression model (p-value< 0.05). These variables include, ever missed appointment schedule, ease of strictly following your medication, thoughts about what will help achieve strict adherence, longest period of time one failed to take TB medication, frequency of collecting TB medicine from health facility, and changes in friends/family relationship after knowing patient's TB status. Table 11 below details how the related factors are associated with anti-tuberculosis treatment non-adherence using simple and multiple logistic regression analysis to find the crude and adjusted odds ratios respectively, their corresponding 95%CI and p-values.

After adjusting for all other variables, there is 5.79 folds increased odds of anti-tuberculosis treatment non-adherence among respondents who ever missed appointment schedule with health care worker compared to respondents who never missed an appointment schedule (aOR=5.79, 95% CI = 2.02 - 16.61). With all other variables controlled for, there is 94.9% decreased odds of non-adherence to anti-tuberculosis treatment in respondents who perceive ease of strictly following TB medications as easy compared to those who perceive it as difficult (aOR=0.051, 95%CI = 0.01 - 0.27). After controlling for all other variables, there is 28.36 times increased odds of anti-tuberculosis treatment non-adherence among respondents who think that to achieve strict adherence, TB patients should always have food available in comparison with respondents who did not have any thoughts to share on what will help achieve strict adherence (aOR = 28.36, 95%CI = 1.53 - 525.29).

With all other variables controlled for, there is 97.0% decreased odds of non-adherence to anti-tuberculosis treatment among respondents who could not recall the longest period of time they failed to take their TB medications compared to respondents who indicated ≤3days as the longest period of time they failed to take their TB medications (aOR = 0.03, 95%CI = 0.01 - 0.14).

After adjusting for all other variables, there is 32.22 folds increased odds of anti-tuberculosis treatment non-adherence among respondents who went for refill of TB medicines once a month compared to those who went to the health facility on daily basis to take their drugs (aOR = 32.22, 95%CI = 1.95 - 531.27). Odds of anti-tuberculosis treatment non-adherence among respondents who went for refill of TB medicines other than once a week or once a month is 18.64 times higher in comparison with those who went to the health facility on dailybasis to take their drugs (aOR = 18.64, 95%CI = 1.18 - 295.72).

With all other variables controlled for, there is 8.3 folds increased odds of non-adherence to anti-tuberculosis treatment in respondents who experienced changes in their relationship with friends/family after they knowing respondents TB status compared to respondents who did not experience such changes in relationship (aOR=8.30, 95%CI = 2.40 - 28.73).

Table 11a: Multiple logistic regression analysis for factors associated with non-adherence to anti-Tuberculosis treatment

Variables	Non-adherent N= 82(25.9%)	Adherent N=235(74.1%)	Unadjusted OR (95% CI)	p-value	Adjusted OR (95%CI)	p-value
Know TB treatment required longer duration to be cured						
Yes	57 (69.5)	223 (94.9)	0.12 (0.06 - 0.26)	**<0.001***	1.54 (0.27 - 8.98)	0.628
No	25 (30.5)	12 (5.1)	Ref		Ref	
Ever missed appointment schedule						
Yes	49 (59.8)	45 (19.1)	6.27 (3.62 - 10.85)	**<0.001**	5.79 (2.02 - 16.61)	**0.001***
No	33 (40.2)	190 (80.9)	Ref		Ref	
Perception on cause of TB						
Don't know	39 (47.6)	148 (63.0)	Ref			
Poor	27 (32.9)	39 (16.6)	2.63 (1.44 - 4.81)	**0.002***	0.92 (0.20 - 4.21)	0.914
Good	11 (13.4)	31 (13.2)	1.35 (0.62 - 2.92)	0.451	6.16 (0.93 - 40.92)	0.06
Very good	5 (6.1)	15 (6.4)	1.26 (0.43 - 3.69)	0.667	1.89 (0.16 - 22.81)	0.615
Excellent	0 (0.0)	2 (0.9)	Omitted		Omitted	
Convinced by family/friends to choose traditional medicine instead of TB drugs						
Never/rarely	52 (63.4)	184 (78.3)	Ref		Ref	
Sometimes	23 (28.1)	40 (17.0)	2.03 (1.12 - 3.70)	**0.02***	1.30 (0.42 - 4.04)	0.647
Usually	0 (0.0)	1 (0.4)	Omitted		Omitted	
Always	7 (8.5)	10 (4.3)	2.48 (0.90 - 6.83)	0.079	1.0 (0.08 - 12.11)	1
Any benefits of strict adherence to TB drugs						
Yes	65 (79.3)	220 (93.6)	0.26 (0.12 - 0.55)	**<0.001***	0.61 (0.11 - 3.40)	0.572
No	17 (20.7)	15 (6.4)	Ref		Ref	

***Significant (p<0.05)**

Table 11b: Multiple logistic regression analysis for factors associated with non-adherence to anti-Tuberculosis treatment

Variables	Non-adherent N= 82(25.9%)	Adherent N=235(74.1%)	Unadjusted OR (95% CI)	p-value	Adjusted OR (95%CI)	p-value
Ease of strictly following your medication						
Easy	51 (62.2)	225 (95.7)	0.07 (0.03 - 0.16)	**<0.001***	0.051 (0.01 - 0.27)	**<0.001***
Difficult	31 (37.8)	10 (4.3)	Ref		Ref	
Thoughts about what will help achieve strict adherence						
Don't know	19 (23.2)	81 (34.5)	Ref		Ref	
Availability of food	8 (9.8)	2 (0.9)	17.05 (3.35 - 86.86)	**0.001***	28.36 (1.53 - 525.29)	**0.025***
To continue taking the medications	18 (22.0)	113 (48.1)	0.68 (0.34 - 1.37)	0.282	1.06 (0.25 - 4.55)	0.939
When the medications are always available	12 (14.6)	11 (4.7)	4.65 (1.78 - 12.13)	**0.002***	4.48 (0.681 - 29.43)	0.119
Committed treatment supporter	3 (3.7)	1 (0.4)	12.79 (1.26 - 129.84)	**0.031***	38.99 (0.19 - 8174.41)	0.179
Detailed counselling	2 (2.4)	5 (2.1)	1.71 (0.31 - 9.47)	0.542	1.79 (0.14 - 23.27)	0.655
Good treatment from health workers	2 (2.4)	9 (3.8)	0.95 (0.19 - 4.75)	0.948	0.88 (0.04 - 20.96)	0.936
Money	0 (0.0)	1 (0.4)	Omitted		Omitted	
Reminder	17 (20.7)	10 (4.3)	7.25 (2.87 - 18.32)	**<0.001***	5.15 (0.78 - 33.98)	0.088
When the medications make one feel better	1 (1.2)	2 (0.9)	2.13 (0.18 - 24.75)	0.545	0.12 (4.90 - 2791.75)	0.676
Longest period of time you failed to take TB medication						
≤3days	27 (32.9)	41 (17.5)	Ref		Ref	
5days	19 (23.2)	14 (6.0)	2.06 (0.89 - 4.79)	0.093	2.10 (0.45 - 9.84)	0.346
7days	12 (14.6)	12 (5.1)	1.52 (0.60 - 3.87)	0.382	2.74 (0.52 - 14.50)	0.236
≥14days	18 (22.0)	11 (4.7)	2.48 (1.02 - 6.07)	**0.046***	3.64 (0.72 - 18.46)	0.118
Can't recall	6 (7.3)	157 (66.8)	0.58 (0.02 - 0.15)	**<0.001***	0.03 (0.01 - 0.14)	**<0.001***

***Significant (p<0.05)**

Table 11c: Multiple logistic regression analysis for factors associated with non-adherence to anti-Tuberculosis treatment

Variables	Non-adherent N= 82(25.9%)	Adherent N=235(74.1%)	Unadjusted OR (95% CI)	p-value	Adjusted OR (95%CI)	p-value
Pill burden						
Yes	24 (29.3)	22 (9.4)	4.00 (2.10 - 7.65)	**<0.001***	0.93 (0.26 - 3.37)	0.916
No	58 (70.7)	213 (90.6)	Ref		Ref	
Frequency of collecting TB medicine from health facility						
Daily	11 (13.4)	23 (9.8)	Ref		Ref	
Once a week	57 (69.5)	158 (67.2)	0.75 (0.35 - 1.65)	0.478	6.60 (0.91 - 47.95)	0.062
Once a month	8 (9.8)	48 (20.4)	0.35 (0.12 - 0.98)	**0.046***	32.22 (1.95 - 531.27)	**0.015***
Other	6 (7.3)	6 (2.6)	2.09 (0.55 - 7.99)	0.281	18.64 (1.18 - 295.72)	**0.038***
Time spent at health facility for refill of medications						
< 1hour	58 (70.7)	196 (83.4)	Ref		Ref	
1 hour to <2hours	18 (22.0)	37 (15.7)	1.64 (0.87 - 3.10)	0.125	1.52 (0.32 - 7.24)	0.599
2hours - 3hours	5 (6.1)	2 (0.85)	8.45 (1.60 - 44.69)	**0.012***	0.60 (0.04 - 10.23)	0.726
> 3hours	1 (1.2)	0 (0.0)	Omitted		Omitted	
TB treatment stock out at health facility						
Yes	50 (61.0)	60 (25.5)	4.56 (2.68 - 7.76)	**<0.001***	0.39 (0.11 - 1.40)	0.15
No	32 (39.0)	175 (74.5)	Ref		Ref	

***Significant (p<0.05)**

Table 11d: Multiple logistic regression analysis for factors associated with non-adherence to anti-Tuberculosis treatment

Variables	Non-adherent N= 82(25.9%)	Adherent N=235(74.1%)	Unadjusted OR (95% CI)	p-value	Adjusted OR (95%CI)	p-value
Frequency of TB treatment stock out at health facility					*Excluded from the model*	
Can't recall	23 (46.0)	10 (16.7)	Ref			
Once	1 (2.0)	9 (15.0)	0.05 (0.01 - 0.43)	**0.007***		
Twice	9 (18.0)	3 (5.0)	1.30 (0.29 - 5.86)	0.729		
Sometimes	14 (28.0)	34 (56.7)	0.18 (0.07 - 0.47)	**0.001***		
Many times	3 (6.0)	4 (6.7)	0.33 (0.06 - 1.73)	0.189		
Caregivers response to questions						
Inappropriately	2 (2.4)	2 (0.9)	Ref		Ref	
Appropriately	60 (73.2)	111 (47.2)	0.54 (0.07 - 3.93)	0.544	358.63(0.57 - 227237.9)	0.074
Professionally	20 (24.4)	122 (51.9)	0.16 (0.22 - 1.23)	0.079	110.76(0.17-73802.41)	0.156
Attitude of caregivers						
Excellent	28 (34.2)	140 (59.6)	Ref		Ref	
Very good	15 (18.3)	6 (2.6)	12.5 (4.46 - 35.01)	**<0.001***	8.19 (0.99 - 67.82)	0.051
Good	37 (45.1)	88 (37.5)	2.10 (1.20 - 3.68)	**0.009***	0.51 (0.14 - 1.88)	0.312
Worst	2 (2.4)	1 (0.4)	10.00 (0.88 - 114.10)	0.064	12.27 (0.03 - 5437.95)	0.42
Easy access to health facility						
Yes	50 (61.0)	181 (77.0)	0.47 (0.27 - 0.80)	**0.005***	1.40 (0.39 - 5.08)	0.608
No	32 (39.0)	54 (23.0)	Ref		Ref	

***Significant (p<0.05)**

Table 11e: Multiple logistic regression analysis for factors associated with non-adherence to anti-Tuberculosis treatment

Variables	Non-adherent N=82(25.9%)	Adherent N=235(74.1%)	Unadjusted OR (95% CI)	p-value	Adjusted OR (95%CI)	p-value
Comfortable with waiting time at health facility for medicine refill						
Yes	64 (78.1)	213 (90.6)	0.37 (0.19 - 0.73)	**0.004***	0.52 (0.10 - 2.54)	0.416
No	18 (21.9)	22 (9.4)	Ref		Ref	
Afraid of job loss for being TB patient					*Excluded from the*	
Yes	11 (84.6)	17 (44.7)	6.80 (1.32 - 34.91)	**0.022***	*model*	
No	2 (15.4)	21 (55.3)	Ref			
Availability of treatment supporter						
Yes	67 (81.7)	213 (90.6)	0.46 (0.23 - 0.94)	**0.033***	0.30 (0.76 - 1.21)	0.091
No	15 (18.3)	22 (9.4)	Ref		Ref	
Changes in friends/family relationship after knowing patient's TB status						
Yes	32 (39.0)	29 (12.3)	4.55 (2.52 - 8.20)	**<0.001***	8.30 (2.40 - 28.73)	**0.001***
No	50 (61.0)	206 (87.7)	Ref		Ref	
Availability of food to support TB drug intake						
Yes	58 (70.7)	221 (94.0)	0.15 (0.07 - 0.31)	**<0.001***	1.82 (0.32 - 10.29)	0.496
No	24 (29.3)	14 (6.0)	Ref		Ref	

***Significant (p<0.05)**

Chapter Five: Discussion

5.1 Discussion

This study which included 317 participants assessed the patients' non-adherence to anti-tuberculosis treatment in Montserrado County, Liberia. In our study, patients' non-adherence level to TB treatment was 25%. Similar result was showed in a study conducted in Mbarara hospital in Uganda which found TB treatment non- adherence rate at 25%. This study indicated that non-adherence was measured using patient self-report which result in patients overestimating their adherence (Amuha et al., 2009a).

However, this our finding is lower than a prospective cohort studies conducted in Mumbai Municipal Corporation, India (50%)(Kulkarni et al., 2013), Schenzhen, China (33.74%) which included all health facilities providing TB services (Tang et al., 2015), Buenos Aires, Argentina (40%) (Herrero, Ramos, & Arrossi, 2015) and Mekele, Ethiopia (55.8%) (Eden Kassa, 2014). The variations or possible reasons for the higher level of non-adherence might probably be dueto variances in the designs of study populations, demographic characteristics, sample size and time period over which non-adherence was measured. Furthermore, patients' non-adherence level to TB treatment in Liberia is also higher than other studies conducted.

For instance, Ali & Prins, (2016) recorded 14% non-adherence among TB patients in Sudan, Khartoum state, Thailand (15.6%) (Peltzer & Pengpid, 2015) and Kebede & Wabe, (2012) recorded 10% of non-adherence in Northwestern Ethiopia.

Potential causes for patients' non-adherence to TB treatment in Liberia comprises of limited supply of drugs at the facilities and patients tend to forget to take along their medication when travelling to a different location. Some respondents in minority expressed that they sometimes have difficulty

in remembering to take pills and think that reminder will work best. The inability to remember to take the TB treatment by some patients could be as a results of heavy work schedule as well as other occasions with makes them forgot the timetable for their respective TB treatment. Thus, to enhance adherence to anti-tuberculosis treatment, trained counselors or treatment supporters should be available to enforce health education and constant communication/checkups to TB patients on the effects of regular adherence to medication, taking into consideration their belief and attitudes.

Furthermore, the shortage or unavailability of TB drugs as admitted by majority of the respondents could be due to the fact that healthcare officials at the respective healthcare centers do not put in the request on time or failure on government's part ensure regular supply of drugsat the various health facilities. Unfavorable factor cited by patients included drugs unavailability on appointed scheduled dates. Again, Mekonnen et al (2018) in their studies in Ethiopia state thatbeing sick, busy and drug stock out were some of the identified reasons for non-adherenceamong patients. (Mekonnen & Azagew, 2018)

In our study almost all (majority) of the patients had more knowledge on the severity about TB and believe that it has cure and one can be treated if he/she takes the medication. Therefore, theassociation between patients' general knowledge and non-adherence was not significant. But majority of patients found to be non-adherent were also aware that TB treatment has a longer duration and significantly associated with non-adherence to TB treatment. This shows that patients are being provided health education to improve their knowledge on tuberculosis by the health care providers. Studies revealed TB patient more likely to adhere if education is provided for them (Castelnuovo, 2010). However, other studies showed evidence that knowledge of TB is associated

with non-adherence., (Wares, Singh & Dangi (2003) in Nepal found that limited knowledge about TB, its effects and treatment were discovered among most of the patients who were non-adherent. Another study also differs from ours which showed findings of an association between patients' knowledge on the transmission of TB from person to person and non-adherence (Amuha, Kutyabami,Kitutu, Odoi-Adome, & Kalyango, 2009). Study conducted in urban Morocco found similar findings consistent with our findings there was no association between TB knowledge (treatment duration, causes, transmission, and consequence of stopping TB treatment) and non-adherence. This explains the fact that patients on treatment in that setting, had daily and constant communication with a health provider during treatment period (Cherkaoui et al., 2014).

More than half of the non-adherents to TB treatment in Liberia who claimed to know the benefits of strictly adhering to the TB treatment had ever missed their scheduled medication appointments with the healthcare provider at least for less than 3 days. Being busy with work/farm work, lack of transportation and staying/travelling away from of home were the major reasons for missing their appointments. Ali & Prins, (2016) observed that patients travelling or moving from one address to another were more likely not to continue their TB treatment. Treatment supporters and health care provider should ensure that patients take along their medication when moving or travelling to a different location. Our study proved that there was no relationship between distance to the health facility and non-adherence. Most to the participant took at least one hour to get to the health facility from home via motorcycle which is cost effective.

This may be because patients that are diagnosed and confirmed of having TB are referred to a nearest facility based on the home address of the patients. Although distance was a minor concern, patients sometimes tried to change location of treatment because they are afraid of being identified by neighbors of familiar faces as well as stigma in their communities. Hence, majority of the

patients still pay transportation to get at the health facility which is cost effective. TB patients with limited strength and feeling weak to walk to the health facility encounter problems involving shortage of funds for transport (Widjanarko, Gompelman, Dijkers, & van der Werf, 2009). Treatment non-adherence can also be influenced by financial problems. Patients migrating of travelling from place to place frequently are expected to run out of drugs without proper arrangements being made on how to refill (Muture et al., 2011b). The government of Liberia with the aid of partners deployed community health Assistants in rural communities to help provide medications for TB patients. Gebreweld et al, (2018) recorded that distance tohealth facility was rather manageable to majority of the respondents which to encouraged themto properly take their treatment.

Distance barriers were address by Ministry of Health by training people to become health promoters for TB in the community by creating awareness and providing medication to those who are unable to reach the clinic. Similar to our study, Herrero et al., (2015) conducted a study in Argentina which showed a statistically significant association between long distance to health facilities and non-adherence, hence suggesting that in regards to the study population, cost of transportation on its own serves as is a barrier relating to the distance to health care centers. Despite the free provision of drugs, there is not enough evidence to assure that patients will stick to treatment plan, especially in lower-income sectors. In contrast, several study findings have established that the association between non-adherence and increasing travelling distances to receive health care was significant (Lake, Jones, Bradshaw, & Abubakar, 2011). A significant association was also recognized between distance to the health facility and patient non-adherence to treatment in Khatoum state, Sudan (Ali & Prins, 2016). Hence, the influence of long distance

which is important in patients' non-adherence to TB treatment is well recognized as mentioned by Bernard N Muture in Kenya (Muture et al., 2011b).

In our study, pill burden was mentioned by patients as being one of the major challenges associated with treatment non-adherence. In the intensive phase of the treatment, patients are expected to take 3-4 pills once a day however, to add to the anti-TB pills, some patients admittedtaking other medication such as painkillers due to painful side effects of the TB drugs. Some of the patients alleged that consuming plenty pills were associated with endangering the body and higher risk of drugs intolerance. Treatment supporters at home should alert the health care provider of any additional drug not prescribed for TB patients. Patients will feel satisfied using the fixed-dose combination (FDC) of TB treatment as recommended by WHO to TB programs inorder to reduce the pills burden (WHO, 2017). Chesney, Morin, & Sherr, (2000) previously documented in their study the pill burden adverse impacts as relates to adherence to treatment. The condition is further intensified were health professionals to not caution or advise patients about side-effects of the drugs ((Hardon et al., 2007). Patients not adequately counseled may mistake the feeling of feeling better or improved to cure, thus miss their medication.

Although a bivariate analysis conducted showed no significant association between non-adherence and pill burden (Amuha et al., 2009a), other study conducted in India discovered that TB patients were less likely to take their medication as they provided reasons that the many pills were associated with several side effects (Hardon et al., 2007). Furthermore, our study findings are consistent with Gebremariam et al, (2010) that pill burden represents a major challenge to TB treatment adherence.

Patients waiting more than 1 hour for services at the facility was significantly associated with nonadherence. However, healthcare provider attitudes cited included being friendly, and

professional. This could be because all the health facilities providing TB services have a separate department to cater only to TB patients instead of the regular out-patient departments. Therefore, more attention is being given to patients to reduce the waiting hours. But sometimes, thelaboratory or testing process takes longer time and patients are referred to other facilities for testing of sample. GeneXpert testing takes at least two hours to deliver results which implies that patients should be able to wait and receive them. Therefore, testing capacity should be placed in all the facilities providing TB services. Patients' nonadherence to treatment was due to is the longer time spent (waiting time) at the hospital. Gube et al., (2018) found few non-adherents waiting for less than 1 hour at the health facility for treatment. But on the contrary, Ethiopian study explained that patients waiting for less than 30 minutes adhere more to treatment in comparison with their counterparts (Bayu, Lonsako, & Tegene, 2016).

In our study, respondents felt that healthcare providers were confidential with their diagnosis and they could trust them. They treat patients with professionalism. This shows cordial relationship between the patients and health care provider. Creating a conducive environment enables patients to express their feelings about progress on their medication course to care providers, but if on the contrary, the patients' perception about their condition might be as if they are hopeless. In Asmara, Eritrea, an institutional based research was done to assessed factors influencing adherence to tuberculosis treatment in and found that patients adhered to their treatment as a result of good behaviors and communications that existed with the health workers. This also motivate patients to stick with the treatment. (Gebreweld et al, 2018)

In contrast, study in Ukraine also discovered that several TB patients described extraordinarily negative attitudes from healthcare providers. (Aibana et al., 2020). Patients willingness to continue treatment are compromised by the harshness of health care provider.

This may lead to missed opportunity for the providers to inform people on the importance of TB therapy. Excellent rapport and communication with empathy shown from nurses successfully speeds up patient recovery. Given the emotional problems connected with TB, health care providers support might encourage patient to remain in care. (Charyeva, Curtis, Mullen, Senik, & Zaliznyak, 2019). Sociopolitical studies have shown that poor relationships from provider to patient influence non-adherence. This style of communication discouraged patients from discussing challenges and feelings with the drugs which weakened their control and ownership over their treatment. (Horter et al., 2016). Facilitation of adherence to treatment show simple evidence on the relationships between health care provider and patient are characterized by mutual respect, trust, and shared decision-making (Schoenthaler, Knafl, Fiscella, & Ogedegbe, 2017).

Sociocultural indicators are known to be robust causes of patients' behavior towards seeking health, and therefore, key factors related to patients' non-adherence to TB treatment. TB affects all people regardless of age, sex, race or occupation. In this study, more single males within the age group 20-39 were found to be non-adherent to treatment. One possible factor for non-adherence among men could be they tend to have less contacts with the health care system. The lifestyle or behavior of people in their youthful age may influence treatment compliance. Young population may migrate or change location, engage into activities, occasions which may force them to skip days in their treatment methods. Thus, migration affects stability of residence and it can adversely affect treatment adherence (WHO, 2015). Many young men in age group 15-49 in Mumbai were found to be more non-adherent (Kulkarni et al., 2013). Although sex and age were non-significant factors to nonadherence to TB treatment among patients. This is similar to many other studies done in advanced countries as well as low- or middle-income countries that found no association between adherence scores and the variable age. Jaiswal et al found no association

between factors (age and gender) and non-adherence (Jaiswal et al., 2003). Similarly, in rural areas of Turkey, a study showed that females adhere more to their TB treatment as related to their male counterparts. The Turkish study showed a difference between gender where males who were involved in smoking were non-adherent than female smokers (Pagès-Puigdemont et al., 2016).

Employment status was not associated with nonadherence. But with the limited employment status among patients cited in our study, they expressed fear of losing their Jobs. Employers might feel that once a person is sick with tuberculosis, he is not strong enough to work and might be off duty for quite a long while considering the treatment duration. Government of other private institutions should grant sick leave for ill employees to enable them get paid while sitting home to recover. Manyof the patients were unemployed because some had lost their jobs due to the illness (tuberculosis). A study from China indicated that unemployment, economic burden and demand to spend more hours on jobs might result in a stern economic depression to patients and relatives (Zou, Wei, Walley, Yin, & Sun, 2012)Therefore, respondents in the minority admitted that they did not inform friends or family members about their illness with the mindset that they might be stigmatized in the community or at the workplace. TB patients however find reasons not to disclose their illness to anyone (Gebreweld et al, 2018). For example, in our study, patients experienced variations in the relationshipand attitudes from family and friends after disclosing results.

Majority of the non-adherents admitted having food available to support the TB drug intake. People with TB often have poor appetite therefore, they are encouraged by the healthcare provider to have frequent food intake. Nutrition-wise, patients taking the multiple pills are required to consume healthy especially food which contains a lot of proteins in order to feel healthy and strong.

This often exceeds their financial status (Mandal, Bhatia, Sharma, Mandal, & Arinaminpathy, 2020).

Mabunda and Bradley opposes reports that showed lack of food to be a barrier for treatment adherence because the saying goes: “one cannot take treatment on an empty stomach” (Mabunda & Bradley, 2011).

Stigma becomes possible obstacle to treatment because it makes patients hesitant about attending the nearest health facility in their community or neighborhood for care. This situation leads to disclosure of one’s illness which in turn plays a major role in facilitating treatment adherence and serves as an important public health strategy to avoid further transmission of the disease. A review indicated that one of the behavioral factors that was associated with TB treatment non-adherence was fear of stigma (Elbireer, Guwatudde, Mudiope, Nabbuye-Sekandi, & Manabe, 2011). Patients also mentioned they were interrupting their treatment because they were afraid to be stigmatized. (S. A. Munro et al., 2007b). This suggests that address, more awareness through education campaigns and counselling needs to be improved in the communities to educate people on TB and its mode of transmission so that family and friends don’t see patients as a threat to them and their surroundings.

Our findings revealed that almost all the patients who were assigned a treatment supporter were considered non-adherent to the TB treatment. Assigning treatment supporters to patients depends on the patient. They provide the details (name, phone number, address) of the individual who will serve as treatment supporter for them). The responsibility of the treatment supporter is to help ensure that clients constantly take their treatment, complete and be cured according to the treatment protocol. Most respondents cited that their partner/spouse were serving as treatment supporter at home.

Support from the community members most especially family appears to be very important during TB treatment (Truzyan, Crape, Harutyunyan, & Petrosyan, 2018). A qualitative study conducted in Uzbekistan among TB patients found that motivating factor to keep patients in treatment were support from peers and family members as well as encouragement (Horter et al., 2016).

On the contrary, greater adherence level was shown with patients whose treatment supporters lived in the same home or a neighborhood than supporters who lived far away. A study reported that patients adhere more to treatment if they are directly observed (M. A. Khan, Walley, Witter, Shah, & Javeed, 2005). But results from Tanzania suggested that drug intake observation does not necessarily need daily supervision however, it was argued that regular motivation and support is enough (Mkopi et al., 2012). South Ethiopian study also contradicts our findings that being assigned a treatment supporter does not contribute to anti-TB drug nonadherence among patients (Woimo et al., 2017)

5.2 Limitation of the study

This study focused on only patients who visited the treatment units/ healthcare centers for treatment or refill of their drugs. However, people who came for TB drugs on someone's behalf, indicating patients who are too sick or busy to attend appointments were missed. Additionally, those who dropped out or lost to follow up from TB services were not interviewed.

Chapter Six: Conclusion and Recommendation

6.1 Conclusion

This study revealed that the rate patients' non-adherence to tuberculosis treatment in Montserrado County was high. Non-adherence was higher in male respondents found within the age group 30-39 years. The study explained patients' good perception on causes of TB and the benefit associated with adhering to TB treatment regimen. Patients who consumed at least 3-4 pills daily under the direct observation of a treatment supporter are less likely to adhere to the TBtreatment. Moreover, Patients related factors (longest period of time one failed to take TB medication), socio-cultural related factors (changes in friends/family relationship after knowing patient's TB status, availability of food intake), and hospital related factors (patient waiting hours, patient-provider relationship), are other factors significantly associated with non- adherence to TB treatment among patients. Some leading causes of non-adherence to TB treatment included busy work schedule, lack of transportation, forgetfulness and drug stock-out. Understanding those related factors affecting anti-tuberculosis treatment adherence may help develop more effective policies targeting the most vulnerable patients at-risk and also provide a scientific basis for making effective policies and measures in the future.

6.2 Recommendation

The following were recommended:

Ministry of Health

- Should liaise with employers to ensure that employees TB positive are not at jeopardy of losing their jobs, and that conditions of service for employees include care for TB.

- Should ensure that TB drugs be available at all times in every health facility providing TB services
- Should ensure the decentralization of TB testing and treatment capacity in all health facility to avoid patients, transfer and the cost of transportation
- Should through the health promotion programs, provide health education increase knowledge, increase drug adherence counseling and strengthen the relationship between patient and health care provider

National Tuberculosis & Leprosy Program:

- Should ensure careful selection of treatment supporters and conduct regular meetings or workshop to address patients' best practices, challenges and way forward in adhering to treatment

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APPENDICES

Appendix I: Informed Consent

Project Title:

Non-adherence to anti Tuberculosis Treatment among patients in Montserrado County, 2019

Principle Investigator: Alberta Corvah

Institution Affiliation

School of Public Health, College of Health Sciences

University of Ghana, Legon

PURPOSE OF RESEARCH STUDY:

Adherence is one critical factor in determining treatment success. However, Cure and treatment success rate is poor in Liberia especially in Montserrado County which has not met the national set target 85%. In developing Countries, patient adherence to the standard anti-TB therapy has been estimated to be as low as 40% (Bagchi, Ambe, & Sathiakumar, 2010). Identifying patient related factors (Finlay et al., 2012), will help policy makers and healthcare providers to develop strategies to resolve the problem. For example, patients' lack of knowledge on TB may contribute to increased level of non-adherence. In addition, policy making and health intervention planning are largely dependent on established knowledge. Understanding how socio-cultural related factors, for instance, unemployment and lack of family support, contribute to TB treatment non-adherence will help to strategically position the National Tuberculosis & Leprosy Control Program (NTLCP) to address the condition by adopting context specific approaches to treatment. No study has been conducted in Liberia to determine adherence to TB treatment and associated risk factors. Knowledge gap on the non-adherence level still exists among TB patients and care givers. (Desta, Masango, & Nkosi, 2018b) Therefore, limitations of such have the tendency to increase the prevalence of TB cases as well as shortening life span. Thus, this study which seeks to determine non-adherence level among patients will be used as a baseline for Montserrado County in Liberia.

PROCEDURES:

Fifteen (15) minutes will be allotted for this interview after your consent to participate in this research study. A trained researcher will conduct the interview and populate the questionnaire with the information provided.

Your name and other personal information will not be included on the questionnaire.

RISKS/DISCOMFORTS:

This study presents minimal risk to you. Loss of privacy might be the participating risk involved in this study. Your information provided to the researchers will be secured in a place only allowing access to only researchers. After the we summarize the information provided, your personal identifying information will be deleted. However, refusal to participate is allowed as there will be no penalty involved.

ALTERNATIVES TO PARTICIPATION:

We encourage your voluntary participation in this study. You have the right to change your mind and leave the study as you wish. There will be neither punishment nor benefit will be If you participate or quit.

BENEFITS:

As a benefit of this study, participants will have the opportunity to provide feedback in an organized way by suggesting ways to improve treatment adherence.

WITHDRAWAL PROCEDURES:

You are allowed to discontinue your participation at any time. You have the right to remained silent if you do not wish to answer. Kindly notify the researcher if such situation occurs

COMPENSATION:

There is no compensation for participants in this study.

PRIVACY INFORMATION:

I Alberta will take all necessary precautions to keep your personal information privately to the greatest level. The study reports developed will not have your identifying information. General characteristics of each participant in the interview summaries excluding personal information.

Information from the interview will be disclose only with individuals directly involving with the research or in a management. It is there responsibility of the entire research team to keep your identity confidential, unless you give permission.

CONTACT INFORMATION:

This disclosure statement explains the rights to entitlement by joining this study. The interviewer from can be contacted for further questions. Or you may call the Principal Investigator, (Alberta B. Corvah, Cell # 0770303702).

CONSENT:

_____is knowledgeable on the nature and purpose of the interview procedures including any risks involved. Time was allotted for questions and these questions have been answered to the best of the investigator's ability. A signed copy of this consent form will be made available to the subject.

_____ _____

Investigator's Signature Date

I have been informed about this research study, its' possible benefits, risks, and discomforts. I hereby agree to take part in this research study as a subject. I recognize that I am free to withdraw this consent and quit this project at any time, and that doing so will not cause me any penalty or loss of benefits that I would be otherwise entitled to enjoy.

_____ _____

Subject's Signature Date

Appendix II: Certificate of Ethical approval from Liberia

UNIVERSITY OF LIBERIA
CAPITOL HILL
MONROVIA, LIBERIA
WEST AFRICA

Office of the Institution Review Board — IORO004203

Certification of Human Approvals

February 26, 2020

Alberta B. Corvah
National Public Health Institute of Liberia, Congo Town, Monrovia, Liberia | University of Ghana, School of Public Health, Legon Campus, Accra, Ghana
Email: charleneout2011@hotmail.com

Protocol Title: Non-adherence to Anti-Tuberculosis Treatment among patients in Montserrado County, Liberia

Protocol #: 20-02-200

Dear Ms. Corvah:

In accordance with 45 CFR 46, the human subjects protocol of the above referenced research study reviewed, as an initial, expedited review on February 10, 2020 has been approved by the University of Liberia-Pacific Institute for Research & Evaluation Institutional Review Board (UL-PIRE IRB). This IRB will review the protocol during the implementation of the study to confirm human subject procedures. The expiration date of this approval is February 25, 2021 at Midnight.

Proposed changes to approved human subject research protocol must be reported promptly to the IRB to be reviewed and approved prospectively utilizing a continuing review application. No changes may be initiated without prior approval by the IRB, except where necessary to eliminate apparent immediate hazards to subjects. Any unanticipated problems involving risks to participants or others must be submitted promptly to the UL-PIRE IRB.

The IRB will require you to submit a progress report during the implementation of this study.
This institution is in compliance with requirements for protection of human subjects, including 45 CFR 46, 21 CFR 50, and 56, and 38 CFR16.

Kind regards.

Sincerely yours,

Ms. Cecelia A. Morris, MSN
Chairperson, UL-PIRE IRB

UL-PIRE IRB MONROVIA, LIBERIA

IRB Review Date: 02/10/2020
Approval Period: 02/26/2020 through 02/25/2021
Review Type: INITIAL, EXPEDITED
IRB Review Action: APPROVED
Assurance #: FWA00004853

E-mail: morris.caletha@gmail.com | tegli@ul-pireafrica.org Phone #: 0886-522-833 | 0886-583-774

Appendix III: Questionnaire

Patient ID_____

Interview date_____/_____/_____(dd-mm-yy)

Health facility name_____

Time:_____Gender: M_____F_____

(I) Patients' Non-adherence level

SN		Yes =0	No =1
1.	Do you sometimes forget to take your medication?	Yes=0	No=1
2a.	Over the past 2 weeks, were there any days you did not take your medication?	Yes=0	No=1
2b	If yes, what were the reasons?	Please specify_____	
3a.	Have you ever stopped taking your medication without informing your healthcare provider?	Yes=0	No=1
3b.	If yes, what were the reasons?	Please Specify_____	
4a.	Have you ever travelled or left the home, and forgotten to take along your medication so that you missed some doses?	Yes=0	No=1
4b.	If yes, why	Please specify_____	
5a.	Did you take all your TB medication yesterday?	Yes=0	No=1
5b.	If no, what was the reason?	Please specify_____	

6a.	When you feel well in the body do you sometimes stop taking your medication?	Yes=0	No=1
6b.	If yes, what were the reasons	Please specify_____	
7.	Taking medicine is inconveniencing for some people. Do you ever feel bothered about sticking to your treatment plan?	Yes=0	No=1
8.	How often do you have difficulty remembering taking all your medication?	Never/ Rarely ------- 0 Sometimes---------- 1 Always..... 2 Usually..... 3	

(II) Patient related factors

Patient Knowledge

9.	Do you think that TB is serious disease?	Yes=0	No=1
10.	Do you know that TB can be cured?	Yes=0	No=1
11.	Did you know that TB treatment will require a longer duration to be cured?	Yes=0	No=1
12.	Do you know that TB can be cured if you take your TB treatment?	Yes=0	No=1

Attitude/Beliefs

13a.	Have you ever missed appointment schedule with your doctor?	Yes =0	No=1

13b.	If yes what were the reasons?	Please specify_____
14.	What is your perception/view of the cause of your TB illness?	Please specify_____
15.	Do family or friends convince you to choose traditional medicine (herbs) instead of TB drugs?	Never/ Rarely ------- 0 Sometimes ----------1 Always.....2 Usually.....3
16a.	Are there any benefits of strictly adhering to the treatment you are taking?	Yes=0 No=1
16b.	If yes, what are they?	Please specify_____
17	How easy is it for you to strictly follow your medication?	scale 0 to 10 0= very easy 10=very difficult
18.	What do you think will help you to do better in adhering strictly to the treatment?	Please specify_____
19.	What has been the longest period of time that you did not take your TB medication since you started treatment	≤3days_____ 5 days_____ 7 days_____ ≥14 days_____

Distance

20. Do you live near the hospital where you go for treatment — Yes=0 — **No=1**

21. How long do you take from your house to the hospital you go for treatment?

- <1 hr
- 1-2 hours
- 2-3 hours
- >3 hours

(III) Drug regimen related factors

22	Do the multiple pills lead to pill burden?	Yes=0	No=1
23	How many pills do you take a day?	1_____ pill 2 _____pills 3_____pills 4 _____pills	
24	How many times do you take your pill a day?	1_____time 2 _____times 3 _____times	

25	What time do you take your pill?	Morning Afternoon Evening Midnight	
26a	Does the medication have any side effect on you?	Yes=0 I don't know	No=1
26b	If yes, how does the medication make you feel	Diarrhoea & Vomiting 2 Skin rash 3 Headaches 4 Numbness 5 Painful joints 6 Yellow eyes 7 Others (specify)----------	
27	Currently, are you taking other medicines?	Yes=0 No=1	

(III) Health facility related factors

28	Who collects your TB treatment from the health facility?	Self Treatment supporter Other specify----------
29	How often do you collect your TB treatment from the health facility?	Daily Once a week

		Once a month Only once Don't know Other specify.....	
30	How long do you stay at the health facility when you visit for treatment?	<1 hr 1-2 hours 2-3 hours >3 hours	
31a	Do the health facility sometimes run out of TB treatment?	Yes=0	No=1
31b	If yes, how often	Please specify _____	
32a	Are caregivers confidential with regards to your TB treatment?	Yes=0	No=1
32b	If no why	Please specify _____	
33	How do caregivers respond to your questions?	Appropriately Inappropriately Professionally	
34	How will you grade the attitude (relationship) of caregiver toward you?	Scale 1_____10 1_____Worst 10_____Excellent	

35	Is the health facility easy to reach (convenience of transport/accessibility)?	Yes=0 No=1
36	Is there a herbalist you know who treat TB	Yes=0 No=1
37a	Do you pay to receive your TB treatment?	Yes=0 No=1
37b	If yes, how much?	----------
38	Do you feel comfortable with the time you spend at the hospital for treatment?	Yes=0 No=1

(IV) Socio-cultural related factors

39	Age of respondent in completed years	Please specify _____
40	Sex of respondent	Male Female
41	Marital status	Single _____ Married_____ Separated_____ Co-habiting ____ Widowed Divorced
42	Educational status	Primary Secondary Tertiary Vocational College

		No formal education
43a	Occupational status	Employed Unemployed
44b	If employed,	Government NGO/Private entity Business entrepreneur Other, please specify ----------
45	Have you been afraid you may lose your job if it is known you have TB?	Yes=0 No=1
46	Do you have to pay for transportation to get to the health facility?	Yes=0 No=1
47a.	Do you have treatment supporter at home?	Yes=0 No=1
47b.	If yes, what is your relationship with the treatment supporter?	1 Spouse 2 Mother 3 Father 4 Sister 5 Brother 6 Daughter 7 Son Health worker Other specify.....
48a.	Did you inform your friends/family that you had TB?	Yes=0 No=1
48b	Why or why not?	Please Specify_____
49	Have your relationships with your friends/family changed since finding out you have TB?	Yes=0 No=1

50	Are TB patients mal-treated in your community/Home?	Yes=0 No=1
51	Do you always have food available to support taking your medication?	Yes= 0 No= 1