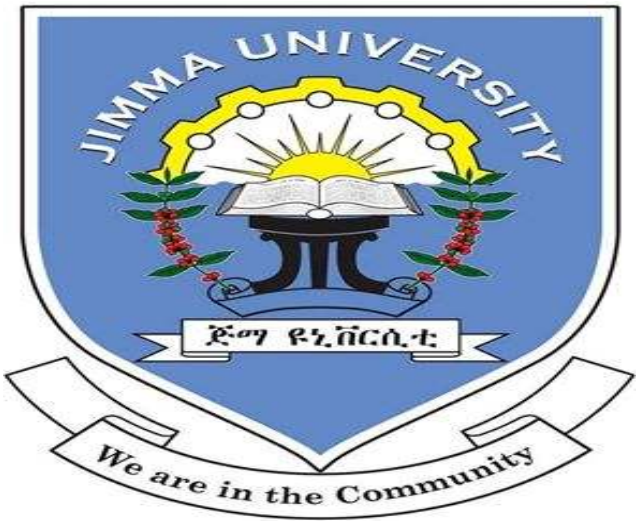
Adherence to Directly Observed Therapy and Associated Factors Among Pulmonary Tuberculosis Patients in Government Health Facilities in Jimma Town, Southwest Ethiopia, 2016



By: Tijani Mohammednur A/Godu (Bsc)

A RESEARCH THESIS TO BE SUBMITTED TO JIMMA UNIVERSITY, COLLEGE OF HEALTH SCIENCES DEPARETMENT OF EPIDEMIOLOGY; IN PARTIAL FULFILLMENT FOR THE REQUIREMENTS OF DEGREE OF MASTERS OF PUBLIC HEALTH

Jun 2016 G.C

JIMMA, ETHIOPIA

JIMMA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

DEPARETMENT OF EPIDEMIOLOGY

Adherence to directly observed therapy and associated factors among Pulmonary Tuberculosis patients in government health facilities in Jimma town, Southwest Ethiopia, 2016

By: Tijani Mohammednur A/Godu (Bsc)

Advisor(s):FasilTessema (MSc)

Muktar Bashir (MPH, MBA)

June, 2016 G.C

JIMMA, ETHIOPIA

Abstract

Background: Tuberculosis control requires high level of adherence to the treatment regimen. If adherence is poor, an emergence of new strains drug resistance bacteria and poor treatment outcomes may develop. In Ethiopia usually less than one third of participant to Directly Observed Therapy program complete full course of Tuberculosis treatment and the treatment success rate of Oromia in general and Jimma town in particular was below the standard.

Objectives: To assess the level and associated factors of adherence to directly observed treatment short course among pulmonary TB patients in Jimma town government health facilities.

Methods: An institution based cross-sectional study was conducted in six government health facilities in Jimma Town between March 20 and April 30, 2016. Data was collected using face to face interviewing method by trained data collectors using structured questionnaire. Data was cleaned, coded and entered into EPI data version 3.1 and analyzed using SPSS version 16. Bi-variate and multivariate logistic regression with 95% CI of AOR was used to judge statistical associations of factors with tuberculosis treatment adherence.

Result: Out of 246 pulmonary tuberculosis patients who have been on Directly Observed Treatment short course, 221 of them were taking their recommended 140 doses of five months therapy strictly. The level of adherence was found to be 95.1 %. Those married (AOR=0.26, 95% CI= 0.1, 2.8), those with no income (AOR=0.19, 95% CL=0.02, 1.81) were more adherent than the single's (P=0.034) and those who earn 500-1000 birr a month (p=0.018) respectively. Those who can read and write (AOR=1.25, 95% CL=0.50, 29.8) were less likely to be adherent when compared with those who complete primary level education (p=0.009) and Being counseled on the duration of treatment (p=0.029), being counseled on what to do for adverse drug reaction (p<0.0001) and presence of substance use (p=0.002) with 95% CI maintained statistical significant association with treatment adherence on multivariate analysis.

Conclusion and Recommendations: The level of adherence observed in Jimma town is relatively high and Service provider's skill on appropriate pre-treatment counseling has important role in maintaining adherence. Therefore Jimma town health office should work in collaboration with other concerned organizations to scale-up counseling skills of care providers though sustainable refreshment trainings.

Key words: - DOTs, Adherence, Pulmonary tuberculosis, Jimma town

ACKNOWLEDGEMENT

I would like to express my heartfelt gratitude to my advisors Mr. Fasil Tessema and Mr. Muktar Beshir for their constructive advice in writing this thesis. And also; I would like to acknowledge my colleague in Jimma Town Health Office, TB care providers in hospitals and health centers, data collectors, my family and friends for their uncountable support.

At last but not the least I would like to thank all the study participants for their sincere response to my questions.

Contents

1. Introduction ..... - 1 -
2. LITERATURE REVIEW ..... - 4 -
2.1 Background ..... - 4 -
2.2 Present status of tuberculosis treatment Adherence. ..... - 5 -
2.3 Factors associated with Adherence ..... - 6 -
2.4 Significance of the study ..... - 10 -
2.5 Conceptual frame work ..... - 11 -
3. Objective of the Study ..... - 12 -
3.1 General Objective: ..... - 12 -
3.2 Specific Objective: ..... - 12 -
4. METHODS AND MATERIALS ..... - 13 -
4.1 Study area and study period ..... - 13 -
4.2 Study design ..... - 13 -
4.3 Population ..... - 13 -
4.4 Study variable ..... - 13 -
4.5 Sample Size and Sampling technique. ..... - 14 -
4.6Inclusion criteria ..... - 17 -
4.7Exclusion criteria ..... - 17 -
4.8 Data collection ..... - 17 -
4.9 Data quality assurance ..... - 17 -
4.10 Data processing and analysis ..... - 17 -
4.11 Ethical considerations ..... - 18 -
4.12 Measurements ..... - 18 -
4.13 Operational definitions ..... - 18 -
5. Result and Discussion ..... - 19 -
5.1 Results ..... - 19 -
5.1.1 Socio-demographic characteristics ..... - 19 -
5.1.2 Level of adherence in Jimma town government health facilities. ..... - 19 -
5.1.3Disease and treatment related factors ..... - 20 -
5.1.4 Service and provider related factors ..... - 20 -
5.1.5 Psychosocial factors ..... - 20 -

5.2 Association of socio demographic, Disease and treatment related, Service and Psychosocial factors with DOTs of Tb treatment adherence in Jimma town. ..... - 25 -
5.3Discussion ..... - 32 -
5.4 Limitation of the study ..... - 34 -
5.5 CONCLUSION ..... - 34 -
5.6 RECOMMENDATION ..... - 34 -
REFERENCE ..... - 35 -
ANNEX II Questioners ..... - 38 -

List of Tables

Table 1 list of Independent variables on Tb treatment adherence study in Jimma town ..... - 14 -
Table 2 Frequency Socio demographic characteristics, Service, Psychosocial, Disease and treatment related factors of DOTs Tb treatment Adherence study participants in Jimma town. (n=246) ..... - 20 -
Table 3 Bivariate analysis of Service, Psychosocial, Disease and treatment related variables on DOTs Tb treatment adherence in Jimma Town 2016. (n=246) ..... - 26 -
Table 4 Multivariate analysis of Service, Psychosocial, Disease and treatment related variables on DOTs Tb treatment adherence in Jimma Town 2016. (n=246) ..... - 30 -
Table 5 Table 5 Reason for missing doses of DOTs Tb treatment adherence study in Jimma town 2016. ..... - 31 -

List of figures

Figure 1conceptual frame work developed after review of different literature on factors associated with adherence to DOTs of PTB patients in Jimma town south west Ethiopia, 2016. .....- 11 -
Figure 2 Schematic presentation of sampling technique and sampling procedure. .....- 16 -
.Figure 3 Proportion of adherent and Non-adherent patients between government facilities in Jimma town 2016 ...- 19 -

ACRONYMS

AFB	Acid-Alcohol Fast Bacilli
AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral Therapy
BCG	Bacillecalmette - Guérin
DOT	Directly-Observed Treatment
DOTS	Directly-Observed Treatment, Short Course
DAE	Drug Adverse Effect
EPTB	Extra Pulmonary Tuberculosis
EC	Ethiopian Calendar
JUSH	Jimma University Specialized Hospital
HCW	Health Care Workers
HIV	Human Immunodeficiency Virus
MDGs	Millennium Development Goals
MDR-TB	Multidrug-Resistant Tuberculosis
NGO	Non-Governmental Organization
NTM	Non Tuberculosis Mycobacterium
NTP	National Tuberculosis Control Program
PHCU	Primary Health Care Unit
PTB	Pulmonary Tuberculosis
QA	Quality Assurance
TST	Tuberculin Skin Test
TB	Tuberculosis
UHEP	Urban Health Extension Program
UHEP's	Urban Health Extension Professionals

VCT	Voluntary Counseling And Testing
WHO	World Health Organizations
XDR-TB	Extensively Drug-Resistance TB

CHAPTER ONE

1. Introduction

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis, a rod-shaped bacillus called “acid-fast” due to its staining characteristics in laboratory. Occasionally the disease can also be caused by Mycobacterium bovis and Mycobacterium Africanum. It is most commonly transmitted by inhalation of infected droplet nuclei(1). Though it affects peoples of all ages and sexes, poverty malnutrition, overcrowding and more recently HIV/AIDS have been known for decades to make some groups more vulnerable to develop the disease (2). The standard WHO regimen for the treatment of TB involves four drugs for the intensive phase of 2-3 months and two or three drugs for a further “Continuation phase” of 6 -8 months where Directly Observed Treatment Short Course (DOTS) is practiced(2).

DOTs is the acronym for Directly Observed Treatment, Short-course and is the brand name for the WHO recommended strategy for TB control. Since its introduction in 1991, it has crucial importance in that health and community workers provide the proper environment for patients to receive the full course of first-line anti-TB drugs during the short-course chemotherapy. It is best organized in such a way that patients receive treatment without having their daily life disrupted. The medication can be given by anyone who is willing, trained, responsible, acceptable to the patient and accountable to the TB control services. This approach makes it possible that patients, for example, receive medication at home or in the workplace and facilitates adherence to treatment(3).

Patient adherence to the advice and directives of health care providers has received increasing attention over the past several years. This is largely due to a growing realization that the promise of efficacious, new therapies to treat long-term and chronic disease conditions cannot be realized unless patients consistently adhere to therapy. In terms of TB control, adherence to treatment may be defined as the extent to which the patient`s history of therapeutic drug-taking coincides with the prescribed treatment(4). The adherence may be measured using either process-oriented or outcome-oriented definitions. Outcome oriented definitions use the end result of treatment. For example, the cure rate is used as an indicator of success while the process-oriented indicators make use of intermediate variables such as appointment keeping or pill counts to measure adherence(5).

1.1 Statement of the Problems

Poor adherence to treatment of chronic disease including TB is a worldwide problem of striking magnitude; however patient with TB are expected to have adherence level greater than 95% in order to facilitate cure(6).The failure for cure increases the risk of development of drug resistance TB and further spread in community which in turn increase morbidity and mortality(7). Drug-resistant TB is a man-made problem, largely being the consequence of human error as a result of individual or combination of factors. Management of drug supply, patient management, prescription of chemotherapy (inappropriate treatment, incorrect use of anti-TB drugs, or use of poor quality drugs), patient adherence and Poor infection control practice has been identified as a major contributing factor for emergence of MDR-TB(8).

The World Health Organization estimates that over 1.7 billion people in the world have been infected with the tubercle bacillus, and over 20 million are with active disease. Every year, there are about 8 million new cases and between 2 to 3 million deaths resulting from Tb despite it is a curable disease. Despite good process with implementing the DOTS strategy, notified TB cases continue to rise in many countries. Globally around 480,000 new multidrug-resistant tuberculosis (MDR-TB)cases occurred in 2013(9). Current treatment regimens for drug-resistant TB are complex, lengthy, toxic and expensive. Only about one half of MDR-TB patients started on treatment globally are reported to be treated successfully, largely due to a high frequency of death and loss to follow-up, commonly associated with adverse drug reactions and high costs of treatment(9).

In Sub-Saharan Africa, the second high burden nation, Tuberculosis is presenting new challenges as a public health problem, especially at a time of increasing threats due to HIV infection, multi-drug-resistant and extensively drug-resistant strains of Mycobacterium tuberculosis. TB also accounts for about 6.7% of all deaths in the developing countries; including 18.5% of all deaths of persons between 15 and 45 years of age(10). This makes TB the greatest cause of death from a treatable disease within the economically productive age group in the world. This makes TB the greatest cause of death from a treatable disease within the economically productive age group in the world. In the region, there is high rate of loss to follow up of TB patient that range from 11.1% -29 %(11).

Ethiopia is one of the seven countries that reported lower rate of treatment success and patient who take TB treatment irregularly. According to hospital statistics data, TB is the leading cause of morbidity, the third cause of hospital admission and the second cause of death in Ethiopia(12).Prevalence of MDR-Tb among new cases of TB increased from 1.6% in 2005 to 17.8% in 2014 in this country(13).

In Oromia, the largest region both in terms of total population and land mass, there have been poor performances achieved in TB control activities in recent years. Despite unprecedented achievements gained in creating access to basic health services through rapid expansion of health facilities, TB case detection and cure rate were below the WHO standard in Oromia in general and in Jimma in particular(14). According to the 17th annual review meeting of HSDP 2015, the case detection (CDR) of Oromia and Jimma town was 48% and 42% and the cure rate (CR) was 71% and 81% respectively. Therefore this study was designed to assess tuberculosis treatment adherence and identify associated risk factors and indicate specific adjustments to be made(15).

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Background

TB is one of the oldest human diseases in the world since its effects had been seen in Egyptian mummies' deformed skeletons, supposedly caused by TB. The symptom associated with the ongoing emaciation of the patient as a result of TB was named "phthisis" by Hippocrates(16). TB is a medico-social problem; factors such as socio-economic and nutritional status, perception of the disease, health-seeking behavior and access to health care, influence its frequency and prognosis. It is generally seen as 'dirty social disease', which mainly affects poor people. 'Hard work' or 'overwork' and 'bad hygiene' are believed to cause TB. It is a major public health problem worldwide. TB is a disease of poverty readily taking advantage of those with weakened resistance due to poor nutrition and general health. Social conditions therefore play a large part in determining a person's susceptibility to the disease (17).

The World Health Organization (WHO) reported in 2013 that there were an estimated 9.7 million new cases and 12 million prevalent cases of TB in the world of which 1.5 million died of the disease. About 26% of the new cases occurred in Africa where poverty and HIV epidemic are the main factors(11-13). Tuberculosis is a global health concern. It is a major cause of illness and death worldwide second to HIV/AIDS, especially in low and middle income countries where it is fuelled by the presence of HIV/AIDS. The World Health Organization (WHO) report on tuberculosis indicated that, in 2010, there were 8.8 million incident cases of tuberculosis, and 1.1 million deaths from TB among HIV-negative people and an additional 0.35 million deaths from HIV-associated TB. Majority of cases were (40%) occurred in India and China and 82% of TB cases were from the 22 high-TB burden countries which includes Ethiopia (18).

Ethiopia is one of the 22 highest TB infected countries with the burden of tuberculosis. It ranks 7th in the world and 2nd in Africa next to Nigeria in the number of TB cases(19).In Oromia region, in 2012/13, the total registered cases of TB were 35,415 with case detection rate of 147/100,000(20). There are 541 registered pulmonary and extra pulmonary tuberculosis in Jimma town (21).

DOTS is the acronym for Directly Observed Treatment, Short-course and is the brand name for the WHO recommended strategy for TB control. Since its introduction in 1991, it has crucial importance in that health and community workers provide the proper environment for patients to receive the full course of first-line anti-TB drugs during the short-course chemotherapy (3,20).

In Ethiopia, a control strategy for TB was initiated in the early 1960s with the establishment of TB centers and sanatoriums in a few places, which then followed by the direct observation treatment short course (DOTS) program in the early 1992. Currently, the DOTS health facility geographical coverage is 100% and the majority (92 %) of the existing hospitals and health centers are implementing DOTS-based TB treatment services (23).

2.2 Present status of tuberculosis treatment Adherence.

Strict adherence to the treatment is imperative in the prevention of development of drug resistance. According to global report of Tb the treatment success rate among new and re-treatment category of 5.4 million TB cases reached 86% globally in 2013 (18).

South East Asia is a high TB burden nation and studies done in china indicate the (42%) non- adherence to re-treatment schedule and the same is true in different states of India (18-19).

Sub-Saharan Africa the second high burden nation seen with treatment success rate of 80% among smear positive pulmonary TB which is lower than WHO target and 40.4 level of non- adherence was in Republic of South Africa(21, 22). In Ethiopia, the previous guideline for first-line anti-TB treatment was 8 months' duration, but the standard has been changed to 6 months. TB therapy requires more than 95% adherence to facilitate cure(4).

Among the 22 high burden countries 15 of them reached the target and Ethiopia is one of the 7 countries from which treatment success rate was lower than the target(23). In Ethiopia different study findings shows unacceptable level of drug adherence , for instance in a cross sectional study done on pediatric 17.8% of the participants had missed their medication thought the coarse(25). Other retrospective cohort study in Jimma zone of south east Ethiopia shows 13.5% Lost to Follow-Up rate which was substantially higher than the WHO recommended target of less than 5%(4).

2.3 Factors associated with Adherence

Socio demographic factors

Both diagnosis delay and non-completion of treatment are two central behavioral challenges. Patients are expected to seek care and complete treatment(24, 25). These complex patterns of care-seeking behavior cause diagnostic delay. With limited or lack of knowledge about symptoms of TB, patients mostly use the services of traditional healers and pharmacies(24).As it is known, coming early to health institutions to make TB diagnosis at the start of the symptoms has strong relationship with the successfulness of any treatment rather than coming after becoming severely complications(12). Having this, in the study done on individuals who had 9 weeks and more cough before TB diagnosis were risk factor for TB treatment failure(6, 26). Most of the TB treatment defaulting are associated with alcohol and tobacco consumption(27). In India, treatment default was linked to substance use in tuberculosis patients(28). It is important to recognize that components of the DOTS strategy are in fact responses to behavioral challenges in TB control.

According to a study conducted in Tigray regional states, factors including feeling better, forgetfulness, lack of knowledge on the benefits of completing a treatment course, running out of drugs at home, HIV Sero-positivity, use of herbal medication were significantly associated with non-adherence to an anti-TB treatment (29).

Employment status was not found to be significantly associated with treatment adherence among the patients, ($p=0.95$) in Tanzania(27). However, according to a study done in northern central Nigeria and Kenya the unemployed respondents were found to have higher treatment adherence than the employed(6,29).

TB is considered as the disease of the poor and it mostly affects those of lower income earnings. This makes it difficult for such patients to afford transportation cost to attend clinic. The daily attendance to the clinic tends to drain their finances and as a result reduces treatment seeking(30). Most of the patients are being paid on a daily basis for the work they do (daily paid workers are those who are not paid when they are at work) and might select to work rather than go to the clinic for their drugs. Again, there is no

payment for sick time so if taking TB treatment that would bring on different symptoms then the best possible option is to stop taking the drugs and this contributed to treatment default (26-27).

The provision of free diagnosis and medicines aims to eliminate costs that deter patients from seeking care and completing treatment(31). Programs that offer enablers such as transportation and food subsidies for patients assume that by minimizing costs the numbers of patients seeking diagnosis and care would increase. Having family size of more than 5 persons, and being re-treatment cases were significantly associated with unsuccessful treatment outcomes in Kenya(32). Similarly, according to WHO country report in Ethiopia, incentive programs also assume that modifying the behaviors of health providers is necessary to increase treatment rates(33).

Adherence study in North West Ethiopia and Kenya on related subject shows, the defaulters of TB treatment is mostly males with assigned reasons of being uncertain about treatment efficacy (21, 31). But a health facility based study done in northern Ethiopia contradict the above finding that, there is no statistically significant associations between sex of the patient for the development of TB treatment failure(30).

The prevalence of TB is highest between the age group of 21-40 and is more prevalent during the wet season(34). In Relation to this being in age between 30-39 years and being farmers by occupation were a negatively risk factors for bad treatment outcomes(35).In contrary, study in northern Ethiopia shows being older than 40 years of age was a factor for bad treatment outcomes(30).

Patients with tertiary education have better knowledge than the others. Most patients default treatment because they relate disappearance of tuberculosis symptoms with cure of the disease. This was because of Patients and their close relatives were not educated and counseled adequately on TB and the necessity for prolonging treatment (25, 34).

Service and provider related factors

Health care providers are expected to perform successfully a number of actions: including offering sputum smear examination to patients, conducting tests adequately, and monitoring medicine intake(36).

Work overload of health workers (AOR=2.38, 95% CL=0.73, 7.69) deny TB patients adequate education on their condition, individually; to enable them have understanding of their symptoms. This promote non-compliance of treatment among the less educated and rural patients. Aside the workload

causing impairment on the quality of evaluation of sputum smear (AOR=1.19, 95% CL=0.21, 6.68), patients had to spend longer period of time at the laboratory for their results before seeing a doctor, and collecting dugs. This is because the same staff is responsible for attending to TB cases as well as other medical conditions(31). Poor access of health facilities, non-availability of anti-TB drugs and where available, un affordability due to financial constraints were other service related factors in Central Nigeria(37). Longer travel time to Tb treatment clinic (AOR=3.98, 95% CL=1.82, 8.73) discourages the patients due to the exhaustion and stress from heavy traffic, especially those in the urban areas(27).

Disease and treatment related factors

Severe medication side-effect cause patients to require an extra clinic visit because of physical discomfort, unnecessary patient distress or worsening symptoms. These reasons increase the likelihood of treatment default. The symptoms mostly reported include: jaundice, itching, skin rash, nausea, and change in vision(38).Studies done in three districts of Arsi Zone, Ethiopia, found that anti-TB drug side effects were significantly associated with a high rate of defaulting(34).

Packaging medicines in blisters and storing them in individualized boxes aims to facilitate correct intake and adherence. Weekly distribution of medicines is intended to be a more effective method than monthly distribution to induce adherence. Non-adherence to an anti-TB drug treatment was also significantly associated with being in the continuation phases of chemotherapy, pill burden, lack of adequate communication with health professionals(6).

Rate of default was high among patients with extra-pulmonary TB, followed by patients with pulmonary TB and negative pre-treatment sputum smear microscopy in study done in Nigeria. That was similar to some studies which demonstrated similarly higher default rate in these two groups compared to the group with PTB and smear positive microscopy(37). However, patients with smear-positive PTB are more likely to complete treatment, possibly because their illness is more severe and symptomatic.

Psychosocial factors

TB is a stigmatized disease as people perceive it negatively. The negative connotations include prostitution, poverty, and un-cleanliness. For these reasons, TB patients face eviction by landlords, divorce, avoidance, being less respected, and loss of job among other forms of humiliation in their community(27). According to the case control study finding in Nigeria: risk factors associated with the cause of TB defaulting in poor resource limited setting include: societal stigma, discrimination luck of

family support and denial(39). The Ghanaian Daily Graphic journal on the 18th of March 2008 edition, reported that a lady teacher nearly abandoned her career when the community in which she stayed got to know that she was suffering from tuberculosis. She could not fetch water from the public stand pipe nor go to the market. To make matters worse, her church members sat far away from her during service so as not to contract the disease

2.4 Significance of the study

Cure of TB cases specially smear positive PTB cases, is without doubt the most effective measure for interrupting the chain of transmission of mycobacterium tuberculosis. As TB is far from being eradicated anywhere in the world, adherence of tuberculosis treatment is a key to controlling and preventing emergence of MDR and XDR TB. Measuring the adherence level and identifying associated factors could be one method of fighting Tuberculosis where there is case detection and treatment success rate below the WHO standard. So that proper interventions can be developed or modified to promote adherence and thus bridge the gap between clinical efficacy of interventions and their effectiveness. Risk factors for non adherence to Tb treatment are of inter-related to each other and it is imperative to assess the risk factors on a holistic level to design proper systems-level adherence interventions.

Policy makers could take into consideration risk-factors to develop better DOTS program with appropriate strategies to tackle reasons for non-adherence. This would lead to a program with higher rates of adherence and thus, a better treatment outcome, besides there was no TB treatment adherence study in Jimma town.

2.5 Conceptual frame work

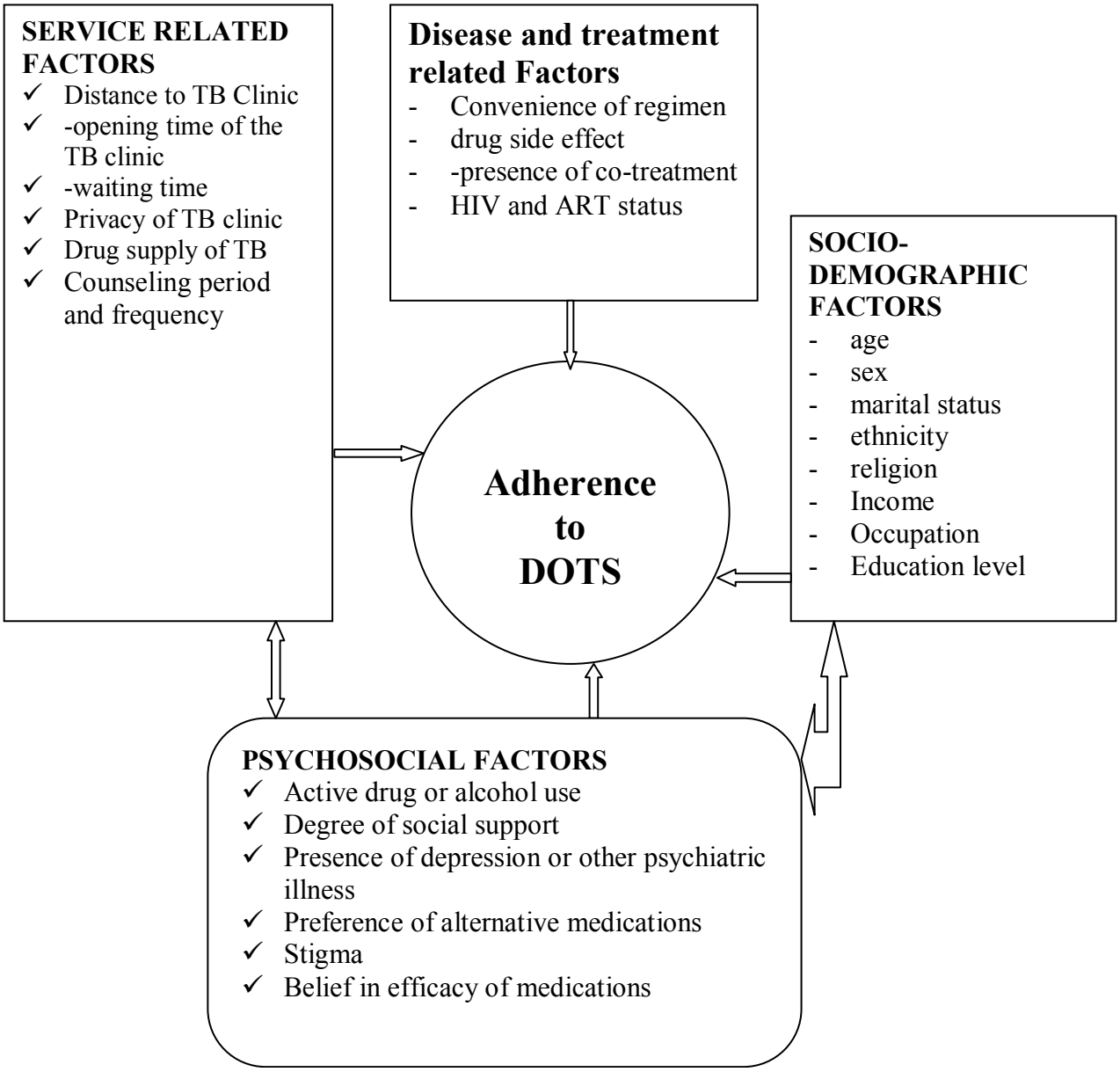


Figure 1conceptual frame work developed after review of different literature on factors associated with adherence to DOTs of PTB patients in Jimma town south west Ethiopia, 2016.

CHAPTER THREE

3. Objective of the Study

3.1 General Objective:

- To assess the level and associated factors of adherence to directly observed therapy (DOT) among pulmonary TB patients in Jimma town public health facilities, 2016.

3.2 Specific Objective:

- To determine the level of adherence to DOTS among PTB patients in Jimma town government health facilities.
- To identify factors associated with adherence to tuberculosis treatment (DOTS) among PTB patients in Jimma town.

CHAPTER FOUR

4. METHODS AND MATERIALS

4.1 Study area and study period

The study was conducted in six government health facilities in Jimma town from March 20 to April 30, 2016. The town is located 352km from the capital city Addis Ababa in Southwest direction and the 189,733 estimated number of population makes it one of the highly populous cities in Oromia regional states. There are four public health centers, one zonal, one specialized referral hospital and one military hospital in the town and around 30 private and 4 nonprofit medium clinics. A total of 230 health professionals of different discipline are there in the town and among them 49 are Urban Health Extension Professionals (UHEP's) serving the community at kebele level(13). The two public hospital included were Jimma University Specialize Hospital (JUSH) and Shenen Gibe zonal hospital which provides more of curative services for approximately 12 million and 900,000 population in the Southwest part of Ethiopia and Oromia respectively. Four public health centers namely: Jimma, Higher 2, Mendera Kochi and Bacho Bore are included in this study and these health centers are organized as a Primary Health Care Unit (PHCU) giving preventive and curative services for 3-5 kebele residents of the town population.

4.2 Study design

Institution based cross-sectional study.

4.3 Population

4.3.1 Source population

All registered pulmonary Tuberculosis patients in the health facilities

4.3.2 Study population

Selected pulmonary tuberculosis patients in government health facilities.

4.4 Study variable

4.4.1 Dependent variable

- Adherence to DOTs

4.4.2 Independent variables

Table 1 list of Independent variables on Tb treatment adherence study in Jimma town

Socio-demographic factors	**Service related variables**	**Disease and treatment related**	**Psychosocial**
- age - sex - marital status - ethnicity - religion - Income - Occupation - Education level	- Distance to TB Clinic - Waiting time - Privacy of TB clinic - Drug supply of TB clinic - Counseling period and frequency	- Convenience of regimen - drug side effect - HIV and ART status - Other co-treatments	✓ substance use ✓ Degree of social support ✓ Presence of depression or other psychiatric illness ✓ Preference of alternative medications ✓ Stigma ✓ Belief in efficacy of medications

4.5 Sample Size and Sampling technique.

- Sample size was calculated by assuming the following parameters:
  - The total size of the population from which the study subjects was selected was**541(**total pulmonary TB patients registered and who are on Tb treatment follow up during the two quarter of year 2008 EFY(21)**.**
  - Expected proportion of adherence in the study population is assumed to be 50%(40).
  - Confidence level of 95 % and
  - Absolute precision of 5%
- Taking the above into consideration and using a single population proportion formula

$$n = \frac{(Z\alpha/2)^2 \, p\,(1-p)}{d^2}$$

- the sample size was found to be 384,
- As the total number of registered PTB cases was much lower than 10,000, population correction formula was used to calculate the final sample size.

- n= n/(1+n/N) = 225 where N= 541 and adding **10%** of non-response rate the total sample size became **246**.

- For second objective sample size was calculated by using Open Epi 7.1 for those factors that can facilitates or inhibits patients' adherence to DOTs of Tb treatment. During calculation 95% CI, 80% power, percent of unexposed with outcome, and percent of exposed with outcome on Tb treatment category, average delay time and appointment card were used and all the calculated samples for both objectives were compared each other's to obtain the maximum sample. So that the sample size calculated by single population proportion becomes higher and it was used.

Variable	**Assumptions**	**Total sample**
Tb treatment category	%outcome in unexposed group =81.8 % outcome in exposed group = 95.3, 95% CI, 80% Power, Ratio 1:1	202
Average delay time for service	% outcome in unexposed group =76.6% outcome in exposed group = 92.2, 95% CI, 80% Power, Ratio 1:1	194
Provision of appointment card	% outcome in unexposed group =70.6% outcome in exposed group = 90.2, 95% CI, 80% Power, Ratio 1:1	148

Sampling technique

The total sample size was distributed to each health facilities based on probability proportional to size allocation method.

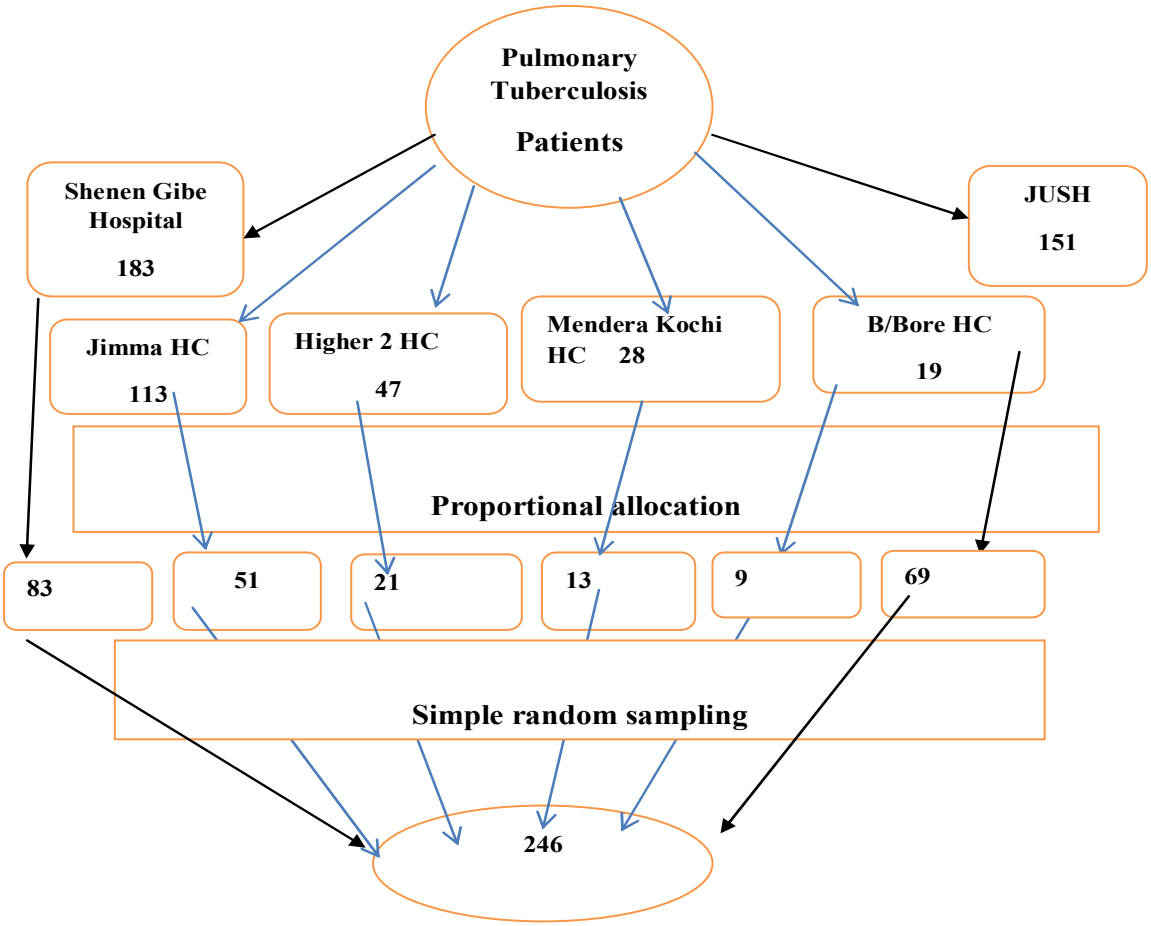


Figure 2 Schematic presentation of sampling technique and sampling procedure.

4.6Inclusion criteria

- All pulmonary TB patients registered in public health facilities and completed the five months treatment
- Age over 18 years,

4.7Exclusion criteria

- Extra pulmonary Tb patients
- Severely ill patients

4.8 Data collection

The participants were contacted in person when patients take their directly observed therapy of anti-Tb medication and those who randomly selected but are unavailable were contacted though telephone to bring them back to TB clinic for interview and face to face interview method were applied. Trained nurses were used as data collector using structured and pre-tested Afan Oromo and Amharic version questionnaire based on the respondents' language preference to collect socio-demographic, psychosocial, disease and treatment related and service related data.

4.9 Data quality assurance

The English version of the questionnaire was translated into the local language Afan Oromo and Amharic and back translated to English by experts. Before the actual data collection, the questionnaire was pretested in 5% of the actual patient at private health facilities and data was collected with ongoing supervision by checking filled formats for their completeness. Data collectors were trained for two days prior to pretesting about how to conduct the interview, the inclusion and exclusion criteria and about questioners coding.

4.10 Data processing and analysis

The data was cleaned, coded and entered into EpiData version 3.1and analyzed using SPSS version 16. Binary logistic regression was done primarily to check which variables have association with the dependent variable individually and then, all variables, with p-value < 0.25 in bivariate logistic regression model were selected for multivariate logistic regression model using backward stepwise probability entry of 0.05 and removal 0.10, hosmer-lemeshow goodness of-fit with method to identify independent factors associated with adherence to DOTs at 95% confidence interval to declare statistical significance. Multicollinearity was checked by variance inflation factor and tolerance of 0.10.

4.11 Ethical considerations

Ethical clearance was obtained from ethical review board of College of Health Sciences, Jimma University. Written permission was obtained from the Oromia Regional Health Bureau. Then, letter of permission was obtained from Jimma town Health office and also heads of the health centers hospitals medical directors was communicated through formal letter from town health office in addition to personal communication. The objective of the study was explained to the study participants in order to obtain their verbal consent before interview and they were told about anonymity. Participants were also reassured for confidentiality of their response.

4.12 Measurements

Level of adherence was measured based on WHOs' standard of anti tuberculosis management which is 95% of the total doses should be taken for effective treatment outcomes (4, 5). Those who are considered to be adherent in new treatment cases should take at least 133 doses of the recommended 140 doses and those who are in re-treatment category should take 186 doses of the recommended 196 doses during their DOTs of anti-Tb treatment.

4.13 Operational definitions

1. Adherent patients: - Those Tb patients who do not miss their dose and /or those who misses below7 and 10 doses during their five and seven months treatment for New and re-treatment t category respectively.
2. Non-adherent:- Those patients who misses greater than 7 and 10 doses of their treatment during their five and seven months treatment for New and re-treatment t category respectively.
3. DOTs:- Direct observation of patients while swallowing their medication.

CHAPTER FIVE

5. Result and Discussion

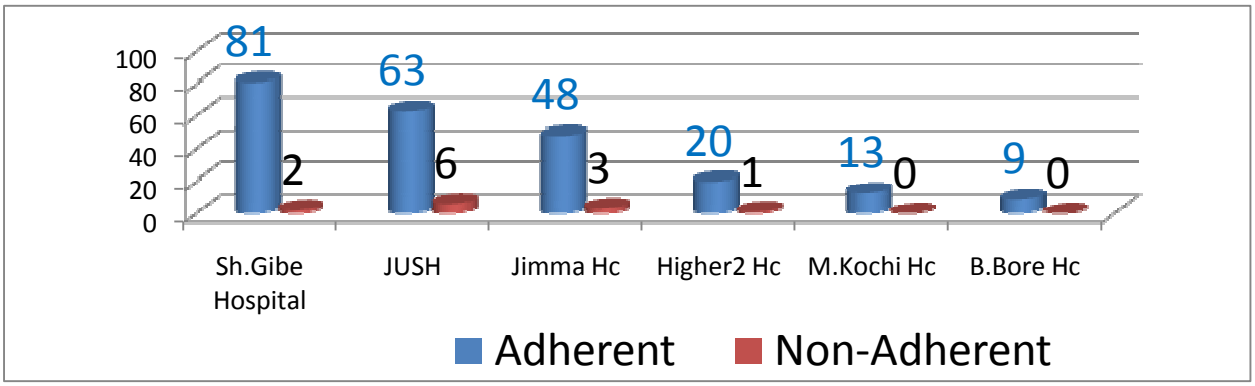
5.1 Results

5.1.1 Socio-demographic characteristics

All sampled patients (n=246) were interviewed and their age ranged from 18-65 with mean of 31years with SD of 10.2 years. Males were 129(52.4%), Oromo 94 (38.2%) and Muslims 118 (48%). More than a half (53.3%) were single and concerning educational status, only 19 (7.7%) completed college certificate. One hundred twenty nine (52.4%) of the respondents were self-employed with nearly half earning 500-1000 ETB per month Table 2.

5.1.2 Level of adherence in Jimma town government health facilities.

Out of 246 Pulmonary TB patients who have been on DOTs of anti Tb medication for the past five months, 221 (89.8%) of them never missed their recommended doses. The level of adherence was found to be 95.1 %. The highest proportions among adherent patients were age below 35 years 161(69%) and single patients128 (54.7%). The highest proportion of non-adherence was observed among patients who received their treatment at Hospitals (66.7%). Among the hospitals, Jimma University specialized hospital shares the highest proportion (75%) of non-adherence and the same is true for Jimma health center in 75%, when compared to patients who attended their treatment at health centers Figure 3.



.Figure 3 Proportion of adherent and Non-adherent patients between government facilities in Jimma town 2016

5.1.3Disease and treatment related factors

The majority, 225(91.5%), of the participants were new TB cases and159 (64.6%) of them were smear positive. About 210(85.4 %) of the patients knew their HIV status, of which 44 (17.9 %) were HIV sero-positive and 41 (93.2%) of them are on ART Table 2.

5.1.4 Service and provider related factors

With respect to collecting anti-TB medication from health center/hospital, majority 174 (70.7%) collect it daily and 147 (59.8%) access the Tb clinic within one Kilometer radius. Seventy six percent of respondents were within walking distance to get into the clinic and 59 (24%) used transport services. The average delay time before being served at the health institution was 1 hour and15 min (SD = 48 min) and 231 (93.9 %) reported that care providers keep theirprivacy237 (96.3%) of them were provided by appointment card to remind their appointment. One hundred ninety four patients (78.9%) were counseled only in the first visit and 30 (12.2%) patients were never counseled. Majority 218 (89.0%) were told what to do when DAE happen Table 2.

5.1.5 Psychosocial factors

Majorities 208 (84.6%) of the respondents were disclosed their Tb disease to their family and 75% of them have got family support. Concerning their belief towards anti-Tb medication almost all (98.3%) believed on the efficacy of the medication and majority 226 (95.4%) prefer seeking medical attention while they feel sick during their illness and only 2.4% were practicing home remedies. About 88% of the study participants were free of any form of substance abuse and only 7.3% of them have history of mental illness Table 2.

Table 2 Frequency Socio demographic characteristics, Service, Psychosocial, Disease and treatment related factors of DOTs Tb treatment Adherence study participants in Jimma town. (n=246)

Characteristics Response	No of respondents	Percent %
Sex		
Male	129	52.4
Female	117	47.6
Age category		
18-24	75	30.5
25-34	93	37.8

35-44	50	20.3
≥45	28	11.4
Marital status		
Single	131	53.3
Married	84	34.1
Widowed	11	4.5
Divorced	20	8.1
Income		
≤499	54	22.0
500-1000	110	44.7
≥1000	25	10.2
no income	57	23.2
Educational level		
No formal education	39	15.9
Read and writ	62	25.2
Primary	71	28.9
Secondary	55	22.4
College and above	19	7.7
Religion		
Muslim	118	48.0
Orthodox	96	39.0
Protestant	23	9.3
Others*	9	3.7
Occupation		
Unemployed	43	17.5
Self-employee	129	52.4
Government employee	29	11.8
Others*	45	18.3

Ethnicity		
Oromo	94	38.2
Amhara	42	17.1
Dawro	43	17.5
Gurage	48	19.5
Others*	19	7.7
Smear result		
Positive	159	64.6
Negative	87	35.4
Tb Treatment category		
New	225	91.5
Re-treatment	21	8.5
HIV status		
Positive	44	17.9
Negative	166	67.5
Unknown	36	14.6
Taking treatment other than TB		
Yes	11	4.5
No	235	95.5
Ever encountered DAE		
Yes	35	14.2
No	211	85.8
Presence of Missed dose		
Yes	25	10.2
No	221	89.8
distance of the clinic in KM		
< 1km	147	59.8
greater than 1km	99	40.2
frequency of Tb clinic visit		
daily	174	70.7

Weekly	55	22.4
Monthly	10	4.1
others	7	2.8
Duration of service		
≤2 hours	216	87.8
3-4 hours	21	8.5
> 4hours	9	3.7
Means of travel to the clinic		
Walking	157	76
vehicle	59	24
Knowledge of impact of missing tablets		
Yes	232	94.3
No	14	5.7
Frequency of counseling		
first visit only	194	78.9
in every visit	22	8.9
never counseled	30	12.2
Counseled on total duration of therapy		
Yes	227	92.3
No	19	7.7
Counseled on what to do when DAE happen		
Yes	218	89.0
No	27	11.0
Reminding through Provision by appointment card		
Yes	237	96.3

No	9	3.7
Keeping patients Privacy		
Yes	231	93.9
No	15	6.1
Disclosure to family and friend		
Yes	208	84.6
No	38	15.4
Family support		
Yes	173	70.3
No	73	29.7
Believed efficacy of Anti Tb treatment		
Yes	241	98.0
No	5	2.0
Preference of seeking treatment while sick		
home remedies	23	9.3
visiting spiritual healers	16	6.5
visiting medical service	127	51.6
Others	80	32.5
presence of history of mental illness		
Yes	19	7.7
No	227	92.3
Presence of substance use		
Yes	45	18.3
No substance use	201	81.7

(*) others for occupation included students and NGO employee & in ethnicity were Kefa & Hadiya**,** in religion Catolic, in frequency of visit every 3 days and in presence of co-treatment visiting kalicha.

5.2 Association of socio demographic, Disease and treatment related, Service and Psychosocial factors with DOTs of Tb treatment adherence in Jimma town.

Bivariate analysis of socio-demographic factors shows, Age (p=0.12), Marital status (p=0.01), Religion (p=0.07), Educational level (p=0.03), Income (p=0.1) and Ethnicity (p=0.21) have significant association with treatment adherence. Among disease and treatment related factors only treatment category with (p=0.051) become significantly associated and the rest; smear result, HIV status, presence of co-treatment and occurrences of DAE has no significant association with adherence Table 3.

Concerning association of factors related to service; being counseled on what to do if DAE happen (p=0.02) being counseled about total duration of Tb treatment (p<0.001), provision of appointment card (p=0.03), frequency of counseling (p=0.17) and keeping privacy (p=0.001) found to be significantly associated with treatment adherence and the rest, frequency of Tb clinic visit, distance of the clinic and waiting time with 95% CI have no significant association Table 3.

Analysis of psycho social factors shows disclosure of their disease to family or friends (p=0.001), belief on efficacy of anti-Tb (p=0.15) and health seeking trend towards Tb (p=0.02), presence of history of mental illness (p=0.03) and presence of substance use (p =0.02) become significantly associated with Tb treatment adherence Table 3.

After multivariate analysis educational levels (AOR=0.004, 95% CI= 0.001, 0.12), marital status (AOR=0.02, 95% CI= 0.001, 0.46) and monthly income (AOR=0.035, 95% CI= 0.002, 0.57) of the respondents have statistically significant association with Tb treatment adherence

Table 4.

Among significantly associated service related factors being counseled about the total duration of treatment (AOR=0.02, 95% CI= 0.004, 0.11), being counseled on what to do when DAE happen (AOR=0.18, 95% CI= 0.08, 0.83) become statistically significant. Among psychosocial factors on multivariate analysis presence of substance use (AOR=14.4, 95% CI= 1.62, 79.1) become significant with non adherence

Table 4.

Table 3 Bivariate analysis of Service, Psychosocial, Disease and treatment related variables on DOTs Tb treatment adherence in Jimma Town 2016. (n=246)

Variables	Adherence status		P value	Crude OR (95 % CL)	95.0% C.I. for EXP(B)	
	No & % of adhered	Number & % of non adhered			Lower	Upper
Sex						
Male	122 (94.6%)	7 (5.4%)		1.00		
Female	112 (96%)	5 (4%)	.77	1.28	.39	4.16
Age group						
18-24	73 (97.3%)	2 (2.7%)	.12	2.07	.39	11.01
25-34	88 (94.6%)	5 (5.4%)	.39	1.00		
35-44	49 (98%)	1 (2%)	.36	2.78	.32	24.51
≥45	24 (85.7%)	4 (14.3%)	.13	.34	.09	1.37
Marital Status						
Single	128 (97.7%)	3 (2.3%)	.01	1.00		
Married	81 (96.4%)	3 (3.6%)	.58	.63	.13	3.21
Widowed	9 (81.8%)	2 (18.2%)	.02	.11	.02	.71
Divorced	16 (80%)	4 (20%)	.003	.09	.02	.46
Income						
≤499	68 (89.5%)	8 (10.5%)	.42	.48	.093	2.44
500-1000	110 (96.5%)	4 (3.5%)	.37	1.00		
≥1000	7 (100%)	0	.74	.67	.07	6.75
no income	49 (100%)	0	.10	.29	.07	1.26
Educational Level						

No formal education	38 (95%)	2 (5%)	.04	.09	.01	.86
Read and writ	60 (92.3%)	5 (7.7%)	.04	.87	.053	14.23
Primary	68 (97.1%)	2 (2.9%)	.92	1.00		
secondary	52 (99.98%)	1 (0.02)	.43	.38	.03	4.29
College certificate	14 (87.55)	2 (12.5%)	.03	.08	.01	.78
Religion						
Muslim	110 (93.2%)	8 (6.8%)	.26	1.00		
Orthodox	102 (98.1%)	2 (1.9%)	.07	6.91	.85	56.25
Protestant	20 (90%)	2 (10%)	.74	.76	.15	3.85
Others	2 (100%)	0	.63	.58	.07	5.25
Race						
Oromo	89 (91.8%)	8 (8.2%)	.64	1.00		
Amhara	41 (97.6%)	1 (2.4%)	.27	3.34	.39	28.03
Dawuro	41 (95.4%)	2 (4.6%)	.53	1.67	.33	8.39
Gurage	47 (98%)	1 (2%)	.22	3.83	.46	32.04
Others	16 (100%)	0	.69	1.55	.18	13.32
Occupation						
Unemployed	41 (95.4%)	2 (4.6%)	.640	1.36	.28	6.64
Self employed	121 (93.8%)	8 (6.2%)	.267	1.00		
GOV employee	28 (96.6%)	1 (3.4%)	.534	1.85	.22	15.41
Others	44 (97.8%)	1 (2.2%)	.216	2.91	.35	23.93
Smear result						
Positive	152 (95.6%)	7 (4.4%)		1.00		
Negative	82 (94.3%)	5 (5.7%)	.64	.76	.23	2.46
Tb Treatment category						
New	216 (96%)	9 (4%)		1.00		
Re-treatment	18 (83.7%)	3 (14.3%)	.05	.25	.06	1.01
HIV status						

Positive	41 (93.2%)	3 (6.8%)	.76	.60	.15	2.43
Negative	159 (95.8%)	7 (4.2%)	.48	1.00		
Unknown	34 (94.4%)	2 (5.6%)	.73	.75	.15	3.76
Presence of co-treatment						
Yes	11 (91.7%)	1 (8.3%)		1.00		
No	224 (95.7%)	10 (4.3%)	.52	.49	.06	4.19
Ever encountered DAE						
Yes	32 (91.4%)	3 (8.6%)	.28	.48	.12	1.85
No	202 (95.7%)	9 (4.3%)		1.00		
Frequency of counseling						
first visit only	186 (96%)	8 (4%)	.17	1.00		
in every visit	19 (88.4%)	3 (13.6%)	.07	.27	.07	1.11
never counseled	29 (96.7%)	1 (3.3%)	.84	1.25	.15	10.34
Frequency of Tb clinic visit						
daily	166 (95.4%)	8 (4.6%)	.59	1.00		
Weekly	53 (96.4%)	2 (3.6%)	.76	1.28	.26	6.20
Monthly	9 (90%)	1 (10%)	.45	.43	.05	3.85
others	6 (85.7%)	1 (14.3%)	.28	.29	.03	2.69
Distance to Tb clinic						
< 1km	140 (93.2%)	7 (4.8%)	.91	1.00		
≥1km	94 (95%)	5 (5%)		.94	.29	3.05
Waiting time						
< 2 hrs	205 (95.1%)	10 (4.9%)	.76	1.00		
2-4 hrs	20 (95.2%)	1 (4.8%)	.98	.98	.12	8.02
> 4hrs	9 (90%)	1 (10%)	.46	.44	.05	3.81
Being Counseled on what to do when DAE happen						
Yes	210(96.3%)	8 (3.7%)	.02	1.00		
No	23 (85.2%)	4 (14.8%)		.22	.06	.78
Being Counseled about the total duration of treatment						
Yes	222(97.8%)	5 (2.2%)	0.000	1		
No	12 (63.2%)	7 (36.8%)		.04	.01	.14

Appointment card provided						
Yes	227(95.8%)	10 (4.2%)	.03	1.00		
No	7 (71.4%)	2 (28.6%)		.15	.03	.84
Privacy						
Yes	223(96.5%)	8 (3.5%)	.001	1.00		
No	11 (73.3%)	4 (26.7%)		.09	.03	.38
Disclosure to family						
Yes	198(95.2%)	10 (4.8%)	.91	1.00		
No	36 (94.7%)	2 (5.3%)		.91	.19	4.32
Presence of family support						
Yes	165 (95.4%)	8 (4.6%)		1.00		
No	69 (94.5%)	4 (5.5%)	.78	.84	.24	2.87
Belief in Anti-Tb medication						
Yes	230 (95.4%)	11 (4.6%)		1.00		
No	4 (80%)	1 (20%)	.15	.19	.02	1.86
Trend of Tb Treatment						
Home remedies	20 (95.2%)	1(4.8%)	.11	.65	.07	6.12
Visiting Spiritual healers	13 (81.3%)	3 (18.7%)	.71	.14	.03	.70
Seeking medical attention	123 (96.8%)	4 (3.2%)	.02	1.00		
Others	77 (95.1%)	4 (4.9%)	.52	.63	.15	2.58
Presence of history of mental illness						
Yes	16 (84.2)	3 (15.8%)	.03	.22	.05	.89
No	218 (96%)	9 (4%)		1.00		
Substance use						
Yes	35 (85.4%)	6 (14.6%)	.01	5.00	1.53	16.32
No	199 (97.1%)	6 (2.9%)		1.00		

Table 4 Multivariate analysis of Service, Psychosocial, Disease and treatment related variables on DOTs Tb treatment adherence in Jimma Town 2016. (n=246)

Variables	Adherence status		Crude OR (95% CL)	Adjusted odds Ratio (95% CL)
	No & % of adhered	No & % of Non adhered		
Marital status				
Single	128(97.7%)	3(2.3%)	1.00	1.00
Married	81 (96.4%)	3(3.6%)	.63 (.125-3.2)	0.26 (0.03-2.19)
Widowed	9 (81.8%)	2(18.2%)	.11 (.02-.71)	0.02 (.001-.46)
Divorced	16 (80%)	4 (20%)	.09 (.02-0.5)	0.06 (.01-.56)
Educational level				
No formal education	38 (95%)	2 (5%)	.09 (0.01-0.86)	.09 (.005-1.37)
Read And Writ	60 (92.3%)	5 (7.7%)	.87 (.05-14.2)	1.25 (.50-29.8)
Primary	68 (97.1%)	2 (2.9%)	1.00	1.00
Secondary	52(99.98%)	1 (0.02)	.38 (.03-4.3)	.18 (.01-3.19
College & above	14 (87.55)	2(12.5%)	.08 (.01-.78)	.004 (.000-.12)
Monthly Income				
< 499	8 (10.5%)	68 (89.5%)	.47 (.09-2.44)	.035 (.002-.57)
500-1000	4 (3.5%)	110 (96.5%)	1.00	1.00
>1000	0	7 (100%)	.67 (.08-6.75)	6.04 (.36-101.6
No income	0	49 (100%)	.29 (.08-1.28)	.19 (.02-1.81)
Being counseled on total duration of Treatment				
Yes	222(97.8%)	5 (2.2%)	1.00	1.00
No	12 (63.2%)	7(36.8%)	.04 (.01-0.14)	0.02 (.004-.11)
Being counseled on what to do when DAE happen				
Yes	210(96.3%)	8 (3.7%)	1.00	1.00
No	23 (85.2%)	4(14.8%)	.22 (0.06-0.78)	.18 (.08-0.83)
Presence of substance use				
Yes	39 (86.7%)	6 (13.3%)	5.0 (1.5-16.3)	14.41 (1.62-79.1)
No	195 (97%)	6 (3%)	1.00	

(*) Marital status (P=0.034), educational status (0.009), Monthly income (0.018), counseling on total duration (p=0.029), counseled on what to do when DAE (p<0.0001), substance use (p=0.002)

Half of (50%) the Non- adherents were substance users and the most common reasons for missing of doses were: being busy and forgetfulness 6(24%) each and followed by getting relief from the symptoms 5(20%) Table 5.

Table 5 Table 5 Reason for missing doses of DOTs Tb treatment adherence study in Jimma town 2016.

		Adherence status		
		Non-adherent	Adherent	Total
Reason for missing anti Tb doses	get relieved	2	3	5
	Lack of progress	0	2	2
	Being busy	3	3	6
	Being frustrated by long Duration of treatment	1	0	1
	Big pills	2	0	2
	Forget fullness	2	4	6
	Drug side effect	2	1	3
Total		12	13	25

5.3Discussion

In this study among pulmonary TB patients in Jimma town, 95.1% of the patients were found to be adherent to DOTs of anti Tb treatment and that means majority of patients were strictly taking their treatment doses. It was in the range of the WHO's recommended level that required more than 95% adherence to facilitate cure(4). The finding was much higher than the one in north Ethiopia Alamata, 88.5%, and the study done in Rwanda 90% and much higher than the one in central Ethiopia Adama 64.83%(38, 39,21,).This could be due to the fact that expansion of public health facilities seen in recent years in the town makes DOTs service more accessible and use of mobile phones for reminding patients to collect drugs for the continuation phase. The use of mobile phones in contact tracing is a novel approach that needs to be promoted.

In this study there was statistically significant association between marital status and Tb treatment adherence. Patients who were married (AOR=0.26, 95% CI= 0.03, 2.19) were more likely to be adherent than those single and the widowed (AOR=0.02, 95% CI= 0.001, 0.46) and the divorced (AOR=0.06, 95% CI= 0.01, 0.56) patients were less likely to be adherent. The study finding was consistent with the one in Kenya and Republic of China (42,43). This finding contradicts with the one in Bahrdar city of North Ethiopia and Benin City of central Nigeria where single patients were more adherent (37,43). The possible reason might be due to the fact that those married have someone whom remind them to take their medication and who may help them in household chores that facilitates treatment adherence. Widowed and divorced patients may have their own child whom needs their care and that may cause them busy and forgot to take their medication.

With regard to educational status, patients who can read and write (AOR=1.25, 95% CI= 0.50, 29.8) were more adherent to DOTS services compared to those who have no formal education (AOR=0.09, 95% CI= 0.005, 1.37) and those with college certificate holders (AOR=0.004, 95% CI= 0.001, 0.12). This finding is in line with the study in central Nigeria, western Europe(33, 23). This could be due to the fact that highly educated people are more likely to be engaged to some form of employment and that will not be comfortable for collecting their treatment doses timely and this will probably lead them to be non adherent and those who have no formal education can't understand and practice what was told by service provider and their perception towards the danger of missing doses could be poor and that will makes them to be less likely adherent than those who read and write.

This study confirmed that counseling patients about the total duration of treatment with (AOR=0.02, 95% CI= 0.004, 0.11) was found to become statistically significant with Tb treatment adherence and the result is synonymous with the one in Alamata Ethiopia and Nigeria which states better communication between health professionals, particularly dispensers and patients is essential for improving treatment adherence(34,35). This could be due to the fact that pre treatment counseling on the total duration of therapy can help patients to set their mind for the full course of therapy and this could facilitates patients to rearrange their schedule so that they strictly adhere to their treatment.

The finding of this study also indicate that being counseled on what to do when drug adverse effect (DAE) happen (AOR=0.18, 95% CI= 0.08, 0.83) become statistically significant with Tb treatment adherence and it was supported by the findings in central Nigeria and the one in Bahirdar city of north Ethiopia (33,29). This is possibly due to the fact that occurrence of drug adverse effect in different forms can affect treatment adherence and those who are informed on what to do if it happen can manage those minor side effects at home and they can consult their clinician for the sever one, this may avoid interrupting their medication so that it facilitates adherence.

Patients with no income (AOR=0.19, 95% CI= 0.02, 1.81) were more adherent when compared to those who earn more than 1000 Ethiopian birr. The finding was consistent with the one in Tigray region of northern Ethiopia and benin city of Nigeria which states those with high income has poor adherence to their treatment (38, 44).

Those who have history of Substance use (AOR=14.41, 95% CI= 1.62, 79.1) were 14 times less likely to be adherent to their DOTs TB treatment than those who are free of substance. The finding was consistent with the study in United States and Western Europe (20). This could possibly be due to the fact that substance addiction can result in forgetfulness which can leads to missing their doses and in addition those substances may have interaction with anti Tb drug and creates synergy to aggravate minor symptoms.

Tuberculosis control programs in the town do a better job holding rather than finding cases. Even though it shows the efforts of the government and the development partners, adherence among TB patients needs to be kept in the range and improved so as to achieve treatment success and cure rate of 85%, as it is one of the health indicators of the growth and transformation plan two (GTP 2) of Ethiopia in the coming five years.

5.4 Limitation of the study

The treatment outcome of patients involved in this study were known based on the inclusion criteria and those patients who followed their 5 and more months treatment may have high probability of good compliance to the treatment and this will probably inflate the adherence level of this study finding. Majority of participants in this study were from hospital and they were not asked about their preference of facility for their treatment and this will have its own impact on recommendation of treatment facility based on the study findings.

5.5 CONCLUSION

The level of adherence observed in Jimma town was relatively high and it was in the range of adherence level set by the WHO. Appropriate pre-treatment counseling especially on total duration of treatment and counseling on what to do when ADE happen were important contributors of adherence and forgetfulness, being busy with work and getting relief from the symptom by early treatment effect were important predisposing factors for DOTs Tb treatment non-adherence. Social problems such as divorce and widowed, lack of formal education and being addicting with different substances have had an important role in affecting directly observed treatment of anti-Tb medication non adherence.

5.6 RECOMMENDATION

The regional health bureau and the town health office should work in collaboration with other NGOs in arranging sustainable refreshment training for care providers so that to scale-up their counseling skill to maintain the adherence level as high as possible. Service accessibility enhanced by cascading the treatment center at kebele level so as to address those patients miss their dose by being busy.

Integrated adult education should be strengthened to enable majority of adult population read and write and primary education should be expanded by ministry of education.

Finally this study shows the level of adherence and some associated factors yet further study should be done to investigate the reported low treatment outcome and the reason behind such outcomes in this town.

REFERENCE

1. USAID/MCHIP/Coregroup. Community-Based_TB Prevention and care. CORE Gr TB Gr. 2013;

2. FMOH. Guidelines for clinical and programmatic management of tb, leprosy and tb/hiv in ethiopia fifth edition. Natl Guid. 2012;

3. Group W, Group W, Group W, States WHOM, Group W, Group W. Improving access to second-line anti-TB drugs. WHO/CDC/TB. 2000;283.

4. Ministry of Health. Adherence to Treatment and Directly Observed Therapy. Guidelines for Tuberculosis Control in New Zealand 2010 [Internet]. Newzeland; 2010;5–21. Available from: http://www.moh.govt.nz

5. Sum artojo E. A social behavioural account of patient adherence. Am Rev Respir Dis. 1993;147:1311–20.

6. Anyaike C. ADHERENCE TO TUBERCULOSIS THERAPY IN UNILORIN TEACHING HOSPITAL , ILORIN , NORTH-CENTRAL NIGERIA Abstract : Int J Sci Environ. 2013;2(6):1441–61.

7. Akilew K and mulugeta B. Non adherence to anti TB treatment. Afr J Nurs Midwifery. 2013;10(1371):1371.

8. WHO. The STOP TB strategy: Building on and enhancing DOTS to meet the TB-related Millennium Development Goals. WHO/HTM/TB. 2006;4(368).

9. WHO. The use of bedaquiline in the treatment of MDR-TB. WHO Glob Heal. 2014;

10. WHO. Global TB report 2012. WHO/HTM/TB. 2012;

11. Castelnuovo B. A review of compliance to anti tuberculosis treatment and risk factors for defaulting treatment in Sub Saharan Africa. Afr Health Sci. 2010;10(4):320–4.

12. FMOH. Tuberculosis, Leprocy and TB/HIV Prevention and control programme. fourth edition. Addis Ababa; 2008;

13. FMOH. FEDERAL MINSTRY OF HEALTH annual Bulletin 2014. Addis Ababa; 2014.

14. Tb H. Heal TB MSH / HEAL TB Annual Project Report. Addis Ababa; 2012.

15. ORHB. ANNUAL REGIONAL TUBERCULOSIS, LEPROCY AND TB/HIV PROGRAM BULLETIN. ADAMA; 2015.

16. Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, et al. HARRISON'S Manual of Medicine. 17th ed.

17. Chayaka J. Optimizing the diagnosis of pulmonary tuberculosis. J East african Med TB Treat. 2007;3(10):453–4.

18. WHO. Global Tuberculosis Report 2015. WHO/HTM/TB. 2015;22.

19. WHO. Guidelines for the programmatic management of. WHO/HTM/TB. 2011;6.

20. Tb H. HEAL TB Annual Report PY2. Addis Ababa; 2013 Dec.

21. JTHO. Jimma town health office the two quarter performance report 2008. Jimma; 2015.

22. Goals TMD. THE STOP TB STRATEGY. WHO stop TB Partnersh. 2006;37.

23. MOH/EHNRI. First Ethiopian national population based survey. first edition. Addis Ababa; 2011 Jul;1–117.

24. Peltzer K. Factors at first diagnosis of tuberculosis associated with compliance with the Directly Observed Therapy (DOT) in the Limpopo Province, South Africa. Curationis. 2002;247–54.

25. Kelifa Osman Yusuf B, Fromsa Seifu M, Kefale Gelaw B, Tadesse Gebremariam E, Ahmed Mohammed M, Osman Yusuf α K, et al. Non Adherence and its Contributing Factors to Anti-TB Drug in Children's at Adama Referral Hospital, Oromia, Ethiopia. Glob J Med Res B Pharma. Global Journals Inc; 2015;

26. Gebremariam MK, Bjune GA, Frich JC. Barriers and facilitators of adherence to TB treatment in patients on concomitant TB and HIV treatment : a qualitative study. BMC Public Health [Internet]. BioMed Central Ltd; 2010;10(1):651. Available from: http://www.biomedcentral.com/1471-2458/10/651

27. Mwakapeje ER. Factors preventing complition of treatment among registered TB patients. Muhimbilli; 2010.

28. Talukdar N, Basu A, Punekar RM. An Ethnographic Study on the Factors Affecting Adherence to Directly Observed Treatment Short-Course in Typical Indian Settings. J Tuberc Res [Internet]. 2015;3(3):19–25. Available from: http://www.scirp.org/journal/jtr

29. Fisseha G, Etana B, Haileslassie K, Alemayehu M. Determinant Factors of Treatment Failure among Tuberculosis Patients under Directly Observed Therapy in Tigray Regional State Public Hospitals, North Ethiopia: A Case-Control Study. Glob J Med Res. Global Journals Inc; 2014;14(5).

30. Addis Z, Birhan W, Alemu A, Mulu A, Ayal G, Negash H. Treatment outcome of Tuberculosis patients in Azezo health center North west Ethiopia. Int J Biomed Adv Res. 2011;4(3):2229–3809.

31. Girma(B.sc) A. Quality Assessment of Directly Observed Treatment Short-Course of Tuberculosis in Afar National Regional State. Addis Ababa; 2007.

32. office of medical service ministry of medical service K& D. Adherence with Evidence-based TB Standards and Guidelines in Selected Health Facilities in Kenya. Jhpiego Corp. 2013;

33. Norgbe GK, Smith JE, Cur M, Du Toit HS, Cur M. FACTORS INFLUENCING DEFAULT RATES OF TUBERCULOSIS PATIENTS IN GHANA. Afr J Nurs Midwifery. 2011;13(2):67–76.

34. Ethiopia W country office. WHO Annual Report 2011. WHO global health country office Ethiopia. Addis Ababa; 2011.

35. Elkomy H, Awad M, El-shora A, Elsherbeni B. Assessment of the efficacy of Directly Observed Treatment with short course (DOTS) for pulmonary tuberculosis in Sharkia governorate. Egypt J Chest Dis Tuberc. 2013;62:257–61.

36. Waisbord S. Behavioral barriers in tuberculosis control. Chang Proj Educ Dev. 2006;

37. Chukuma Anyaike, Omotoso Ibrahim, Oluwole Adeyemi OA& OS. ADHERENCE TO TUBERCULOSIS THERAPY IN UNILORIN TEACHING HOSPITAL, ILORIN, NORTH-CENTRAL NIGERIA. Int J Sci Technol. 2013;2(6):2278–3687.

38. Shargie EB, Lindtjørn B. Determinants of Treatment Adherence Among Smear-Positive Pulmonary Tuberculosis Patients in Southern Ethiopia Methods and Findings. PLOS Med. 2007;4(2).

39. Oladeji Oloyede Michael Rn, *Tijani Wakili Adelani Rn BYA, Rn, Hamid Oluyedun, B.Pharm PVR. Factors Influencing Clients' Compliance with Therapy of \nTuberculosis in Ibadan, Nigeria\n. IOSR J Nurs Heal Sci. 2014;3(1):57–62.

40. Haynes RB, Ackloo E, Sahota N et al. Interventions for enhancing medication adherence. Cochrane Database Syst. 2008;(2):2008.

41. Tesfahuneygn G, Medhin G, Legesse M. Adherence to Anti-tuberculosis treatment and treatment outcomes among tuberculosis patients in Alamata District, northeast Ethiopia. BMC Res Notes. 2015;8(503).

42. Xu B, Zhao Q, Hu Y, Shi Y, Wang W, Diwan VK. Experiences in anti-tuberculosis treatment in patients with multiple previous treatments and its impact on drug resistant tuberculosis epidemics. Glob Health Action. 2014;

43. Kassie M, Aragaw A, Belay A. Assessment of the quality of directly observed treatment short-course of tuberculosis in Bahir Dar city administration, North West Ethiopia. Sci J Public Heal Sci J Public Heal Spec Issue Heal Behav Public Heal [Internet]. 2015;3(1):6–13. Available from: http://www.sciencepublishinggroup.com/j/sjph

ANNEX II Questioners

JIMMA UNIVERSITY

COLLEGE OF HEALTH SCIENCE

DEPARETMENT OF EPIDEMIOLOGY

Dear participant,

I would like to express my appreciation for giving me your time and this is a research questions developed by Master of public health students of Jimma University to assess the level of adherence to DOT tuberculosis management and associated factors and the information obtained will be used only for the purpose of research. The study will involve some personal issues, in order to effectively attain the objectives and also I need to assure that confidentiality is our value. So we politely request your cooperation to answer the questions accordingly.

There is no need to mention your name and you do have the right not to respond or to withdraw in the meantime, but your input has great value for the success of the research.

Would you willing to participate?

_____ Yes, I want to participate in the study (Please go to the next page).

_____ No, I don't participate in the study (Thank you very much!).

CODE_____ DATE_____

1. Socio-demographic information

S.No	Questions	Category	Code
1.1	Age in Years		01
1.2	Sex	Male	01
		Female	02
1.3	Educational level?	Not educated/Illiterate	01
		Read and Wright	02
		1-6 grade	03
		7-10 grade	04
		11-12 (preparatory)	05
		College /University	06
1.4	Marital status?	Single	01
		Married	02
		Divorced	03
		Widow/widower	04
		cohabiting	05
1.5	Religion?	Orthodox	
		Muslim	
		Protestant	

		Others	
1.6	Ethnicity?	Oromo	
		Amhara	
		Gurage	
		Dawro	
		Others specify	
1.7	Residence?	Urban (Jimma town)	01
		Rural (Out of Jimma town)	02
1.8	Monthly income in Birr?	< 500	**01**
		500 – 1000	**02**
		>1000	**03**
1.9	Occupation?	Self employee	**01**
		Government employee	**02**
		Unemployed	**03**
		others	**04**
1. Disease and treatment related information			
2.1	Sputum Smear result?	Smear positive	**01**
		Smear Negative	**02**
2.2	Tuberculosis treatment category?	New	**01**
		Retreatment	**02**
2.3	Did you know your HIV status?	Yes No	01 02

2.4	If yes to Question 18 what was your result?	Negative Positive	01 02
2.5	If positive to Question 18 did you start ART?	Yes No	01 02
2.6	If yes to ART Did yourtaking ARV affect your anti-tuberculosis treatment?	Yes No	01 02
2.7	Did you ever miss taking the TB drugs?	Yes No	01 02
2.8	If yes to question 22When was the time (Phase) you missed your medication?	Intensive (The first 2 month) Continuation (the last 4 months) Both phase	01 02 03
2.9	If yes to question 22 how many doses you missed?		
2.10	If yes to question 10, What was your reason for missing your dose?	Was feeling well	1
		Shortage of money for transport	2
		Was feeling weak	3
		Drug reaction	4
		Forgetfulness	5
		Other specify	99
2.11	Did you know that missing anti-Tb dose does affect you and your family?	yes No	**01** **02**

	2. Service & Provider related information	Response	Code
3.1	How frequent you visited Tb clinic for anti-Tb medication?	Daily dose	01
		Weekly dose	02
		Monthly	03
		Others----------	99
3.2	Are you told about total duration of treatment by the health professional at 1st registration?	Yes	01
		No	02
3.3	Did the health professionals educate you on the disease condition?	Yes	01
		No	02
3.4	How often were you counseled on the condition by the care providers?	On the first visit	01
		On each visit	02
		Once a while	03
		Never counseled	04
3.5	Did the care providers provide privacy while attending to you at the health center?	Yes	01
		No	02
3.6	Did the health care providers give card indicating your review date?	Yes	01
		No	02
3.7	How long did you have to wait at the health center on each visit before you are served with the drugs?	<2hrs	01
		3hrs	02
		4hrs	03

		>4hrs	04
3.8	How far was your home to the clinic in kilometers (Km)?	½ -1	01
		1 ½ -2	02
		2 ½ - 3	03
		4. >3	04
3.9	How did you get to the clinic?	Walked	**01**
		Took a car	**02**
		Others (specify) ----------	**03**
3.10	If you boarded a car, how much did you spend on transportation to the clinic and back home? ----------		**88**
3.11	Have you ever encounter TB drug adverse effect?	Yes No	**01** **02**
3.12	Did the care provider told you what to do when it happens?	Yes No	**01** **02**
Psycho Socio- information			
3.13	Were those in your family, house and friends knew that you were suffering from TB?	**Yes**	**01**
		No	**02**
3.14	If No, why	Fear of avoidance	**01**
		Fear of eviction	**02**
		Fear of divorce	**03**
3.1	If Yes, what support did they render concerning your	Reminding me to take my drugs.	**01**

5	treatment?	Supporting financially.	**02**
		Helping in household chores.	**03**
		No support	**04**
		Took me to spiritualist	**05**
		Non Applicable	**06**
3.16	What is the cultural belief of Tuberculosis in your locality?	Demon inside	**01**
		Curse	**02**
		Spiritual disease	**03**
		Don't know	**04**
3.17	What is the attitude of the community members in accessing health care services in relation to TB?	Self medication	**01**
		Spiritual healer	**02**
		Shrine	**03**
		Don't know	**04**
3.18	What do you think was the cause of your TB?	Hard work	**01**
		Poverty	**02**
		Infectious disease	**03**
		Don't know	**04**
3.19	Have you ever encounter mental illness?	Yes	**01**
		No	**02**
3.20	Did you use any of this drugs/substance while you are on your medication?	Alcohol	01
		Cigarette	02
		Shish a	03

		Khat chewing	04
3.21	Did you use other treatment alongside the health center treatment?	Yes No	01 02
3.22	If yes to question 13 List them	a . cultural b. religious c. others	01 02 03
3.23	What was your reason(s) for using other treatment?	a. luck of trust on anti-Tb only b. preferring cultural medicine C..others	01 02 03
3.24	Do you believe in efficacy of the anti-TB medication?	Yes No	01 02
3.25	Are you aware that your incomplete treatment is dangerous to your family and community members also?	Yes No	01 02