



ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY

OFFICE OF GRADUATE STUDIES

**Assessment of Tuberculosis and Human Immunodeficiency Virus Co-infection
at Metehara Sugar Factory Hospital in East Shoa Zone, Oromia Regional
State, Ethiopia**

A Thesis

Submitted to the Department of Applied Biology

School of Applied Natural Science

**In Partial Fulfillment of the Requirements for the Degree of Master of Science
in Biology**

By: Bizuayehu Mekuria

Adama, Ethiopia

September, 2017

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Approval of Board of Examiners

We, the undersigned, members of the Board of Examiners of the final open defense by Bizuayehu Mekuria have read and evaluated his thesis entitled “**Assessment of Tuberculosis and Human Immunodeficiency Virus Co-infection at Metehara Sugar Factory Hospital**” and examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirement of the Degree of Master’s in Biology.

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I hereby declare that this MSc. Thesis is my original work and has not been presented for a degree in any other university, and all sources of material used for this thesis have been duly acknowledged.

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Subject: Thesis Submission

This is to certify that the thesis entitled “**Assessment of Tuberculosis and Human Immunodeficiency Virus Co-infection at Metehara Sugar Factory Hospital**” submitted in partial fulfillment of the requirements for the degree of Master of Biology, the Graduate program of the department of Applied Biology, and has been carried out by Bizuayehu Mekuria Id. No. GSU/ 0401/06 under my supervision. Therefore, I recommend that the student has fulfilled the requirements and hence hereby he can submit the thesis to the department.

Name of Advisor _____

Signature _____ Date _____

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LIST OF ABBREVIATIONS AND ACRONYMS

AFB	Acid Fast Bacillus
AIDS	Acquired Immune Deficiency Syndrome
ART	Anti-Retroviral Therapy
CPT	Cotrimoxazol prophylaxis therapy
DOTS	Directly Observed Treatment short course
EHNRI	Ethiopian Health and Nutrition Research Institute
EFMoH	Ethiopian Fedeval Ministry of Health
EPHI	Ethiopian Public Health Institute
EPTB	Extra Pulmonary TB
HAPCO	HIV/AIDS Prevention and Control Office
HIV	Human Immunodeficiency Virus
IPT	Isoniazid preventive therapy
MDRTB	Multi-drug Resistance TB
MSRMC	Metehara sugar research metrological center
PEPFAR	President’s Emergency Plan for AIDS Relief
PLWHIV	People Living With HIV
PTB	Pulmonary TB
SNPTB	Smear Negative Pulmonary TB
SPPTB	Smear Positive Pulmonary TB
TST	Tuberculin skin test
TB	Tuberculin bacillus
VCT	Voluntary Counseling and Testing
WHO	World Health Organization
ZN	Ziel-Neelsen staining

ABSTRACT

Tuberculosis-Human immunodeficiency virus co-infection represents a novel pathogenic scenario at the global level. It has recently been realized that the epidemiology, clinical manifestations, and management of both HIV and M. tuberculosis infections are different and far more complex in co-infected compared to mono-infected patients. The aim of this retrospective study was to assess the prevalence of TB and HIV co- infections among patients who visited Metehara Sugar Factory Hospital in Fentalle district from March 2012 to April 2017. Retrospective data related to the patients visited Metehara Sugar Factory Hospital for the last 5 years was collected by inspecting the patient health records and systematically analyzed the health information. In total 1165 patients attended the DOTS clinic of the hospital. Among these 1028 (88.2%) were TB-positive. Of these TB-positive patients in the present study, 218 (21.2%) were co-infected with HIV. The HIV prevalence rate was higher in females and the age group of 25-34 years old that calls a need for intervention and collaborative efforts towards the prevention of the infections among these most affected portions of the society. In the current study, the trend of TB-HIV co-infection showed gradual decrease for the last five years with the highest case (25.1%) in 2015 and the lowest case (14.3%) in 2016 to April 2017. The overall treatment success among TB patients was 76.9%. Sex, marital status, and occupational status were socio-demographic factors that showed statistically significant association with HIV infection among TB patients while the type of TB and unsuccessful treatment outcome among co-infected TB patients were clinical characteristics that showed statistically significant association with HIV infection (p-value <0.05). The overall level of satisfaction related to the health services provided by Metehara sugar hospital said to be satisfactory that need further efforts to improve areas of healthcare services where patients showed dissatisfaction.

Key words: *Co-infection, HIV, Metehara, Prevalence, TB*

1. INTRODUCTION

1.1 Background of the Study

Tuberculosis is a chronic infectious disease caused by *Mycobacterium tuberculosis* which is also known as Tubercle bacilli. According to World Health Organization (WHO) (2013), TB is a major health problem throughout the world. It is one of the world's most common causes of death in the era of Human Immunodeficiency Virus (HIV). As a major global health problem, it causes ill-health among millions of people each year and ranks as the second leading cause of death from an infectious disease worldwide, after (HIV) (WHO, 2013). Moreover, it is one of the most common infections that threaten people living with HIV (PLWHIV) in the developing world and together with HIV; TB is responsible for the deaths of over 4 million people annually (RESULTS Canada, 2010). It shares about twenty-five percent of all causes of the deaths (Mitiku *et al.*, 2016).

Fekadu *et al.* (2015) stated that the most TB cases are in Asia, the highest incidence rates are in sub-Saharan Africa where high rates of HIV and malnutrition weaken immune systems and accelerate the spread of the disease. Consequently, the number of new TB cases in most African countries has more than quadrupled since 1990, with 2.8 million new TB cases and roughly 735 thousand deaths annually. Up to 81% of all TB cases are reported from 22/202 high burden countries (Oromia Region Health Bureau (ORHB), 2015). According to the Ethiopian Ministry of Health hospital statistics data, tuberculosis is the leading cause of morbidity, the third cause of hospital admission (after deliveries and malaria) and the second cause of death in Ethiopia after malaria (EFMoH, 2008).

According to WHO global TB report 2011, Ethiopia is one of the High Burden Countries (HBCs) where the prevalence of TB was estimated to be 394 new cases per 100,000 populations. The country is rated 7th among the 22 high burden countries (EFMoH, 2012). People living with HIV who are also infected with TB are much more likely to develop TB disease than those who are HIV-negative. Starting in the 1980s, the HIV epidemic led to a major upsurge in TB cases and TB mortality in many countries, especially in southern and eastern Africa. The prevalence of HIV co- infection among TB patients is highest in the African region.

HIV and Tuberculosis are closely associated. HIV promotes the progression from latent infection to active disease and TB is the leading infectious killer of people living with HIV (Lata *et al.*, 2015). Infection with HIV is an established risk factor for acquiring and developing infection with tuberculosis, and the recent increase in the worldwide prevalence of HIV infection has contributed to the rising global incidence of TB (Abera *et al.*, 2009).

Hailu and Eshetu (2013) reported that HIV infection is the most common predictor of TB incidence, and the other way round, TB is a common opportunistic infection in sub-Saharan Africa. Thus, the countries in the sub-region continue taking the leading position in HIV/TB morbidity and mortality rate, where the TB epidemic was primarily driven by HIV infection.

Ethiopia is one among these most heavily affected countries by HIV and TB co-infection. The worldwide epidemic of HIV infection has contributed to a resurgence of TB, now a leading cause of HIV related morbidity and mortality (Lata *et al.*, 2015). According to EHNRI (2011), the recent WHO estimates for Ethiopia were annual incidence of 261 per 100,000 (including HIV positive), prevalence of 394 per 100,000 (including HIV positive), and mortality of 35 per 100,000 people (excluding HIV positive). TB/HIV co-infection rate of the national report in Ethiopia revealed 40%-50 % (EHNRI, 2011).

Ethiopia is identified as one of the 22 High Burden Countries (HBC) in the world where 80% of the world's TB cases are found (EPHI, 2014). The WHO global TB report for 2013 indicated that there were an estimated 230,000 (251 per 100,000) incident cases of TB in Ethiopia in 2012. There were an estimated 16,000 TB deaths (17 per 100,000) in Ethiopia during the same time period, excluding deaths among those co-infected with HIV.

The prevalence of HIV among TB positive individuals at Metehara Sugar Factory hospital has not been studied. Therefore, this Retrospective study was aimed at and initiated to investigate the prevalence and trends of TB and HIV co- infections that would provide information about the prevalence and trends of the dual infections that might contribute to make decisions on prevention and control of these diseases.

1.2 Statement of the Problem

Since 2002, Ethiopia is implementing the TB/HIV collaborative activities (EFMoH, 2009). However, only few studies reported that HIV co-infection has been a major public health challenge among TB patients of the country (Sebsibe and Takele, 2013). Therefore, assessment about HIV co-infection among TB patients might help to understand the spread of the co-infections and to monitor the performances of TB and HIV sustainable controlling and monitoring activities (WHO, 2012). Understanding the predictors of TB/HIV co-infections in the local context is critical for Ethiopia to improve co-management of TB/HIV co-infected patients (Mitiku *et al.*, 2016).

Abera *et al.* (2009) showed that the prevalence of TB infection was significantly associated with the incidence of HIV and vice versa across the areas in Oromia region. Assessment of the prevalence of TB among HIV patients and vice versa is increasingly seen as important, as the HIV epidemic has continued to fuel the TB disease and as new solutions have emerged to tackle this developing situation.

Overcrowding living condition, poor ventilation in most house holdings encourages spread of TB in the study area. Moreover, risk factors such as smoking, Khat chewing and alcoholism are common among vulnerable and most at risk communities (truckers, mobile daily laborers, out of school youth). Alcohol and Khat use substantially and significantly increase the likelihood of having multiple sexual partnerships which may have a significant role for the spread of the TB and HIV infections in the area.

The researcher didn't come across any study conducted concerning the prevalence of TB-HIV co-epidemics in the study area. Thus, the study helps in filling information gap and as a baseline for future studies. Therefore, in light to this, the present retrospective and descriptive study was conducted to test the hypothesis that Tuberculosis and HIV co-infections were significantly prevalent among patients who attended Metehara Sugar Factory Hospital, for the past five years (from March 2012 to April 2017).

1.3 Objectives of the Study

1.3.1 General objective

This study was aimed at assessing the prevalence and risk factors associated with TB-HIV co-infection among TB-HIV co-infected patients who visited Metehara Sugar Factory Hospital from March 2012 to April 2017.

1.3.2 Specific objectives

- To investigate major socio-demographic and clinical risk factors of HIV infection among TB patients who visited Metehara Sugar Factory Hospital from March 2012 to April 2017
- To demonstrate the trend of TB-HIV co-infection among TB patients who visited Metehara Sugar Factory Hospital for the last five years
- To assess the level of satisfaction among TB-HIV co-infected patients against the health service provided by Metehara Sugar Factory hospital during, April, 2017.

1.4 Research questions

1. What was the status of TB and HIV co-infection among patients who attended Metehara Sugar Factory Hospital from March 2012 to April 2017?
2. Was there any possible association between TB-HIV co-infection and patients' socio-demographic and clinical characteristics?
3. What was the trend of TB-HIV co-infection during the past five years?

1.5 Definition of Terms

Tuberculosis: Tuberculosis is a systemic infection manifested only by evidence of an immune response in most exposed individuals. The WHO defined tuberculosis as “an infectious bacterial disease caused by *Mycobacterium tuberculosis*, which most commonly affects the lung (and) is transmitted from person to person via droplets from the throat and lungs of people with the active respiratory disease” (WHO 2015).

Tuberculosis treatment outcome: The final known status of a TB patient who was started on anti-TB treatment

Treatment success: The sum of patients who are declared ‘cured’ and those who have ‘completed’ treatment

Mycobacterium tuberculosis: *Mycobacterium* is a genus of Gram-positive bacilli that demonstrate the staining characteristic of acid-fastness. It’s the etiologic agent of tuberculosis and most devastating cause of infectious disease deaths worldwide today.

Prevalence: a measure of total number of cases of a disease in a population.

Co-infection: simultaneous infection of a host by two or more diseases

Acquired immunodeficiency syndrome: The most important disease resulting from a human retrovirus infection, caused by either of two lenti viruses (lenti-, “slow”) termed human immunodeficiency viruses types 1 and 2 (HIV-1 and HIV-2). A devastating disease, for which there is no present cure.

2. LITERATURE REVIEW

2.1 Epidemiology of Tuberculosis

Tuberculosis is a major public health problem throughout the world. About a third of the world's population (about 2 billion people) is estimated to be infected with Tubercle bacilli and hence at risk of developing active disease. Of the 9 million annual TB cases, about 1 million (11%) occur in children (under 15 years of age) of these childhood cases, 75% occur in the 22 high-burden countries (WHO, 2015). Worldwide, the reported percentage of all TB cases occurring in children varies from 3% to more than 25% (EFMoH, 2012). In 2014, there were 1.5 million TB deaths of which approximately 890,000, 480,000 and 140,000 were men, women and children, respectively (WHO, 2015).

Africa, more specifically sub-Saharan Africa, faces the worst TB epidemic, where TB associated morbidity and mortality occurs mainly in the economically productive age group (15-60 years) (Esmael *et al.*, 2013). EHNRI (2011) reported that in the year 2009/10 Ethiopia registered 146,172 cases of TB. Among these, 139,261 were new cases; 46,132 new smear-positive (33.1%); 49,037 new smear-negative (35.2%); 44,092 new extra-pulmonary TB (EPTB) (31.6%).

TB is affecting all sexes and age groups. Poverty is a risk factor for developing TB, which places Ethiopia as a high-risk environment. Among the total smear positive TB cases reported in 2009/10, 55.5% were males, 7.5% were children <14 years old, and 2% were above the age of 65. The 15 to 34 age group was found to be the one most affected with TB, accounting for 62% of notified new smear positive TB cases. The disproportionately large burden of TB in this age group, which comprises a large part of the total workforce in the country, could be contributing to poverty. The same age group, being parents of young children, could also be heavily contributing to transmission of TB in the household and to the overall burden of childhood TB in the country (EHNRI, 2011).

2.1.1 Pathogenesis of Tuberculosis

Mycobacterium tuberculosis belongs to the genus *Mycobacterium* and is grouped in the *M. tuberculosis* complex together with other genetically similar and human pathogenic strains (Drobniewski *et al.*, 2003). It causes one of the oldest diseases known to affect humans. It was classified as a family of Mycobacteriaceae and the order Actinomycetales. Of the pathogenic species belonging to this complex, the most frequent and important agent of human disease is *M. tuberculosis*. The complex includes *M. bovis*, *M. africanum* and *M. microti*. *M. tuberculosis* is a rod-shaped, non-spore-forming, thin aerobic bacterium measuring about 0.5µm by 3µm. It does not stain readily and is often neutral on Gram's staining. However, once stained, the bacilli cannot be decolorized by acid alcohol, a characteristic justifying their classification as acid-fast bacilli (AFB). Acid fastness is due mainly to the organisms' high content of mycolic acids, long-chain cross-linked fatty acids, and other cell-wall lipids.

Tuberculosis usually affects the lungs but can affect any part of the body except hair, teeth and nails (RESULTS Canada, 2010). The disease spreads via droplet infection when people with pulmonary expel the bacilli while coughing, sneezing, and talking (WHO, 2011). The Ethiopian Ministry of Health (2008) reported that bacilli usually enter the body by inhalation (breathing). They may spread from the initial location in the lungs to other parts of the body via the blood stream, the lymphatic system, via the airways or by direct extension to other organs. Tuberculosis is broadly classified into Pulmonary TB (PTB) that accounts for 85% of all TB cases and that further classified as; Smear-positive PTB: comprises 75 – 80% of PTB cases, worldwide and Smear-negative PTB: comprises 20 – 25% of PTB cases, worldwide (FFMoH, 2012).

Extra-pulmonary TB which is the result of the spread of tuberculosis to other organs, most commonly pleura, lymph nodes, spine, joints, genitor-urinary tract, nervous system or abdomen and it represents 14% of all TB cases in the world and 12% of all TB in high burden Countries (HBC) (FFMoH, 2008). Prevalence of Smear Positive TB among adult and all age group was 108 and 63/ 100,000 respectively (EHNRI, 2011).

TB can be latent (inactive) or active. Close to one-third of the world's population has dormant or latent TB. While many will simply live with dormant TB and not know it, for those whose immune systems are compromised (be it through general poor health or through another infection, like HIV), active TB can develop and, without treatment, will most certainly be fatal. HIV-negative person with a latent TB infection has a 10% chance of progressing to active TB over his or her entire lifetime, whereas a HIV-positive person has a 10% chance of developing active TB each year (RESULTS Canada, 2010).

2.1.2 Diagnosis of TB

The most commonly used point-of-care diagnostic tests include smear microscopy with Ziel-Neelsen (ZN) staining, a technique largely unchanged since it was first described by Robert Koch in 1882. In that it is rapid and cheap, ZN staining is widely used worldwide for detection of TB, and it is still the only method for definite diagnosis of this disease in many low-income countries, including Ethiopia (Mitiku *et al.*, 2016).

A patient with *Mycobacterium tuberculosis* complex identified from a clinical specimen, either by culture or by a newer method such as molecular probe assay (LPA) in countries lacking laboratory capacity to routinely identify *M. tuberculosis*, a pulmonary case with one or more initial sputum specimens positive for acid-fast bacilli (AFB) is also considered to be a 'definite' case provided that there is external quality assurance with blind rechecking (WHO, 2013). According to WHO (2013), diagnosis of TB in most low- and middle-income countries still relies on low-cost sputum smear microscopy, despite its relatively low sensitivity and inability to detect drug resistance.

2.1.3 Treatment of TB

Since TB was being recognized worldwide, the WHO endorsed an intervention program called Directly Observed Treatment Short-Course (DOTS). Global efforts to control TB were strengthened in 1991, when a World Health Assembly resolution recognized TB as a major global public health problem.

Two targets for TB control were established as part of this resolution – 70% of case detection rate and 85% of cure rate by the year 2000, which means that at least the 70% of new smear positive cases should be detected and at least the 85% of these cases should be treated (EFMoH, 2011).

The WHO Stop TB strategy which is reflected in the national TB control program has currently achieved 100 percent geographical coverage and 92% of public hospitals and health centers offer DOTS (EFMoH, 2011). According to EFMoH (2013) health and health related indicators; tuberculosis is the third leading cause of death in Ethiopia. According to this report, 130,614 new TB cases were detected nationally, and the case detection rate was 58.9%, the TB treatment success rate and cure rate was 91% and 70% respectively.

2.2 Epidemiology of HIV

More than three decades after the discovery of the first clinical symptoms of the acquired immune deficiency syndrome, the HIV/AIDS epidemic is continuing to expand and globally the number of people living with HIV (PLWHA) continues to grow for example 35 million people currently living with the disease in 2012 (UNAIDS, 2012). Esmael *et al.* (2013) reported that the national adult HIV prevalence infection in Ethiopia was 1.5%. In 2012, the HIV/AIDS Prevention and Control Office (HAPCO) estimated that there were around 1,116,216 people living with HIV. There were also a total 855,720 AIDS orphans in the country.

2.2.1 Pathogenesis of HIV

HIV is a bilipid enveloped RNA virus that exists in two major types designated HIV-1 and HIV-2. HIV-1 is spread globally and is by far the most prevalent, whereas HIV-2 is geographically restricted mainly to West Africa (EFMoH, 2012).

HIV is a retrovirus, which means that it carries its genetic information in the form of RNA that must be transcribed into DNA to enable replication. This is achieved through attachment of the virion to CD4 receptors and the chemokine receptors CXCR4 and CCR5 on the surface of the host cell, which results in fusing of the membranes and injection of the RNA into the cell matrix. Inside the host cell, the RNA is transcribed into double-stranded DNA by the viral reverse transcriptase. This linear DNA then enters the nucleus and fuses with the host DNA with the help of integrase (Weber, 2001).

In an HIV-infected human host, in addition to the activated circulating CD4 cells, there are also latent reservoirs of infected cells in the body in “silent” or “quiescent” CD4 cells and other immune cells, which is why HIV cannot be cured by ART. Furthermore, HIV has a rapid mutation rate, because the reverse transcriptase is prone to errors and viral generation time is short. This complicates the development of vaccines and treatments (EFMoH, 2008).

Someone can be infected with HIV in several ways. It can be transmitted through unprotected sexual intercourse with an infected partner, injection or transfusion of contaminated blood or blood products, sharing unsterilized injection equipment that has been previously used by someone who is infected; materno-fetal transmission (during pregnancy, at birth, and through breastfeeding (Gyar *et al.*, 2014).

Three major mechanisms of CD4⁺T-lymphocyte killing by HIV have been suggested: direct virus-mediated cytolysis, virus-induced apoptosis, and indirect killing through immune effect or mechanisms. Direct virus-mediated cytolysis has been demonstrated in vitro and syncytium formation may accelerate the cytolytic process. Here infected cells are killed because of viral replication in these cells, disrupting the cell membrane (Gyar *et al.*, 2014).

2.2.2 Diagnosis of HIV

For HIV diagnosis currently different testing methods can be used. These methods detect the presence of infection by detecting one of the following: HIV antibody, HIV antigen, combined HIV Antibody/Antigen, HIV viral nucleic acid and HIV virus by viral culture method (WHO, 2013). Among the testing methods, detection of antibodies involves the detection of the p24 antigen or viral RNA or DNA. The most common method entails antibody detection with enzyme-linked immune sorbent assay (ELISA). This technique is sensitive in chronic HIV, but antibodies against the virus do not develop until about 3-4 weeks after initial infection (WHO, 2013).

2.2.3 Treatment of HIV

Antiretroviral therapy (ART) is the cornerstone of the overall strategy to reduce morbidity attributed to HIV related infections (HAPCO, 2013). Moreover, the introduction of highly active antiretroviral therapy (HAART) was the significant breakthrough in the battle against HIV/AIDS.

Although antiretroviral drugs cannot eradicate HIV from infected cells, the therapy has resulted dramatic decline in morbidity and mortality associated with HIV, prolong survival, improve quality of life, restore and preserve immunological function (EPHI, 2014).

ART has averted 7.6 million deaths between 1995 and 2013 including 4.8 million deaths in sub-Saharan Africa. Similarly, providing access to antiretroviral medicines for pregnant women living with HIV has averted more than 900, 000 new HIV infections among children since 2009 (EPIH, 2014).

2.3 Co-infection of TB-HIV

The global impact of the converging dual epidemics of TB and HIV remains as one of the major public health problems or challenges of our time (Hailu and Eshetu, 2013). HIV positive person co-infected with MTB has 50-60% life time risk of developing TB disease, as compared to an HIV negative person who has a 10% lifetime risk of developing TB disease (Lata *et al.*, 2015).

In resource-limited settings, Tuberculosis (TB) and Human immunodeficiency virus (HIV) co-epidemics remain a major public health challenge. There were an estimated 1.1 million TB/HIV co-infected patients worldwide in 2011; 79% of these cases were in the African Region (Sebsibe and Takele, 2013). The fatal synergy of the HIV infection and TB, and the emergence of multidrug resistant Mycobacterium TB have further contributed to a re-emergence of TB in many part of the world including Africa (WHO, 2012).

In sub-Saharan African, HIV is one of the main reasons for the increase in TB, and TB is considered to be the most prevalent opportunistic infection and also the most common cause of AIDS related death in people living with HIV (PLHIV) (WHO, 2014). In Ethiopia, the incidence of TB is exacerbated by HIV co-infection, with approximately 20% of cases presenting with TB also co infected with HIV (Sintayehu *et al.*, 2011).

2.3.1 Treatment of TB-HIV Co-infection

The treatment of TB in PLHIV is essentially the same as in HIV negative patients. It is well tolerated and in general the outcome of treatment is good, particularly inpatients in the early course of HIV infection. TB treatment must therefore be commenced without delay in PLWH.

However, due in part to HIV-related complications, predominantly in the first months of TB treatment, death occurs more commonly in HIV-positive than in HIV negative TB patients, with higher risk of death in the late stage of HIV infection. These complications can be decreased to a large extent by prescribing Cotrimoxazole Prophylaxis Treatment (CPT) (2 tablets or one double strength tablet daily) to all HIV-positive TB patients irrespective of the stage of HIV infection. When available, ART substantially decreases the risk of death in HIV-infected TB patients (EFMoH, 2012).

The complication of treatment outcomes of both diseases due to the TB-HIV co-infection results particularly from the concomitant use of anti-retroviral treatment (ART) and intensive phase of TB treatment; additionally, it leads to drug-drug interaction, side effects of multiple drugs, increased pill burden, decreased adherence and development of higher rate of drug resistant organisms due to the combination of the above factors. It also causes difficulties in diagnosis and treatment of TB due to unusual clinical picture with increased smear negative Acid Fast Bacilli (AFB) pulmonary TB, atypical finding on chest radiography and increased prevalence of extra pulmonary TB (Fekadu, 2015).

EPHI (2014) reported that in 2014 about 78.2% and 49.2% of HIV positive TB patients were enrolled on CPT and ART, respectively. EPHI (2014) reported that the CPT and ART status of will provide a good picture about the extent of linkage of HIV co-infected TB patients to HIV care and treatment services, as this is one measure of quality of TB/HIV care.

2.4 Co-infections of TB-HIV in Ethiopia

TB and HIV co-infection has been well documented in Sub-Saharan African set up. Studies showed that the prevalence of co-infection was 31.25%, even the rate was as high as 80%. Studies in Ethiopia also depicted that the co-infection condition has being on increasing rate 6.6%, to 75% in the previous decade (Esmael *et al.*, 2013). TB/HIV co-infection rate of the national report in Ethiopia revealed 40%-50 % (Fekadu, 2015).

Ethiopian Health and Nutrition Institute(EHNRI) (2013) reported that Out of the total 14,797 newly enrolled in HIV pre-ART care, the majority 13,672 (92.4%) of them were screened for TB at initial visit. This screening has shown an increase from the pilot phase report (82.5%). The screening rate shows regional variation, ranging from 71.1% in SNNPR to 99.7% in Tigray and

Somali. The graph below shows the number of patients screened for TB in different regions. This finding shows that the percentage is in line with the Global plan to stop TB which is 100% screening for all HIV positive patients (Fig. 1).

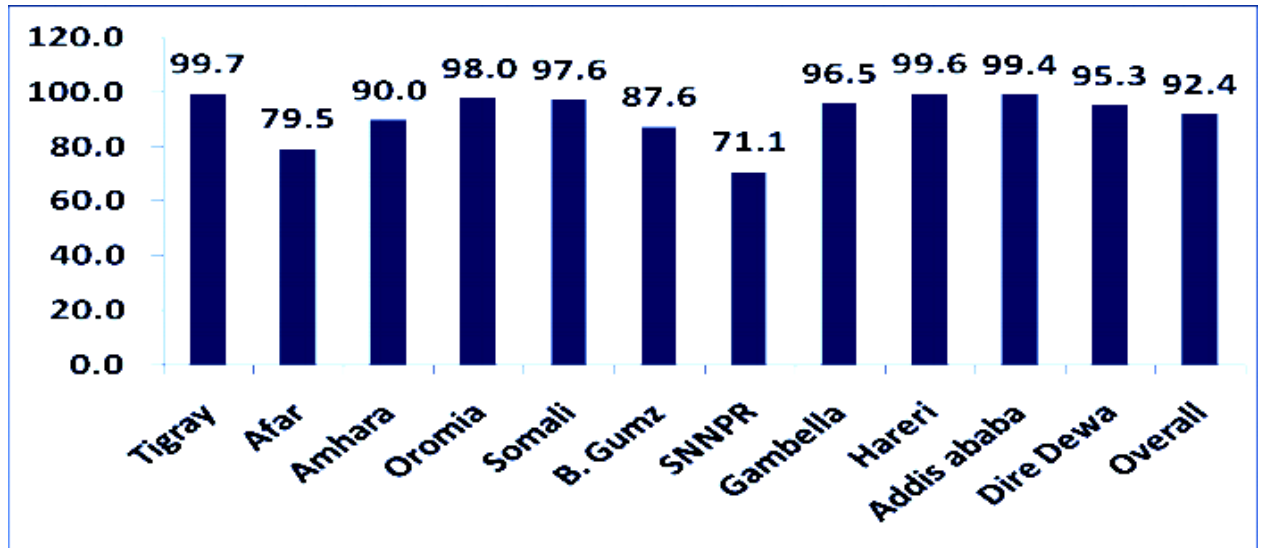


Figure 1. Number of patients screened for TB among newly enrolled for HIV care by region in Ethiopia from July 2011 to June 2012 (ENHRI, 2013).

Based on the two key TB/HIV indicators (proportion of HIV screened TB patients and HIV positive TB patients), of the total HIV positive patients, who were screened for TB at initial visit, active TB was detected on 7.8% of them, the active TB prevalence after enrollment in HIV care ranges from 1.7% in Tigray to 17.7% in SNNPR. The graph (Fig. 2) shows the proportion of TB cases detected out of the total screened HIV positive patients by region (EHNRI, 2013).

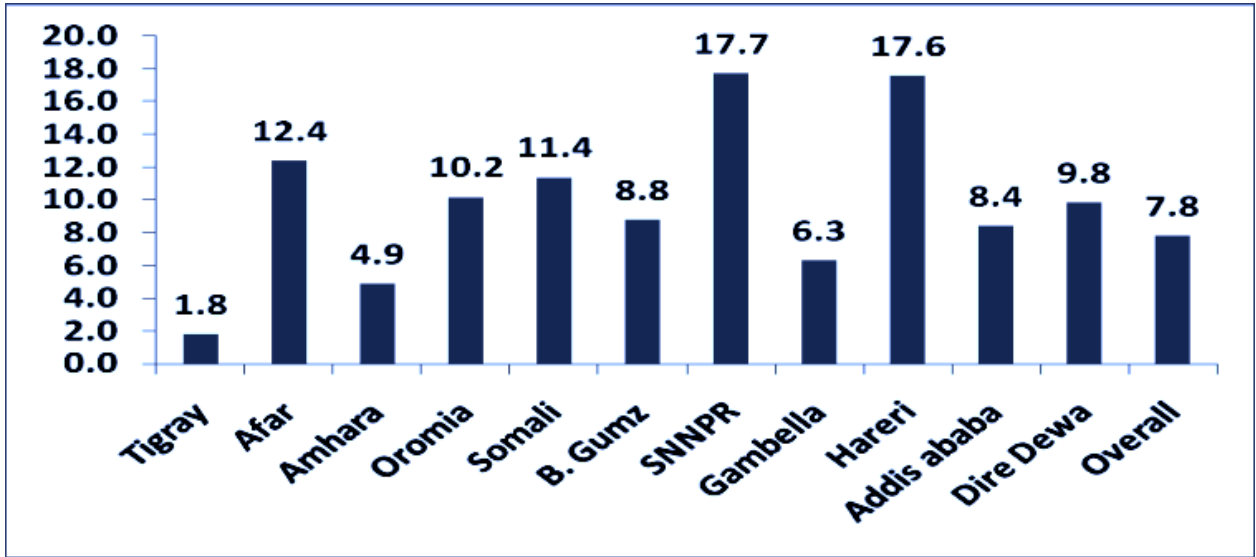


Figure 2. Number of active TB cases detected among HIV positives by region in Ethiopia from July 2011 to June 2012 (EHNRI, 2013).

The indicator used to assess the prevalence of HIV/AIDS among TB patients showed that of the total TB patients registered during the reporting period (2011-2012), who were screened for HIV, 20% of them were positive for HIV (Fig. 3). The HIV prevalence per region ranges from 4.8% in Harari to 30.6% in Addis Ababa (EHNRI, 2013).

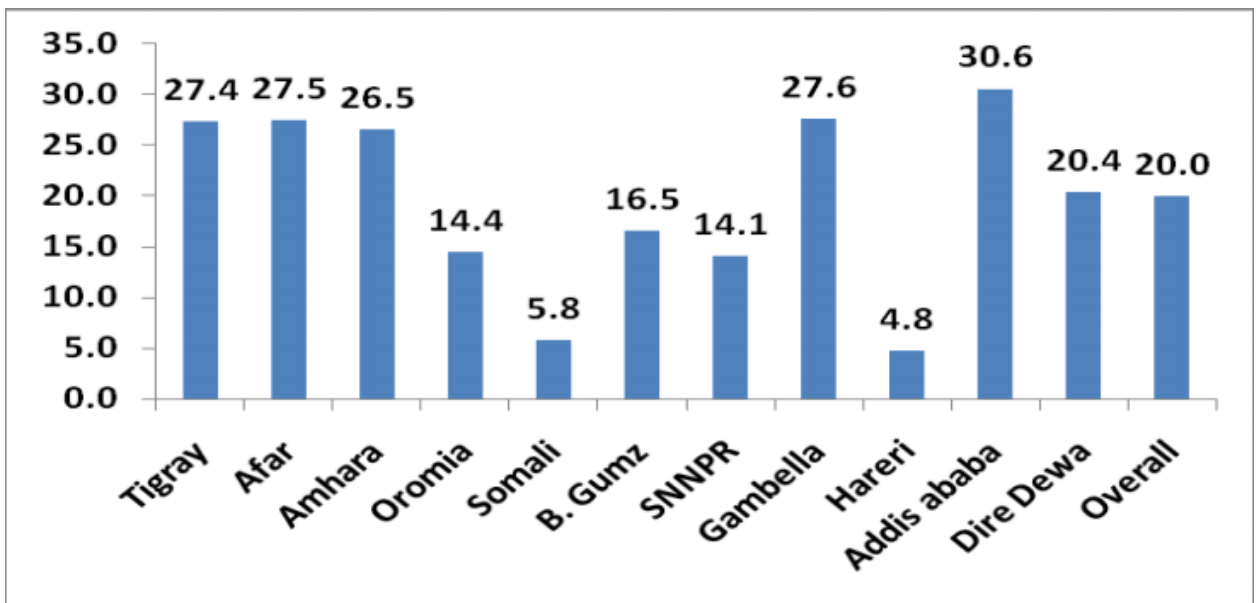


Figure 3. HIV prevalence among all patients by region in Ethiopia from July 2011 to June 2012 (EHNRI, 2013).

The indicator used to assess the prevalence of HIV/AIDS among TB patients defines an important population for specific interventions, such as CPT and ART, aimed at reducing the burden of HIV among TB patients and their communities. It will also be used as the denominator for indicators that measure the uptake of these interventions. Measuring the proportion of HIV positive TB patients gives important information for targeting of resources, strategic planning of activities, and monitoring the effectiveness of HIV prevention, care and treatment interventions over time (EPHI 2014).

EPHI (2014) reported that the HIV prevalence among new TB patients per region ranges from 1.4% in Harari to 30.6% in Afar. Higher HIV prevalence among New TB patients was found in Afar (30.6%) followed by Addis Ababa (26.8%) and Gambella (23.7%) regions. On the other hand, the lowest prevalence was observed in Harari (1.4%) and Somali (1.9%).

3. MATERIALS AND METHODS

3.1 Description of the Study Area

This study was carried out in Metehara Sugar Factory (MSF) in Fentalle district, East Shoa Zone of Oromia Regional State. The factory is bounded by escarpments from east, west and south. It is located at 8°50'N latitude and 39°50'E longitude and an altitude of 950 m above sea level (Fig. 4). It is found at a distance of 200 km Southeast of Addis Ababa within upper Awash Valley, near the main road to Harar. The area is typically characterized by semi-arid climate with a mean relative humidity of 55.4%, average annual rainfall of 543 mm, mean minimum and maximum temperatures of 17.2°C and 32°C, respectively (MSRMC, 2016).

Metehara Sugar Factory Hospital provides services for over 2800 patients per year. In the DOTS clinic, TB patients are treated and monitored as per the national tuberculosis and leprosy control program (NTLCP) guideline (EFMoH, 2008). There are also TB/HIV collaborative activities at the hospital which aim to reduce the burden of TB among people living with HIV (PLHIV) and to reduce the HIV/AIDS burden among TB patients.

There were 4 doctors, 3 health officers, 30 nurses, 8 health extension workers, 5 laboratory technicians, 1 radiologist, 2 HIV and Anti HIV drug treatment nurses, 2 data encoders and case managers. The clinics provide basic health services entirely based on clinical symptoms within the respective villages and communities including from nearby Afar and Somali districts. However, laboratory based medical treatment for TB and HIV is provided only in the hospital. This retrospective descriptive study was conducted from March 2017 to April 2017.

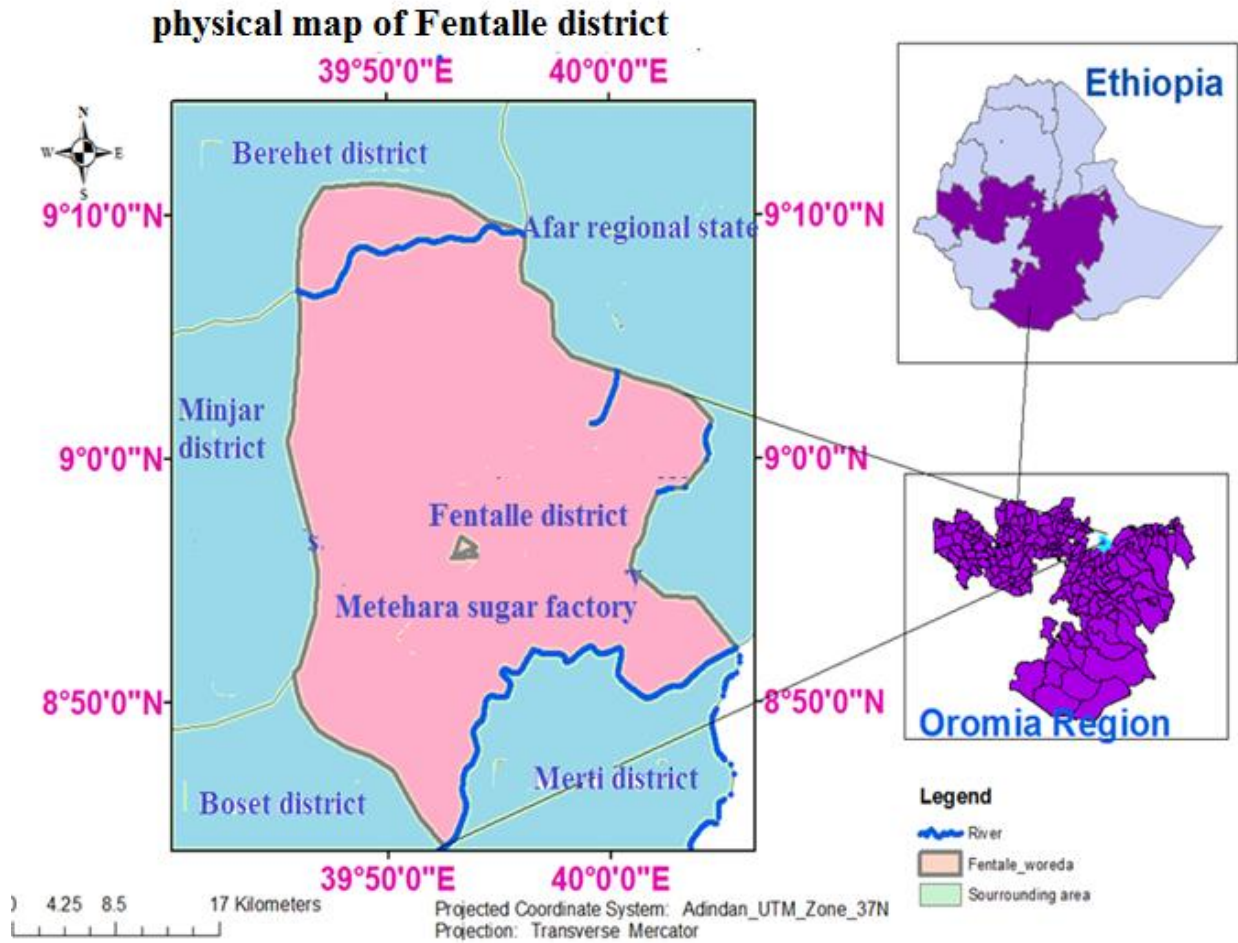


Figure 4. Map of the study area (Source: Ethio Arc GIS, 2017)

3.2 Study population

The population of this study was all TB patients who attended Metehara Sugar Factory Hospital for the last five years. All Patients who have been examined for TB based on the finding of acid fast bacillus (AFB) on microscopic examination of a diagnostic specimen such as a smear of expectorated sputum or of tissue sample and clinical symptoms, CD4⁺T cells counts of < 200 cells/mm³ for HIV/AIDS, respectively over the aforementioned study period was included in the study.

3.3 Inclusion and Exclusion Criteria

All Patients with complete Socio-demographic, clinical related characteristics documentation and records on log book of Directly Observed Treatment Short-course (DOTS) clinic of Metehara Sugar Factory Hospital were included in the study, whereas incomplete case files data on log book were excluded.

3.4 Variables

The response variable for this study is the occurrence of TB/HIV co-infection. The predictor variables are socio-demographic characteristics (age, sex, residence, occupation,) and clinical related characteristics (ART status, TB type, and Treatment outcomes) of the patients.

3.4.1 Treatment Outcomes

Patients' treatment outcomes were classified as recommended by WHO and adapted in Ethiopia. The outcomes were classified as cured, treatment completed, which were considered as 'successful' or 'good' while treatment failure, died, defaulted or transferred out considered as 'unsuccessful' or 'poor' outcomes. A patient was considered as "cured" if a negative sputum smear (without AFB) was obtained in the last month of treatment and at least one previous occasion. A patient was considered as having "completed treatment" if treatment had been completed and smear examination results were available at the end of the treatment. "treatment failure" was marked by becoming AFB sputum positive again at least five months after the commencement of treatment.

A "defaulter" was a patient who did not return to collect the ant tuberculosis for 8weeks or more after the date of the last attendance during the course of treatment. A "transferred out" was defined as a patient who was transferred to another reporting unit area for whom the treatment result was unknown. Death was reported for patients who died during treatment regardless of cause (EFMoH, 2012).

3.5 Data Collection

3.5.1 Study design and data collection

The design of this study was a five year retrospective descriptive survey of the prevalence of *Mycobacterium tuberculosis* and HIV co-infections among patients who visited Metehara Sugar Factory Hospital from March 2012 to April 2017 where they were registered and treated according to the clinical guidelines of the National Tuberculosis and Leprosy Control Program (NTLCP) (EFMoH, 2008).

Retrospective data records collected and reviewed from documents contained basic Socio-demographic and clinical information and descriptive interview questions were used to assess patients' level of satisfaction against the health care services provided by DOTS clinic at Metehara Sugar Factory Hospital.

3.5.2 Interview

A structured interview (using a prepared check list) was conducted with randomly selected HIV infected TB patients to assess their level of satisfaction against the health services provided during April, 2017. Co-infected patients who were participated in the interview were selected randomly by lottery method from the list of TB patients attended the DOTS clinic during April, 2017.

3.6 Data Analysis

Collected data were organized, coded and entered in to statistical package for social science (SPSS) version 20. Data were rechecked for missing values. Frequencies and summary statistics (percentage) were used to describe the study population in relation to socio-demographic and clinical variables among the study participants. Statistically significant associations between dependent and independent variables were declared at P-value < 0.05.

3.7 Ethical Consideration

This study was conducted after obtaining ethical clearance from Oromia Health Bureau, ‘‘Health Research Ethical Review Committee.’ Before conducting the study, the purpose and importance of the study was explained to the MSF management, DOTS-HIV care unit officials and participants of interview. Confidentiality and anonymity of the data, the participants’ information in questionnaire and interview were secured by using codes throughout the study.

4. RESULTS

4.1. Socio-Demographic Characteristics of TB Patients Attending the TB Care Unit at Metehara Sugar Factory Hospital during the study period

Table 1. Socio-demographic characteristics of TB patients at Metehara Sugar Factory Hospital from March 2012 to April 2017 (N=1028).

Characteristics of variables	Number	Percentage (%)
Sex		
Male	575	55.9%
Female	453	44.1%
Total	1028	100%
Age (years)		
0-14	60	5.8%
15 -24	152	11.0%
25 - 34	628	60.4%
35 - 44	99	14.0%
45 - 54	76	7.5%
>55	13	1.3%
Total	1028	100%
Residence		
Inside MSF	382	38.1%
Outside MSF	646	61.9%
Total	1028	100%
Occupational status		
Employed	334	32.5%
Housewife	166	16.1%
Unemployed	156	15.2%
Farmer/pastoralist	78	7.6%
Others	294	28.6%
Total	1028	100%
Marital status		
Married	521	50.7%
Single	299	29.1%
Widowed	39	3.8%
Divorced	22	2.1%
Children/undecided	147	14.3%
Total	1028	100%

Note: Others = students, merchants, preschool children, pensioners, commercial sex worker.

4.2 Clinical Characteristics of TB Patients Attending TB Care Unit at Metehara Sugar Factory Hospital during the study period

Table 2. Clinical characteristics of TB patients at Metehara Sugar Factory Hospital, from March 2012 to April 2017

Characteristics		Number	Percentage (%)
Type of TB	SPPTB	143	13.9%
	SNPTB	674	65.6%
	EPTB	211	20.5%
	Total	1028	100%
HIV status	Positive	218	21.2%
	Negative	810	78.8%
	Total	1028	100%
ART status (N=218)	Pre ART	48	22.0%
	On ART	170	78.0%
	Total	218	100%
Treatment outcome	Completed	664	64.6%
	Cured	137	13.3%
	Transfer out	28	2.7%
	Defaulter	109	10.6%
	Failure	44	4.3%
	Dead	46	4.5%
	Total	1028	100%

Note; MSF = Metehara Sugar Factory, SPPTB = Smear Positive Pulmonary TB, SNPTB = Smear Negative Pulmonary TB, EPTB =Extra Pulmonary TB, ART = Anti Retro viral Therapy

4.3. Prevalence of TB-HIV Co-infection by Age Group of the Study Participants

Table 3. Prevalence of TB-HIV co-infection among the study participants by their age group and sex at Metehara Sugar Factory Hospital from March 2012 to April 2017 (N=218).

Age years	Male		Female		Both sexes	
	No. exam.	No. pos. (%)	No. exam.	No. pos. (%)	No. exam.	No. pos. (%)
0-14	31	3 (10%)	29	6 (21%)	60	9 (15%)
15-24	93	19 (20.4%)	59	24 (41%)	152	43 (28.3%)
25- 34	354	68 (19.2%)	274	69 (25.2%)	628	137 (21.8%)
35 - 44	53	5 (9.4%)	46	15 (33%)	99	20 (20.2%)
45 - 54	36	2 (5.6%)	40	6 (15%)	76	8 (11%)
>55	8	1(13%)	5	0 (0%)	13	1 (8%)
Total	575	98 (45%)	453	120 (55%)	1028	218(21.2%)

Note; No. exam= Number of examined, No. pos. =Number of positives

4.4 Prevalence of TB-HIV Co-infection by Marital Status and Sex of Study Participants

Table 4. Prevalence of HIV infection among TB patients by their marital status and sex at Metehara Sugar Factory Hospital from March 2012 to April 2017 (N=218).

Marital status	Male		Female		Both sexes	
	No. exam.	No. pos. (%)	No. exam.	No. pos. (%)	No. exam.	No. pos. (%)
Married	262	35 (13.4%)	259	43 (16.6%)	521	78 (15%)
Single	208	54 (26%)	91	51 (56%)	299	105 (35.1%)
Widowed	8	0 (0%)	31	6 (19.4%)	39	6 (15.4%)
Divorced	10	1 (10%)	12	5 (41.7%)	22	6 (27.3%)
Children	87	8 (9.2%)	60	15(25%)	147	23 (15.6%)
Total	575	98 (45%)	453	120 (55%)	1028	218 (21.2%)

4.5 Prevalence of TB-HIV Co- infection by Occupational Status of the Study Participants

Table 5. Prevalence of HIV infection among TB patients by occupational status and sex at Metehara Sugar Factory Hospital from March 2012 to April 2017 (N=218).

Occupational status	Male		Female		Both sexes	
	No. Exam.	No. pos. (%)	No. Exam.	No. pos. (%)	No. Exam.	No. pos. (%)
Employed	234	28 (12%)	100	31 (31%)	334	59 (18%)
House wife	-	-	166	21 (15%)	166	29 (14.5%)
Unemployed	96	46 (48%)	60	34 (57%)	156	80 (51.3%)
Farmer/pastoralist	71	14(20%)	7	0 (0%)	78	14 (18%)
Others	174	10(6%)	120	31 (26%)	294	41 (14%)
Total	575	98 (17%)	453	120 (27%)	1028	218 (21.2%)

Note: Others = students, merchants, preschool children, pensioners, commercial sex workers, No. Exam. = Number of examined, No. pos. = Number of positives.

4.6 Prevalence of TB Types among HIV Positive TB Patients by Sex and Age

Table 6. Prevalence HIV infection by the type of TB, sex and age among HIV positive TB patients at Metehara Sugar Factory Hospital from March 2012 to April 2017 (N=218).

	No. HIV positives	SPPTB No. (%)	SNPTB No. (%)	EPTB No. (%)
Sex				
Male	98	6 (6.1%)	72 (73.5%)	20 (20.4%)
Female	120	9 (7.5%)	95 (79.2%)	16 (13.3 %)
Total	218	15 (6.9%)	167 (76.6%)	36 (16.5%)
Age (years)				
0-14	9	1 (11.1%)	8 (88.8%)	0
15-24	43	3 (6.9%)	35 (81.4%)	5 (11.6%)
25 - 34	137	6 (4.4%)	104 (75.9%)	27 (19.7%)
35 - 44	20	3 (15%)	14 (70%)	3 (15%)
45 - 54	8	2 (25%)	62.5% (5)	1 (12.5%)
>55	1	0	1 (1%)	0
Total	218	15 (6.9%)	167 (76.6%)	36 (16.5%)

Note: SPPTB = Smear Positive Pulmonary TB, SNPTB = Smear Negative Pulmonary TB, EPTB = Extra Pulmonary TB.

4.7 Trend of TB-HIV Co-infection among TB Patients at Metehara Sugar Factory Hospital from March 2012 to April 2017

A considerable variation was observed in trends of HIV infection, where the highest cases were observed in the year 2015 and the lowest in 2016 to April 2017 (Fig. 5).

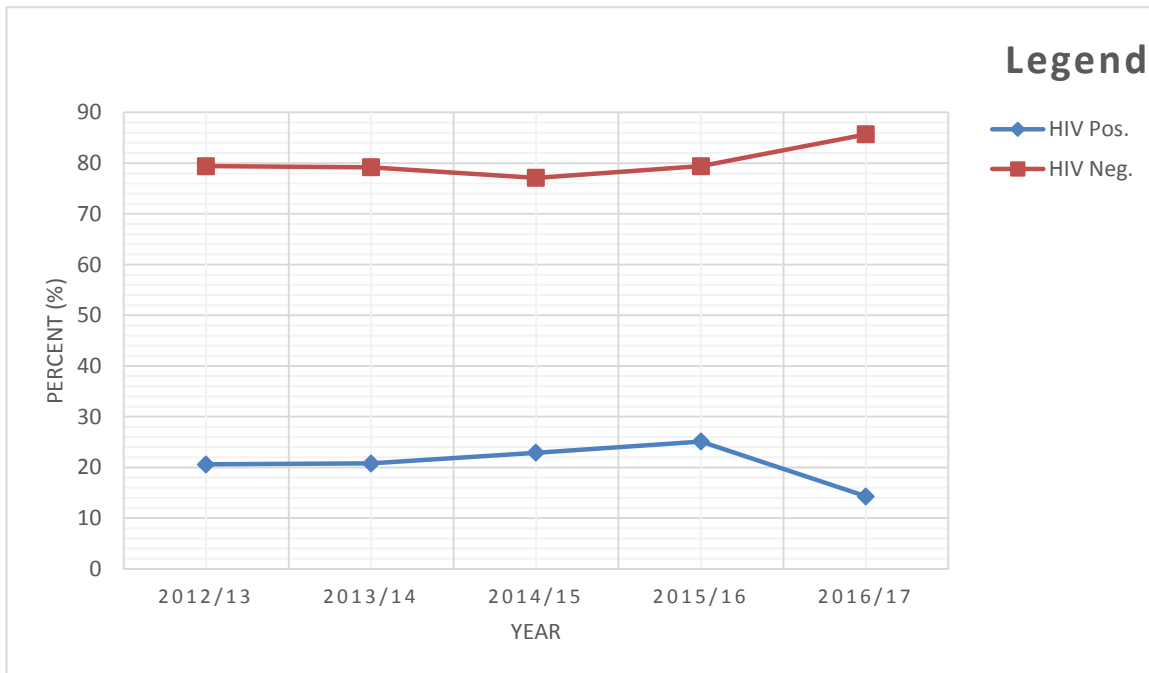


Figure 5. Trend of TB and TB-HIV co-infection at Metehara Sugar Factory Hospital from March 2012 to April 2017

4.8 Association of Socio-demographic and Clinical Characteristics with HIV infection among the study participants of at Metehara Sugar Factory Hospital

Regression analysis of the data was performed to identify among variables that significantly associated with TB-HIV co-infection in the study population. This analysis showed that sex, marital status, occupation, type of TB and treatment outcome were independently associated with HIV infection (Table 7).

Table 7. Regression analysis of socio-demographic and clinical characteristic of the study participants at Metehara Sugar Factory Hospital from March 2012 to April 2017

Characteristics	HIV Status			Odd ratio (95%, CI)	X ²	P-Value
	No. Exam	HIV Pos.	HIV Neg.			
Male	575	98 (17%)	477 (83.0%)	1		
Female	453	120 (26.5%)	333 (73.5%)	0.570 (0.422,0.771)	13.35	0.000
Age group(years)						
0-14	60	8 (13.3%)	52 (86.7%)	2.118(0.244,18.354)	0.464	0.496
15-24	113	25 (22.1%)	88 (77.9%)	4.734(0.597,37.527)	2.166	0.141
25 - 34	621	154 (24.8%)	467 (75.2%)	3.348(0.432, 25.977)	1.336	0.248
35 - 44	144	20 (13.9%)	124 (88.2%)	3.038 (0.373, 24.763)	1.077	0.299
45 - 54	77	10 (13%)	67 (87%)	1.412 (0.162, 12.334)	0.097	0.755
>55	13	1 (7.7%)	12 (92.3%)	1		
Marital status						
Married	518	76 (14.7%)	442 (85.3%)	0.949 (0.572, 1.574)	0.041	0.840
Single	301	106 (35.2%)	195 (64.8%)	2.918 (1.762, 4.872)	14.11	0.001
Widowed	39	6 (15.4%)	33 (84.6%)	0.980 (0.369, 2.604)	0.022	0.968
Not applicable	148	24 (16.2%)	124 (83.8%)	2.022 (0.716, 5.711)	1.765	0.184
Divorced	22	6 (27.3%)	16 (72.7%)	1		
Occupation						
Employed	334	59 (17.7%)	275 (82.3%)	1.324 (0.858,2.042)	1,609	0.205
Housewife	166	24 (14.5%)	142 (85.5%)	1.043 (0.605,1.797)	0.023	0.880
Unemployed	156	80 (51.3%)	76 (48.7%)	6.496 (4.119,10.243)	35.14	0.000
Farmer/pastor.	78	14 (17.9%)	64 (82.1%)	1.350 (0.694,2.627)	0.780	0.377
Other	294	41 (13.9%)	253 (86.1%)	1		
Residence						
Inside MSF	382	77 (20.2%)	305 (79.8%)	1		
Outside MSF	646	141 (21.8%)	505 (78.2%)	0.904 (0.662,1.235)	0.400	0.527
Types of TB						
SPPTB	143	15 (10.5%)	128 (89.5%)	1		
SNPTB	674	167 (24.8%)	507 (75.2%)	1.601 (1.074,2.386)	5.346	0.021
EPTB	211	36 (17.1%)	175 (82.9%)	0.570 (0.299,1.085)	2.933	0.087
Treatment outcome(N=214)						
Successful	781	67 (9%)	736(91.5%)	1		
Unsuccessful	219	147 (69.5%)	50(30.5%)	17.520 (5.796,7.958)	25.74	0.000

4.9 Patients' Level of Satisfaction for TB and HIV Healthcare Services Provided by Metehara Sugar Factory Hospital

A total of 12 TB clients (interviewees) were participated in order to assess the patients' level satisfaction for TB and HIV health services provided by Metehara Sugar Factory Hospital in April, 2017 (Table 8).

Table 8. Interviewees level of satisfaction against healthcare service provisions at Metehara Sugar Factory Hospital during April 2017

Questions	Yes	No	Total
1. Were the waiting areas suitable?	10(83%)	2(17%)	12
2. Did you get healthcare services on time?	8 (67%)	4 (33%)	12
3. Were healthcare providers polite?	8(67%)	4 (33%)	12
4. Were healthcare providers listening to your problem?	7(58%)	5 (42%)	12
5. Were medicines always available?	9(75%)	3(25%)	12
6. Did you satisfy by DOTS and VCT services provide by the hospital?	8 (67%)	4 (33%)	12

5. DISCUSSION

The findings in the present study showed the prevalence of TB-HIV co-infection among patients who attended Metehra Sugar Factory Fentalle District, Oromia Regional State, Ethiopia. Of the 1165 study participants who were enrolled in the study, 1028 (88.2 %) have a documented HIV test result, among whom about 218 were HIV-positive. These findings are higher than that reported for Ethiopia in 2013 with just 71 % of TB patients having a documented HIV status (WHO, 2014).

The present study found 21.2% HIV sero-prevalence among TB patients in the study area. This finding is inconsistent with the findings at Metema Hospital in Amhara Regional state from 2009-2012 (20.1%) (Tarekegn *et al.*, 2016), a study conducted from 2009-2014 at Fenote Selam District Hospital, Amhara Regional State, Northwestern Ethiopia (22.1%) (Desalegn, 2015).

However, the current study finding was higher than that of studies conducted from 2008 to 2013 at Debretabor Hospital, Northwestern Ethiopia (12.7%) (Adisu *et al.*, 2016), and at secondary Hospital in Abokuta Ogun State, Nigeria from 2008-2012 (16.7%) (Babajide *et al.*, 2014) and 2015 national rate of 10% (WHO, 2016). On the other hand, this finding was lower than studies conducted at Adama Hospital Oromia Regional State (31%) (Lengisa *et al.*, 2015), Debre Markos Referral Hospital (44.8%) (Esmael *et al.*, 2013) and Muhibili National Hospital Tanzania (44.2%) (Pili and Said, 2012).

The high prevalence of TB-HIV co-infection in the study area may be associated with the commonly consumption of alcohol, smoking and Khat chewing among young and adults that could push towards unprotected sexual practice that in turn may expose to the infections. The other factors that could attribute to the prevalence of the co-infection among the study participant might be crowded living conditions in camps, family TB history as well as a fear of stigma and discrimination of TB / HIV patients in the community.

The health professionals at the study area also suggested that these factors were contributed to the TB-HIV co-infection among study participants (personal communication). Moreover, Ephrem *et al.* (2015) showed that Khat chewing was more commonly associated with developing active TB among diagnosed TB patients. Similarly Zerihun *et al.* (2014) reported that drinking alcohol was significantly associated with increased risk of HIV infection among TB patients.

Of the 218 HIV positive TB patients the majority (65%) were living outside MSF. This might be due to the reason that the patients were living in the nearby towns and districts of Afar and Somali regions found on major transport corridor from Addis Ababa to Djibouti where the infections prevail. The results of urban co-infection in the present study were in agreement with the findings of a study conducted in Dabat, northwest Ethiopia that showed urban co-infection rate of 64% (Sebssibe and Tadesse, 2013).

The high proportion of TB and HIV co-infections in urban area may be due to the high HIV/AIDS dissemination that would have the effect on TB development (Jemberu, *et al.*, 2017). Similarly, a study at Felege Hiwot Hospital, Northwestern Ethiopia, showed a higher urban co-infection rate of 81.3% (Biadgign *et al.*, 2013). In contrast, a study by Garedeu and Nemera (2017) in Oromia region showed urban co-infection rate of 21%. This prevalence of co-infection in urban areas can be clearly explained by the reason that crowded household living conditions that attributed to the spread of TB that in turn accelerate HIV infection (Alemie and Gebreselassie, 2014).

Out of the 218 co-infected TB patients, 55% were females and this was statistically significant (OR=0.422-0.771; P= 0.000) that revealed significant association between female TB patients and TB-HIV co-infection. This finding is similar with a 54.7% HIV sero-positivity in females at a tertiary hospital Southeast Nigeria (Azuike *et al.*, 2014). Like other studies made elsewhere in the country, in the present study more female TB patients contracted HIV than males. For instance, a study at Bishoftu Hospital Oromia Regional State, Eastern Ethiopia, showed prevalence of 37% co-infection among females (Damtew *et al.*, 2013). Similarly, a study in Gambella Regional State Hospital, southwest Ethiopia, showed 76.3% rate of TB-HIV co-infection in females (Jemberu *et al.*, 2017).

The possible reason for higher TB- HIV co-infection among female patients in the present study might be associated with socio-economic challenges such as monthly income and weak economic background of females. Furthermore, the high TB-HIV co-infection prevalence in female TB patients described here likely to be due in largely part to the background epidemiology of High infection in the area and permanent immune suppression associated with pregnancy and more likely lowered immunity due to the stress as a result of their biological, economic and cultural roles as a household care-givers (Esmael *et al.*, 2013).

For instance Penap *et al.* (2013) reported 45% co-infection among females in Nigeria. In addition, the higher prevalence of TB-HIV co-infection in female than males is expected due to the fact that the penile-vaginal transmission by an infected individual in a single sexual exposure is as low as one in 1000 from female to male and as high as one in 300 from male to female (Georgina *et al.*, 2013).

Even though not statistically significant, the results in the current study showed that TB patients with in age group of 25-34 years were the highest in contracting HIV than other age groups of TB patients. This might be due to the fact that people in this age group are vulnerable to TB and HIV risk behaviors such as substance use and unprotected sexual practices in the study area. In addition, the high co-infection prevalence among these age groups which comprises a large part of workforce and productive section of the society might face grave consequences of poverty that aggravate in acquiring the infections. This age group, being parents of young children, could also be heavily contributing to spread of TB in the household (EHNRI, 2011).

The higher HIV co-infection among 25-34 years old TB patients in the present study was in agreement with findings of other areas. For instance, studies at Bishoftu Hospital Oromia Regional State Eastern Ethiopia (Damtew *et al.*, 2013), Metema Hospital Northwest Ethiopia (Tarekegn *et al.*, 2016), and at primary Hospital in Nepal (Sah *et al.*, 2015) reported that the highest HIV infected TB patient were within age group of 25-34 years.

Regarding the prevalence of TB-HIV co-infection in terms of marital status, a higher rate of co-infection was found among single and co-infected male TB patients. A statistically significant association (OR=1.762-4.872; P=0.001) was observed between single marital status and TB-HIV co-infection. The possible reason might be single and male patients in the study area were more exposed for risk factors and behaviors such as unprotected sexual practice and unlimited sexual partner that may resulted in increased risks of co-infection.

For instance, Georgina *et al.* (2013), Reported that Single TB patients are likely to have multiple sexual partners and hence are at increased risk of acquiring HIV infection. Moreover, by virtue of their marital status, single people have a different lifestyle to those who are married. This is especially the case for patients, who often migrate to different towns in search of jobs, where they frequently live alone or with peers with increased risks of infections (Ephrem *et al.*, 2015).

The prevalence of TB-HIV co-infection in relation to occupational status of the study participants said to be higher among unemployed study participant with a rate of about 51%. Of these most of them were males and it was statistically significant (OR=0.605-1.797; P=0.000). The possible reason behind these findings might be socio-economic constraints associated to unemployment such as low income and living standard, malnutrition, poor health status among the study subjects. For instance Azukie *et al.* (2014) reported that high rates of unemployment increase the spread of HIV. This is because many of the unemployed youths are forced to go into prostitution and drug selling/intravenous drug use, hence the spread of HIV. Lack of employment where job insecurity seems leads to behaviors that increase the risks of tuberculosis and HIV infections such as higher alcohol consumption, smoking and unprotected sex (Przybylski *et al.*, 2014).

Sharma *et al.*(2005) reported that TB-HIV co-infection is intricately linked to unemployment that resulted in poverty and homelessness which may result in malnutrition , drug side effect and low stamina among patients and may possibly lead to poor adherence , death or discontinuation of anti TB chemotherapy. Of the 218 HIV infected TB patients, the majority (77%) had SNPTB which was statistically significant (OR=1.074-2.386; P=0.021). Among these about 79% females and 74% males had SNPTB. The age group of 25- 34 years old accounted for the majority of SNPTB.

The higher proportion HIV infection among SNPTB patients in the present study was nearly similar with the findings at Bale Robe Hospital, Oromia Regional State, Ethiopia (71.8% SNPTB) (Tachbale *et al.*, 2017). But this finding was by higher than findings of studies at other areas. For instance at Adama Hospital that reported about 65% SNPTB co-infection with HIV (Lenjisa *et al.*, 2015). In the present study smear negativity was independently associated with HIV infection. Similarly, Pili and Said (2012) reported a statistically significant association between smear negativity and HIV infection.

The higher prevalence of SNPTB among co-infected study subjects in present study might be due to a number of factors. First, it could be variation in the concentration of AFB in the sputum and the rate of caseation necrosis. Second, Low sensitivity of microscopic examination together with the advent of HIV/AIDS increased the prevalence of smear negative pulmonary TB. From the experience, smear negative pulmonary TB patients take less precaution to prevent TB transmission. And hence increasing the prevalence of smear negative pulmonary TB increased the risk of TB transmission (Tibebu and Gobena, 2014).

The third, possible reason might be due to over-diagnosis of SNPTB and EPTB cases. Because, higher proportion of EPTB cases were diagnosed and transferred in from private clinics which have no any imaging and pathologic techniques. This justification was supported by health professionals in the study area (personal communication, 2017). Moreover, studies have shown that HIV infected patients are twice as likely to have sputum smear-negative which results from their compromised immune response leading to less cavity formation (Sebssibe and Tadesse, 2013).

The proportion of Anti-Retroviral Therapy (ART) coverage in the present study was 78%. This was in line with studies conducted in DOTS clinic, Northern Amhara (76.3%) (Mekonnen *et al.* 2015), in southwestern Ethiopia (79.2%) and that of national level report (75%) (EPHI, 2015). But, higher than the findings at public DOTS clinics in Addis Ababa (54.6%) (Mesfin, 2011), and at Muhimbili National hospital in Dares Salam, Tanzania, (55.4%) (Pili and Said, 2012).

But, lower than Oromia Regional data (89.8%) and WHO target of 100 % ART uptake as per recommendation on the national guideline (EPHI, 2015). The ART coverage in the present study might be associated to adherence of the patients to ART and services provided in the clinic which is critical for achieving viral suppression and good clinical outcomes.

The present study found that treatment success (defined as treatment completed and cured) after completion of dose regimen was 80%. This finding was lower than the findings at Jimma University Specialized Hospital and Omonada training health center, Southwest Ethiopia, 86% (Abebe and Mulugeta, 2015), lower than findings at Debretabor Hospital, North western Ethiopia (87.1%) (Adisu *et al.*, 2016) and the target set in Ethiopia to achieve overall treatment success rate of 89% (FEMoH, 2013). On the other hand, it was higher than studies at Adama Hospital East Shoa, Ethiopia (64%) (Lenjisa *et al.*, 2015) and Mizan Aman General Hospital southwestern Ethiopia (29%) (Feseha *et al.*, 2015). Therefore, in the current study area, the treatment success was said to be satisfactory which might be explained by high rate of patients completed the treatment and low proportion of patients that were transferred out to other health facilities.

Moreover this study found that HIV co-infected TB patients had a higher rate (67.1%) of unsuccessful treatment outcomes (defined as death, default transfer out or failure) compared to those without HIV infection (33%). In contrast, these findings were lower than the findings of Ali *et al.* (2016) in Addis Ababa, Ethiopia, with a rate of 88.2% and 11.8% unsuccessful treatment outcomes among HIV positive TB patients and those HIV negative TB patients respectively.

The present study showed statistically significant association between unsuccessful treatment outcome and TB-HIV co-infection (OR=5.796-7.958; P=0.000). This might be due to combination of failed follow up and poor adherence of patients to their medications. In line to this, a study in West Gojam Zone, North west Ethiopia showed that HIV co-infected patients were at increased risk of unsuccessful treatment outcome than HIV negatives (Senedu *et al.*, 2016). Similarly a study at Gimbi Town Health facilities, Western Ethiopia revealed that unsuccessful treatment outcome showed statistically significant association with TB-HIV co-infection (Garedew and Namera, 2017).

The prevalence of TB-HIV co-infection at Metehara Sugar Factory Hospital showed an increased trend from 2012 to 2015 (20.8% to 25.1%). This increments might be associated with factors such as the presence of high HIV infection, the level of awareness towards the diseases and healthcare services during those years. A decreased trend was observed from 2016 to April 2017 (25.1% to 14.3%). The variation observed in the prevalence of TB-HIV co-infection was most probably due to the common occurrences and temporal variation of the infections in the study area (personal communication, 2017).

The decreased trend of co-infection in the study area might be associated with improved diagnosis and treatment provisions to prevent opportunistic infection among TB patients as soon as they detected HIV positive.

In terms of patients' satisfaction for the provision of health services by Metehara Sugar Factory Hospital, about 83% of the respondents were found that the waiting areas suitable for them while waiting for their medications whereas only about 17% patients complained of dissatisfied with the waiting places. Regarding waiting time to get services, 67% of the patients reported that they did not wait long before being attended by the healthcare provider while 33% patients complained of long waiting times before being attended. This might be due to the majority of health workers were supportive and respectful to the patients. However, the satisfaction rate in the present study was by far lower than a cross-sectional clinical survey conducted in Amhara and Tigray Regions that showed satisfaction rate of 85% (HAPCO, 2012).

The majority (75%) of the patients reported that the healthcare provider who attended them was polite in comparison to the remaining 25% of patients reported that the healthcare provider was not polite. About 58% of the patients responded that their healthcare provider listened to their problems and supportive. This was similar to clinical survey report in Amhara and Tigray Regions (66%) (HAPCO, 2012). In terms of availability of medicines 75% of the patients responded that medicines were always available to them every time they visit the hospital for their repeat treatment.

Overall reflection from the patients interviewed on satisfaction related to the diagnosis and the DOTS and VCT services provided by Metehara sugar hospital showed that the majority (67%) were satisfied with the services they had received on the day of the interview. This was lower than the 2012 HAPCO report (89%). In light to this, the present study showed that most of the services rendered by the hospital said to be met patients' needs. For each question item, more than half of patients rated their satisfaction as above average and suggesting that the hospital met most of its clients' perceived needs.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Investigating HIV prevalence among tuberculosis patients is increasingly being recognized as important, as the HIV epidemic continues to fuel the global TB epidemic. The HIV prevalence in TB patients is a sensitive indicator of the spread of HIV into the general population.

The present study found that TB-HIV co-infection is still high in the study area with a rate of 21.2% which indicates people's awareness on transmission and prevention of TB and HIV is low. On the other hand, 88.2 % of TB patients were screened for HIV but ART coverage was 78% which was lower than WHO target of 100 %. The majority of HIV infected patients were in the age group of 25-34 years. TB patients living outside MSF accounted for higher HIV infection than those living inside MSF.

The present study showed that there were increased trend of TB-HIV co-infection from 20.6% to 25.1% in 2012/13 to 2015 then declining trend during 2016 to April, 2017 from 25.1% to 14.3%. The possible reason for the declining prevalence of TB-HIV co-infection in the study area might be due to the effort towards provision of DOTS and ART services to prevent the dual infections.

The other reason may be due to the current collaborative efforts by the hospital to increase interventions and awareness of the community targeted to the prevention and control of TB-HIV co-infection. Most of patients were satisfied by healthcare services provided by the hospital. However, a few areas of dissatisfaction were also identified. These included the need to ensure appropriate ethical approach from some healthcare providers and patients waiting time to see healthcare providers.

6.2 Recommendations

Based on the findings of the present study, the following recommendations are suggested:

- Even though the prevalence of TB-HIV co-infection showed a declining trend in the study area, the co-epidemics remain as public health burden. Thus, actions targeting (health education and early case detection) on those statistically significant predictors are necessary to effectively reduce TB-HIV co-infection.
- The majority of TB-HIV co-infected patients in the study area were found to be females and patients in the age group of 25 to 34 years. Hence sex and age targeted interventions like awareness creation training should be given to female and sexually active age groups of the population.
- Further population based studies are highly recommended in the district level to assess the clinical, radiologic, immunologic and demographic features of TB-HIV co-infection.
- Provide due attention to communication and social mobilization that further strengthen to achieve 100 % ART coverage and treatment success as per the recommendation on the national guideline.
- Improve health service provisions at areas where the patients showed dissatisfaction. Moreover, more research is needed to compare and assess the actual quality of health services versus satisfaction with services in the study area.

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Appendix 2

Questions about level of satisfaction for TB / HIV patients Level of satisfaction by patients
about the health service given at Metehara Sugar Factory Hospital during April, 2017

Questions	Yes	No	Total
1. Are the waiting areas suitable?			
2. Do you get healthcare services on time?			
3. Were healthcare providers polite?			
4. Were healthcare providers listening to your problem?			
5. Were medicines always available?			
6. Did you satisfy by DOTS and VCT services provide by the hospital?			

Appendix 3

Gaaffiiwwan waa'ee sadarkaa itti quufinsaa dhukkubsattoota TB-HIV tajaajila fayyaa Hospitaala
Warshaa Sukkara Matahaaraa irraargatan, Mudde, 2017

Gaaffiiwwan Dhiyyatan	Lakki	Eeyyee	Ida'ama
1. Iddowwan dabaree itti eeggatan mijaawaa dha?			
2. Tajaajila fayyaa yeroo dhaan argaatanittu?			
3. Oggeessoonni fayyaa kan hospitaalichaa namuusa ogummaa qabu?			
4. Oggeessoonni fayyaa kan hospitaalichaa waa'ee dhibee keessan dhaggeeffatuu?			
5. Qorichawwan isin barbaachisan yeroon argattuu?			
6. Tajaajila waliigalaa gama DOTS fi VCT tiin argattan quubsaa dha?			