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DEPARTMENT OF ZOOLOGICAL SCIENCES

REPORTED TUBERCULOSIS (TB) AND TB/HIV CO-INFECTION IN MOTTA  
TOWN HEALTH CARE FACILITIES, NORTHWEST ETHIOPIA

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## ACRONYMS

AAU	Addis Ababa University
AFB	Acid Fast Bacilli
AFS	Acid Fast Staining
AIDS	Acquired Immunodeficiency Syndrome
ART	Anti-Retroviral Therapy
BCG	Bacille - Calmette-Guerin
CDC	Center for and Disease Control and Prevention
CDR	Case Detection Rate
CNR	Case Notification Rate
CPT	Co-trimoxazole Preventive Treatment
CXR	Chest X -Ray
DACA	Drug Administration and Control Authority
DOT	Directly Observed Treatment
DOTS	Directly Observed Treatment Short-course
EPTB	Extra-Pulmonary Tuberculosis
FMOH	Federal Ministry of Health
HIV	Human Immunodeficiency Virus
ICN	International Council of Nurses
IUATLD	International Union against TB and Lung Disease
LTBI	Latent Tuberculosis infection

MDR-TB	Multi-Drug Resistant Tuberculosis
MHC	Motta Health Center
MTB	<i>Mycobacterium Tuberculosis</i>
MTB/RIF	<i>Mycobacterium Tuberculosis</i> and Resistance to Rifampin
NTP	National TB control program
PTB	Pulmonary Tuberculosis
SNPTB	Smear Negative Pulmonary Tuberculosis
SPPTB	Smear Positive Pulmonary Tuberculosis
SPSS	Statistical Package for the Social sciences
TB	Tuberculosis
TNF	Tumor Necrosis Factor
TSR	Treatment Success Rate
USAID	United States Agency for International Development
WHO	World Health Organization
XDR	Extensively Drug Resistance
YMH	Yeshgaw Motta Hospital
ZN	Ziehl –Neelsen



## **ABSTRACT**

*Tuberculosis (TB) caused by Mycobacterium tuberculosis is a major public health problem and continues to be a world leading killer disease primarily affecting the poor people in developing countries. The necessities of this study to provide information's against TB about continuous evaluation of TB in different settings. The objective of the current study was to determine the reported TB and TB/HIV co-infection among patients attending public health care facilities found in Motta town. The study also analyzed TB/HIV co-infection, case detection rate (CDR) treatment success rate (TSR) among patients attending Directly Observed Therapy Short Course (DOTS) by comparing to national and global level. A five year (2012-2016) retrospective cross sectional study design based on secondary data of total TB patients with socio demographic information registered from TB Registry unit of the patients found in the TB center was used and the data were analyzed using SPSS version 20 software through one sample test and one way ANNOVAs. From a total of 551 TB patients 313 (56.8%) were males and 238 (43.2%) were females with male to female ratio 1.3:1. Majority of the TB cases (91.1%) were within the active economically productive age groups (15-54 years). The CDR was 39% which was lower than the national (62%), regional (52%) and global (64%) showing that the study area did not met the global target of 70% by 2015. All TB patients were tested for HIV which achieved the global target by 2015. The prevalence of TB/HIV co-infection in the study area was higher (26.9%) compared to the national prevalence (11.0%) requiring more action to control TB/HIV co-infections. Generally, there was a minimal variation in trend of TB/HIV co-infection, the reported cases of TB decreased for the last five years by 11.5%( $p = 0.00$ ). However, TB remains a major health problem in Motta town and its surroundings. Strengthening TB and HIV collaborative activities to decrease the high burden of TB/HIV co-infection of Motta town, using sensitive and recent diagnostic tools to increase the case detection rate of smear positive pulmonary TB and modifying the daily available Bacillus Calmette Guerin( BCG) vaccine to make it more effective in all age groups for the future are recommended to overcome the high burden of TB and TB/HIV co-infection.*

Key words: Case detection rate, Directly Observed Treatment Short course, Treatment success rate, Tuberculosis, TB/HIV co-infection

## 1. INTRODUCTION

Tuberculosis (TB) is one of the oldest and is rampant communicable disease of mankind which is caused by *Mycobacterium tuberculosis* (MTB). It transmitted when people active infection sneeze, cough, talk nearest to healthy person or otherwise transmit respiratory fluids through the air. It mainly attacks the lungs, but can also affect other parts of the body. According to World Health Organisation (WHO) 2015 report, TB now ranks alongside HIV as a leading cause of death worldwide. Human immunovirus (HIV) death toll in 2014 was estimated at 1.2 million, which included the 0.4 million TB deaths among HIV positive people. Although about 80% of all TB cases are found in developing countries primarily in Africa, Asia and Eastern-Europe, but the budget allocated to successfully diagnose and treat TB is limited. Due to complicated and a delayed diagnosis of active TB, particularly among immune suppressed TB/HIV co-infected patients that lead to a continuous spread of TB. Due to the dangerous effect of HIV on the susceptibility to active TB, sub-Saharan Africa has been highly affected and accounts for around 80% of all TB/HIV co-infected cases (Lawn and Zumla, 2011).

TB is a world-leading killer disease and has received considerable attention in recent years, primarily affecting poor people in many developing countries where it is closely associated with hiv immunovirus/acquired immune deficiency virus (HIV/AIDS). It mainly affects people who are active economically productive age group who are between (15-45 years), thereby causing large social and economical crisis on a country. Around one-third of the world's population is to be infected with *Mycobacterium tuberculosis* and hence at risk of developing active disease (WHO, 2007). Globally, in 2005 the annual incidence of TB expressed as the number of new TB cases was about 8.8 million people (7.4 million of these in Asia and sub-Saharan Africa), and 1.6 million deaths registered in annually (Yadav *et al.*, 2006).

Nationally, TB is the leading causes of morbidity and mortality. The incidence of TB of all forms and smear-positive TB is 341 and 152 per 100,000 populations, respectively. The prevalence and mortality of tuberculosis of all forms is estimated to be 546 and 73 per 100,000 populations, respectively (WHO, 2007).

Because of divergent aggravating factors for the prevalence of TB and TB/HIV co-infection, such as low economic status of the society, poverty, high usage of traditional alcohols, dense population settlement and presence of large number of prisoners in a single prison room, the

community of Motta town remain vulnerable to and highly affected by TB and TB/HIV co-infection. With this regard, even if some related researches were conducted in East Gojjam zone at Debre Markos referral hospital in the previous year, there have been limited in scope. It is clearly observed that, they could not explore the reported TB cases at grass root levels, like district hospital and health centers. Therefore, this thesis was necessary to study reported TB and TB/HIV co-infection in Motta town health care facilities (YMH and MHC).

## **1.1 RESEARCH QUESTIONS**

The study attempted to answer the following research questions:

- ✚ What was the reported male to female ratio of TB patients among patients that attended DOTS (Directly Observed Therapy-Short course) service in the study health care facilities from 2012-2016?
- ✚ What were the reported TB cases among different age groups?
- ✚ What was the CDR of SPPTB in the study health care facilities?
- ✚ Did the trend of TB reported cases show a decline from 2012 to 2016?
- ✚ What was the reported rate of TB/HIV co-infection cases in specified year?
- ✚ Did the trend of TB/HIV reported cases show a decline from 2012 to 2016?
- ✚ What was the treatment outcome of TB patients particularly the treatment success rate in Motta town health care facilities in relation to 85% of global target by 2015?

## **1.2 OBJECTIVES OF THE STUDY**

### **1.2.1 GENERAL OBJECTIVE:**

The main objective of this study was to determine the reported TB and TB/HIV co-infection in Yeshgaw Motta district Hospital and Motta health center in during the past years from 2012-2016.

### **1.2.1 SPECIFIC OBJECTIVES:**

1. To determine the reported TB cases by sex and age category among TB Patients attending DOTS service in the study site from 2012-2016.
2. To describe the trend of TB and TB/HIV report in the specific year from 2012-2016.
3. To determine the reported TB/HIV co-infection among TB patients attended DOTS services from 2012-2016.

4. To describe CDR of smear-positive PTB in Yeshgaw Motta Hospital and Motta Health Center.
5. To determine the treatment outcome particularly TSR of TB patients in relation to the 85% global target by 2015.

### **1.3 LIMITATION OF THE STUDY**

This study uses secondary data which is not more reliable when compares to primary data. Sometimes unclear information's recorded in TB register books by health care workers Which create confusions.

### **1.4 SCOPE OF THE STUDY**

Geographically, the study was limited to Motta town, Amhara Regional State, Northwest Ethiopia. The study was to determine the reported TB and TB/HIV co-infection cases based on secondary data. The study was focused on one governmental district Yeshgaw Motta Hospital (YMH) and Motta Health Center (MHC) that provides the DOTS services to the TB patients in Hulet Eju Ense Woreda and neighboring districts.

## **2. LITERATURE REVIEWS**

### **2.1 TUBERCULOSIS**

#### **2.1.1 ETIOLOGY AND MODE OF TRANSMISSION OF TUBERCULOSIS**

TB is a bacterial disease caused by *Mycobacterium tuberculosis* that belongs to the class actinomycetes, order actinomycetales and family Mycobacteriaceae (Chan *et al.*, 2011). The genus *Mycobacterium tuberculosis* (MTB) is divided into two main groups: *M. tuberculosis* complex and environmental mycobacterium or non-tuberculosis mycobacterium. The MTB complex comprises the closely related species (*Mycobacterium tuberculosis*, *Mycobacterium bovis*, *Mycobacterium africanum*, *Mycobacterium microti* and *Mycobacterium canetti*) that are the causative agents of TB in humans and animals. From these complexes MTB is the major cause of human TB all over the world (Smith, 2003). There are two types of tuberculosis; pulmonary tuberculosis (PTB) and extra pulmonary tuberculosis (EPTB). Pulmonary TB is any bacteriologically confirmed or clinically diagnosed case of TB involving the lung parenchyma or the trachea bronchial tree. Extra pulmonary TB is tuberculosis of organs other than the lungs, such as lymph nodes, abdomen, genitourinary tract, skin, joints, bones, and meninges (FMOH, 2008).

MTB is spread from person to person by aerogenic transmission. The source of infection is a patient with pulmonary TB who coughs and spreads tiny droplets. A single cough may produce up to 3000 droplets, where each one contains one or more tubercle bacilli (Dye *et al.*, 2011). Under normal circumstances small proportions (about 10%) of all individuals who are infected by the tubercle bacilli develop active disease in their lifetime. Majority of people exposed to the bacteria except those with HIV infection do not develop the disease (Uplekar *et al.*, 2010). It means the remaining 90% of cases, individuals remain asymptomatic and non-infectious, and that is latent infection stage. But, in some abnormal circumstances where the immune response is weakened, reactivation of latent infection can develop (Tufriello *et al.*, 2003).

The transmission of TB to other peoples is determined by the amount of microorganisms within the lungs and their spreads into the surrounding air. The concentration of microorganisms is so

high as to be seen on microscopic examinations of sputum specimens in patients infected by pulmonary smear positive cases are the most infectious ones. It means Patients those are smear positive pulmonary cases are the most infectious than patients with smear negative case (micro-organisms cannot be seen directly under the microscope) patients. But extra pulmonary cases are almost never infectious, unless they have pulmonary tuberculosis as well (CDC, 2007).

### **2.1.2 PATHOLOGY OF MYCOBACTERIUM TUBERCULOSIS**

Healthy people exposed to relatively low numbers of bacteria generally clear them before appreciable damage to the lungs occurs. But if the phagocytic cells do not clear the infection, T-cells, polymorphonuclear cells, and macrophages continue to be attracted to the area where bacteria are growing. In some cases the phagocytes fail to kill the bacteria and the T-cells and macrophages protect the growing lesion with a thick fibrin coat. The walled off lesion is called tubercle. Tubercles eventually calcify, giving rise to hard edged lesions visible in chest X-rays. Phagocytes unsuccessfully trying to kill the bacteria cause considerable damage to the lung tissue by releasing lysosomal enzymes and tumor necrosis factor (TNF). TNF causes tissue damage and is probably responsible for the weight loss that occurs in people with tuberculosis. Initially the areas where bacteria are growing have a thick cheese like appearance. As bacteria continue growing and phagocytes continue to enter the area, the necrotic region becomes much more liquid (Boehme *et al.*, 2011).

### **2.1.3 CLINICAL MANIFESTATION OF MYCOBACTERIUM TUBERCULOSIS**

MTB has many manifestations affecting primarily lung (pulmonary disease), bone, the central nervous system and many other organ systems. Pulmonary TB patients usually have weight loss and productive cough for more than three weeks. Symptoms like haemoptysis, chest pain, dyspnea, fever, tiredness, night sweats, loss of appetite and anorexia have also been shown to be common among TB patients (Deus *et al.*, 2012). Persistent cough is the commonest presentation, initially it may be non productive, but as inflammation and tissue necrosis ensue, sputum is produced (Suzuki *et al.*, 2010). Elderly individuals with TB may not display typical signs and symptoms of TB infection, because they may not mount a good immune response.

From 15–20% of active cases, the infection spreads outside the lungs, causing other kinds of TB. These are considered to be extra pulmonary tuberculosis and EPTB occurs more commonly in immune suppressed persons and young children. In those with HIV, this occurs in more than 50% of cases. Notable extra pulmonary infection sites include the pleura (in tuberculous pleurisy), the central nervous system (in tuberculous meningitis), the lymphatic system (in scrofula of the neck), the genitourinary system (in urogenital tuberculosis), and the bones and joints (in Pott disease of the spine), among others. When it spreads to the bones, it is also known as "osseous tuberculosis", a form of osteomyelitis (Kumar, 2007). Sometimes, bursting of a tubercular abscess through skin results in tuberculous ulcer. An ulcer originating from nearby infected lymph nodes are painless, slowly enlarging and has an appearance of "wash leather". A potentially more serious, widespread form of TB is called "disseminated" TB, commonly known as miliary tuberculosis. Miliary TB makes up about 10% of extra pulmonary cases (Dolin, 2010). The signs and symptoms of extra pulmonary Tuberculosis (EPTB) depend mainly on the organ(s) involved (FMOH, 2008). The most common forms and their respective presentations are:

1. Tuberculous lymphadenitis: Slowly developing and painless enlargement of lymph nodes, followed by matting and eventual drainage of pus.
  2. Tuberculous pleurisy: Pain while breathing in, dull lower chest pain, intermittent cough, breathlessness on exertion.
- TB of bones and joints: Localized pain and/or swelling discharge of pus, muscle weakness, paralysis, stiffness of joints.
3. Intestinal TB: Loss of appetite and weight, abdominal pain, diarrhoea or constipation, mass in the abdomen, fluid in the abdominal cavity (ascites).
  4. Tuberculosis meningitis: Headache, fever, vomiting, neck stiffness and mental confusion of insidious onset.

#### 2.1.4 DIAGNOSIS OF TUBERCULOSIS

TB is a curable disease, if it is detected and effectively treated. But the biggest challenge in preventing morbidity and mortality from TB is the difficulty in making a timely diagnosis. All diagnostic technique relying on symptoms, chest radiographs, tuberculin skin tests, microscopy or cultures has particular challenges. Rapid, proper and accurate diagnosis of TB is so essential for decreasing the transmission and incidence of TB, for effective TB control programs, to improve treatment and to control development of drug resistance. Smear microscopy is the sole method used for TB diagnosis in most laboratories in developing countries, where over 95% of TB-related deaths occur. Around 45% infections are detected by sputum microscopy in active pulmonary TB patients. In most cases, *Mycobacterium* culture is the best preferable diagnostic test for TB diagnosis and is the most important method in detecting drug resistance (WHO, 2011).

Laboratories and laboratory networks are basic components of tuberculosis control and treatment monitoring at every level of the health-care system (Steingart *et al.*, 2007). The weakest component of health systems is laboratory services in Low-income and middle-income countries, which have been grossly neglected, understaffed, underfunded over time and outdated tuberculosis diagnostic tests; including sputum smear microscopy, solid culture, and chest radiography (WHO, 2011). In high-incidence countries, TB control relies on passive case finding among patients self-presenting to health care facilities, followed by either diagnosis based on clinical symptoms or laboratory diagnosis using sputum smear microscopy. Serial sputum specimens are required by asking patients to make repeated visits to the health care centers for specimen delivery and collection of results. For many patients, the costs of repeated visits to health care facilities are prohibitive, and patient dropout is a significant problem (Steingart *et al.*, 2007).

Ethiopia is ranked 7<sup>th</sup> among the 22 countries with a high-burden of TB and third in Africa (WHO, 2009). However, most TB laboratories in Ethiopia have only acid fast staining and shortage of resources for culture, identification and drug susceptibility testing of *Mycobacteria*, which present a big hindrance for tuberculosis control in the country (Haileyesus Getahun *et al.*, 2007). Rely on the quality, bacterial load of the sputum specimen and the training and motivation of laboratory technicians, Sputum smear microscopy is the cornerstone of TB diagnosis in



developing countries. Although highly specific in most countries, it is insensitive and detects roughly 50% of all the active cases of TB and cannot detect bacterial resistance to antimicrobial drugs. Sensitivity can be as low as 20% in Children and HIV infected people (WHO, 2008).

The detection rate of AFB is minimized due to low access to high quality microscopy services in poor countries. In addition, in countries with high prevalence of both PTB and HIV infection, the detection rate is low owing to the paucity nature of bacillus in patients infected by TB-HIV. If there is no positive sputum smears for AFB at initial care level, most cases of pulmonary tuberculosis are diagnosed on the basis of clinical and radiological indicators (Haileyesus Getahun *et al.*, 2007).

TB Culture is performed at national reference level and hospital laboratories and it is a more sensitive method for TB diagnosis than smear microscopy and it permits testing for drug resistance. However it requires bio safety materials that are expensive, require long incubation period and well trained laboratory technicians. The other diagnostic method is chest X-ray (CXR). However it is less applicable in low resource countries. Some national TB programmes in developing countries have no functioning TB culture facility at all. TB culture can take weeks because of the slow growth rate of TB bacilli. In most countries TB culture is reserved for retreatment cases. Specimens are often sent to distant laboratories. This can delay processing of specimens and lead to inaccurate results. Furthermore, test results must travel long distances back to reach the clinic and the patient (WHO, 2008).

The diagnosis of PTB in adult is mainly done by collecting a sputum sample. Due to the nature of the waxy coat of *Mycobacterium* cell wall, it retains an aniline dye (Carbolfuchsin) even after decolorization with acid and alcohol; they are thus named Acid Fast Bacilli (AFB). This characteristic enables us to detect them by microscopy. Although this method has low sensitivity; it is widely applied and used globally, because it is simple, rapid and cost-effective in resource limited settings.

Two procedures commonly used for acid fast staining:

1. Carbolfuchsin method which include ZN and Kinyoun methods (Light/ bright field microscope)

2. Fluorochrome procedure using auramine-O or auramine-rhodamine dyes (Fluorescent microscope)

In the 'hot' ZN technique, the phenol-carbolfuchsin stain is heated to enable the dye to penetrate the waxy *Mycobacterium* cell wall. Carbolfuchsin combined with phenol because of the cell wall of mycobacterium which does not stain well by Gram stain. In the 'cold' technique known as Kinyoum method, stain are not heated but the penetration is achieved by increasing concentration of basic fuchsin and phenol and incorporating a 'wetting agent' chemical.

According to FMOH report of 2008, the diagnosis of extra pulmonary TB is based on fine needle aspiration cytology or biochemical analysis of the cerebrospinal, pleural, ascetic fluid or histopathological examination or strong clinical evidence consistent with active EPTB. EPTB occurs more commonly in immune suppressed persons and young children. In those with HIV, it occurs in more than 50% of cases. Latent TB infection can be diagnosed with either a tuberculin skin test (which is sensitive, less expensive and preferable in low-income regions) or an interferon-gamma release assay which is sensitive and more specific than tuberculin skin test. It is impossible to diagnosis of active TB disease by Interferon-gamma release assays and tuberculin skin tests (WHO, 2010).

A chest X-ray and multiple sputum cultures for acid-fast bacilli are typically part of the initial evaluation (Escalante, 2009). Sputum microscopy and culture in liquid medium with subsequent drug-susceptibility testing are currently recommended as standard methods for diagnosing active tuberculosis. The use of solid culture medium is more cost-effective in resource poor countries. Nucleic acid amplification tests, imaging, and histo-pathological examination of biopsy samples supplement these evaluations. In resource-constrained settings with a high prevalence of tuberculosis and HIV infection, an estimated 30% of all patients with tuberculosis and more than 90% of those with multidrug-resistant and extensively drug-resistant tuberculosis do not receive a diagnosis (WHO, 2012). A new molecular diagnostic test called Xpert MTB/RIF assay detects *Mycobacterium tuberculosis* complex within 2 hours, with an assay sensitivity that is much higher than that of smear microscopy. In HIV infected patients, the test has a rate of case detection that is increased by 45%, as compared with smear microscopy. This molecular assay has the potential to improve the performance of national tuberculosis programs and is currently

being implemented in district-level laboratories in 67 countries with a high prevalence of tuberculosis (WHO, 2012).

### **2.1.5 TREATMENT AND MANAGEMENT OF TUBERCULOSIS**

Treatment of tuberculosis has now been standardized by putting patients in to different categories based on smear status, seriousness of the illness and previous history of treatment for tuberculosis. The objectives of anti-TB treatment are to cure the patient of TB (by rapidly eliminating most of the bacilli), to prevent death from active TB or its late effects, to prevent relapse of tuberculosis (by eliminating the dormant bacilli), to prevent the development of drug resistance by using a combination of drugs and to decrease the transmission to others.

The drugs used as first line treatment of tuberculosis both in the intensive phase and continuation phase with their mode of action are the following: Isoniazid (bactericidal), Rifampicin (bactericidal), Pyrazinamide (bactericidal), Ethambutol (bacteriostatic) and Streptomycin (bactericidal) (WHO, 2002).

The Treatment process of TB has intensive (initial) phase and continuation phase. In initial phase, taking three or more drugs are taken for eight weeks for new cases and twelve weeks for re-treatment cases with the assumption of making the patient non-infectious by rapidly reducing the load of bacilli in sputum, usually within two to three weeks except in case of drug resistance. The drugs must be collected daily by the patient and swallowed under the direct supervision of a health worker. Then continuation phase immediately follows the intensive phase with two or more drugs for four to six months with the assumption of making the patient permanently cured and to avoid relapse after the completion of the treatment (Anteneh Girma, 2007). The drugs must be collected every month and self-administered by the patient, except for retreatment cases and for regimens containing Rifampicin (FMOH, 2008). The strategy of TB treatment is called Directly Observed Treatment, Short-course (DOTS). It was adopted for the control of TB and formulated global targets for the year 2000, namely to detect 70% of infectious New cases and to cure 85% of the detected infectious cases at the World Health assembly in 1991. WHO TB global report indicated that DOTS was being implemented in 184 countries that accounted for 99% of all estimated TB cases and 93% of the world's population in 2006 (WHO, 2008).

## **2.1. 6 GLOBAL EPIDEMIOLOGY OF TUBERCULOSIS**

It has been claimed that there has been ‘no other single disease, which has been so prevalent and wide spread over such an extensive period in time as TB’ (Glaziou *et al.* 2009). With nearly two million deaths in 2007, TB ranks second only to HIV as a cause of death from an infectious agent. TB is found in every country in the world and it kills 5000 people every day. However, 98% of deaths are occurred in the developing world, particularly those in Asia and Africa (WHO, 2005). The poorest and malnourished women’s are the most vulnerable section of the society.

Around 9.7 million children were made orphans as a result of parental deaths caused by TB in 2009(WHO, 2009). According to 2011 report, the WHO estimates that there were 8.8 million incident cases of TB in 2010. It affects mostly adults in the economically productive ages. It means around 67 of TB cases are estimated to occur among people aged. Global targets for reductions in the epidemiologic burden of TB have been set for 2015 and 2050 within the context of the Millennium Development Goals and the Stop TB Partnership, respectively. However, contrary to the effort to halve TB mortality by 2015 in comparison with 1990, there were nearly 9 million cases in 2011. The emergence of MDR and, more recently, of extensively drug resistance (XDR) strains of *Mycobacterium tuberculosis* is a real threat to achieve TB control and ease the burden it caused (Glaziou *et al.*, 2009).

### **2.1.7 TUBERCULOSIS EPIDEMIOLOGY IN ETHIOPIA**

TB is a major public health problem claiming the lives of thousands of Ethiopians every year (FMOH, 2010). Ethiopia ranks seventh among world 22 high burden countries with an estimated 314,267 TB cases, and 3,000 MDR-TB cases per year. The country had an estimated incidence rate of 378 cases per 100,000 populations (WHO, 2009); the prevalence of tuberculosis of all forms was estimated at 546 per 100,000 populations (WHO, 2007).

And also Ethiopia is among the 27 high MDR-TB burden and 41 high TB/HIV co-infected countries. According to FMOH 2014, the estimates of TB prevalence rate in Ethiopia had increased during the first 4-5 years since 1990 from 425 per 100000 populations per year and

reached 482 per 100000 populations per year in 1994. Since 1995 onwards however, the estimates for TB prevalence rate have shown a steady decline at an average rate of 4% per year, with an increased rate of decline for the last 5 years (5.5% per year) and reached a level of 237 per 100000 populations in 2011. By 2013, the prevalence decreased to 211 per 100000 populations (WHO, 2014).

The decreasing trend in prevalence rates follows the adoption of the Stop TB strategy in 2006/7 by the National TB Control Program (NTP). During the same period, there has been a large expansion of DOTS centers in the country with 100% geographical coverage and 95% health facility coverage (FMOH, 2014). TB mortality rate has also been declining steadily since 1990 and reached a level of 18 per 100000 deaths in 2011 showing the country's achievement of 2015 target for reducing TB related mortality rate.

### **2.1.8 RISK FACTOR OF ACQUIRING TUBERCULOSIS**

1. Diabetes: It increases the risk of active TB disease by impairing the innate and adaptive immune responses, thereby accelerating the proliferation of TB (Martens *et al.*, 2007).
2. Alcohol: the risk of active tuberculosis is substantially elevated among people who drink more than 40 g alcohol per day. It alters the immune system specifically changing the signaling molecules responsible for cytokine production (Room, 2005).
3. Indoor Air Pollution: In developing countries, the percentage usage of solid fuels for cooking is more than 80%. The releasing of carbon monoxide, nitrogen oxide, formaldehyde, and poly aromatic hydrocarbons from biomass combustion which can deposit deep into the alveoli and can cause considerable damage (Smith, 2002).
4. Tobacco Smoke: smoking causes remained a risk factor for TB infection and disease, with additional risk of death in persons with active TB. Biological explanations including impaired clearance of mucosal secretion, reduced phagocytic ability of alveolar macrophages and decrease in the immune response have been given as reasons for increased susceptibility to pulmonary tuberculosis (Arcavi and Benowitz, 2004).
5. Age: TB is mainly a disease of adults in the age group of 15-64years. The efficacy of the current TB vaccine BCG is consistent in protecting infants, especially from the most severe forms of meningeal and miliary TB (Mangtani *et al.*, 2014).

6. Gender: According to Ottmanian and Uplekar (2008) Reports show that men account for high proportion of notified TB cases than women. Worldwide tuberculosis notification data for 2012 show a male-to-female ratio of 1.9:1 and that of the 22 high-burden countries of male-to-female ratio was 1.8:1(WHO, 2013).

## **2.2 TB/HIV CO-INFECTION**

### **2.2.1 PREVALENCE OF TB/HIV CO-INFECTION**

Co-infection is the “simultaneous infection of a cell or organism by separate pathogens” (Mosby's Medical Dictionary, 2009). TB/HIV co-infection is the concurrent presence of HIV and TB infection in an individual. According to Estifanos Shargie (2006), they have complex interaction exist between these two communicable diseases, HIV increase the risk of infection as, it reactivates LTBI and increases the progression to active disease.

TB/HIV co-infection has fatal consequences as TB becomes the leading cause of death in HIV infected patients with acquired immunodeficiency syndrome (AIDS). HIV lowers the host immune response to MTB. The lifetime risk of developing active TB in HIV infected individuals is 10% per year compared with lifetime risk of 5-10% in individuals without HIV. As a result, the TB case notification rate (CNR) has increased four to six folds in Sub Sahara Africa (Afework kassu *et al.*, 2007). HIV affected the performance of TB control programmes by increase the number of TB case and by compromising the treatment out comes. It created a huge challenge to already overstretched and under staffed health system in high burden countries. It reduce the proportion of smear-positive case; and increased the rate of treatment, failure, defaulter and death, which in turn compromised the progress toward achieving the targets recommended for TB control under DOTS strategy.

Globally 1.37 million TB cases (14.8% of 9.27 million cases) were co-infected with HIV. 70% of TB/HIV co-infected occurred in HIV infected people due to TB which accounted for a quarter of death among HIV positive people. Several studies were conducted in different global counties, including sub Saharan Africa. In 2006, the prevalence of HIV among 6,533 registered TB patients in USA was 12 % (CDC, 2010). Different sub Saharan African countries were reported greater than 40% of HIV Seroprevalence rates among TB patients. In Kenya and Uganda, 60%

and 30% of newly diagnosed tuberculosis patient were HIV positive, respectively. In 2005 another study conducted in Kampala, Uganda revealed 42% HIV Seroprevalence among TB patients (Srikantiah *et al.*, 2007).

Ethiopia is one of 41 countries with the high prevalence of TB/HIV co-infection. In 2012, about 65% notified TB patients new their HIV status. Of 96245 TB patients tested for HIV infection, 9819(10%) were positive. Nevertheless, rate of co-infection among TB patients varies according to geographical location and people (Getahun Alemie and Fesha Gebreselassie, 2014; Datiko *et al.*, 2008; Sebsbe Tadesse and Takele Tadesse, 2013). Few studies have been conducted regarding the prevalence of HIV among TB patients in Ethiopia; most of them are health institutions based cross- sectional. In the year 2003 the study conducted in Arsi, Oromiya regional state revealed that the Seroprevalence of HIV among registered TB patients was 37.2%. Almost equal proportions of females and males found to be HIV seropositive, 36.3% and 37.9%, respectively. Another study done in Harar, Eastern Ethiopia in 1997 showed 22% of seropositive among smear positive and 20.4% of seropositive in culture positive TB patients (WHO, 2009). In 2000 a study conducted in Addis Ababa revealed 45.3% of Seroprevalence among 236 AFB confirmed TB patients (Meaza Demissie *et al.*, 2000).

### **2.2.2 TB/HIV CO-INFECTION TREATMENT**

There is no special treatment for HIV positive TB patients; it is the same to non co-infected patients. Occurrence of immune reconstitution, overlapping toxic effects, drug interactions, and regimen length and schedule of administration of anti tuberculosis drugs, timing and drug combinations of antiretroviral drugs are exceptional issues associated with co-infected individuals. Isoniazid, Rifampicin, Pyrazinamide, and Ethambutol are the combination of drugs of choice for the treatment of TB/HIV co-infected patients.

According to WHO (2009), TB treatment, parallel with co-trimoxazole which prevents *Pneumocystis jirovecii*, malaria, different bacterial infections and reduces death and immediately followed by anti retroviral therapy within 8 weeks is the first priority for recommended for all HIV positive TB patients. ART prescribed to patients based on the number of CD4 cell count of less than 50 per cubic millimeter in order to improve their survival. Furthermore, it decreases TB rate by 90% and 60% at the individual and population levels, respectively. For antiretroviral

therapy in patients with active tuberculosis, a regimen with non-nucleoside reverse transcriptase inhibitors such as efavirenz are preferred, and is the drug of first choice (WHO, 2012).

Taking rifampicin significantly decreases serum concentrations of protease inhibitors. The substitution of rifabutin for rifampicin and increased doses of boosted protease inhibitors to avoid this reduction are under way. Patients with HIV-associated tuberculosis should also receive prophylaxis with trimethoprim–sulfamethoxazole.

## **2.3 OPERATIONAL TERMS DEFINITION**

1. Directly Observed Therapy-Short course (DOTS) - main strategy for TB control, which is adopted by WHO and the International Union against TB and Lung Disease (IUATLD). It is a patient centered health system which provides support by observing patients on the process of taking their treatment, and thus ensures that they complete their treatment.
2. Epidemiology-is the scientific corresponds to the study of the distribution and determinants of health related states and domain events in populations and the control of the problem.
3. Extra pulmonary Tuberculosis (EPTB)-this includes tuberculosis of organs other than the lungs, such as lymph nodes, abdomen, genitourinary tract, skin, joints, bones and meninges.
4. Incidence-is the occurrence of new cases of diseases per population size for a certain period of time or the number of cases reported per100, 000 populations.
5. Prevalence- is defined as the ratio of the number of cases of a disease present in a population at a given time and the number of individuals in the population at that time.
6. Pulmonary tuberculosis -is any bacteriological confirmed or clinically diagnosed case of TB involving the lung parenchyma or the tracheo-bronchial tree.
7. Smear Negative Pulmonary Tuberculosis- a patient with sputum suggestive of TB, with at least two sputum specimens which are negative for AFB by microscopy, and with chest radiographic abnormalities consistent with active PTB and lack of clinical response to one week of broad spectrum antibiotic therapy.
8. Smear Positive Pulmonary Tuberculosis- a patient with at least two sputum specimens which are positive for acid fast bacilli (AFB) by microscopy.



### 3. MATERIALS AND METHODS

#### 3.1 DESCRIPTION OF THE STUDY AREA

The study was conducted in Motta town, which is found in East Gojjam of Amhara Regional State, North West Ethiopia. It is bounded by Hulet Eju Ense district. According to the 2015 population projection the woreda has total population of 38,200 about half (18,748) were males. The town is located at a distance of 371 kms from Addis Ababa and 120 kilometers from regional town Bahir Dar. Secondary road that links Dejen with Bahir Dar overlooking the Abay River touches the town. This town has a latitude and longitude of 11°5'N 37°52'E with an elevation of 2,487 meters above sea level and with Woina Dega climatic classification. The town has one governmental district hospital, one health Center and four health Posts. The health care facilities have TB centers that provide DOTS service to TB control program.

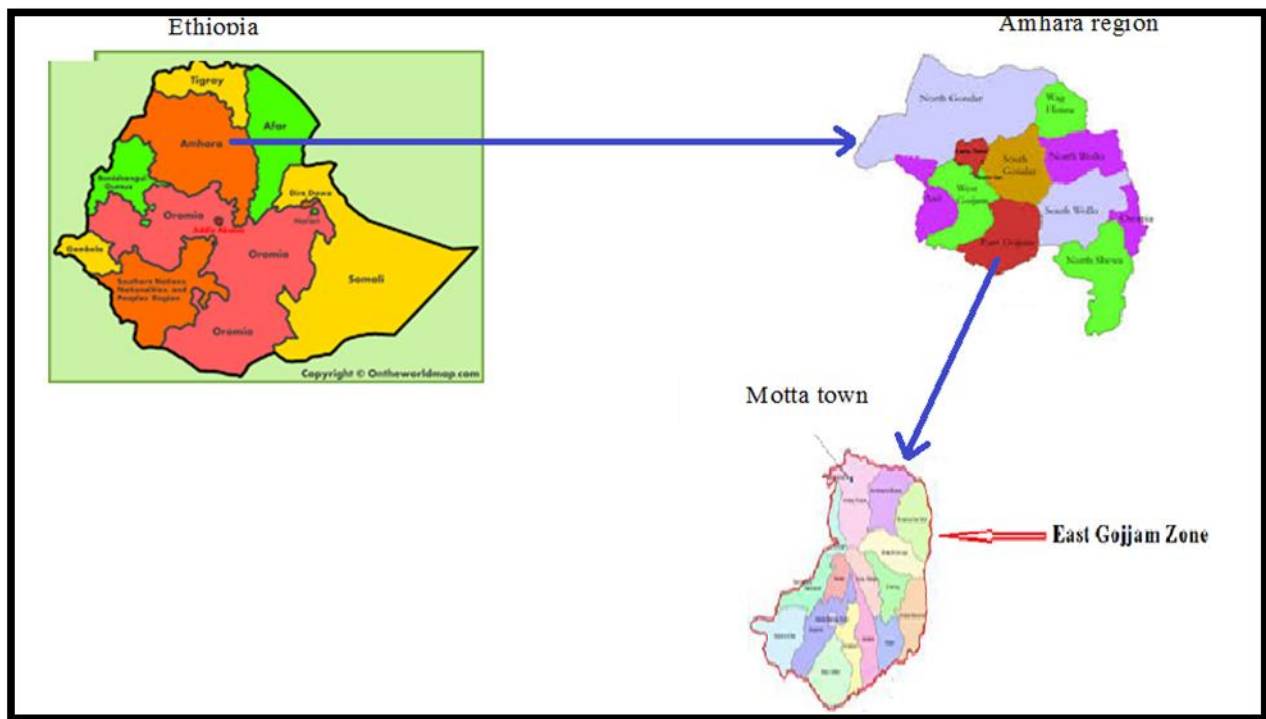


Figure 1. Map of the study area

## **3.2 THE STUDY POPULATION AND SAMPLING TECHNIQUE**

The total number of TB patients who have got health services in YMH and MHC during the period between January 2012 and December 2016 was considered as total population for this study. The samples of the study were all TB patients recorded on the Registry Unit of the hospital and health center from 2012-2016.

## **3.3 INCLUSION AND EXCLUSION CRITERIA**

### **3.3.1 INCLUSION CRITERIA**

1. Patient records from January 01, 2012 up to December 30, 2016 were included.
2. TB out patients who are under treatment during the time of data collection was included.

### **3.3.2 EXCLUSION CRITERIA**

1. TB patient records before January, 2012 were excluded.
2. Private health care facilities were excluded.
3. Clinical records that did not have complete information relevant for the study were excluded.

## **3.4 METHODS OF DATA COLLECTION**

The present study involved a retrospective cross-sectional study design to determine the reported TB cases among patients who have been admitted at Motta district hospital and Motta health center during the last five years (2012-2016). Secondary data from medical records of TB patients was used for analysis to collect necessary information that used to determine the prevalence of tuberculosis and TB/HIV co-infection.

## **3.5 DATA COLLECTION PROCEDURE**

Data was collected from TB registrations books at TB unit of Study areas. The information from TB Registry books was recorded. The variables on the record were age, sex, address of TB and TB/HIV co-infected patients and forms of TB (SPPTB, SNPTB and EPTB). The data was collected by the principal investigator with the help of one nurse who works in each health institutions from December 1, 2016 to December 23, 2016.

### **3.6 DATA ANALYSIS**

Data was analyzed by using SPSS Version 20 statistical packages. In this regard, frequency, percentages and tables were used to analyze the results. The data was summarized, organized, presented and interpreted in the results and discussion part of this thesis paper. P-value < 0.05 was considered as a statistically significant association.

### **3.7 ETHICAL CONSIDERATIONS**

The study was carried out after cooperation letter was obtained from Addis Ababa University, Department of Zoological science to conduct this study. The letter was taken to Motta Hospital and health center and permission was obtained from each institution director. The purpose of the study was then explained to the health care facilities and confidentiality in list of patients that were recorded in registration books at TB unit was keep.

### **3.8 DISSEMINATION OF RESULTS**

After the completion of the current study the result will be presented during thesis defenses in the department of biology as a partial fulfillment of the master of Biology. The findings of this study will be circulated to AAU, College of Natural sciences, Department of Zoological science, and Motta Health bureau. At the end it will be disseminated to national or international conferences and the Ethiopian public health association for possible publications.

## 4. RESULTS AND DISCUSSIONS

### 4.1 TRENDS OF THE REPORTED TB CASES FROM 2012-2016

The present finding suggested that the highest reported TB was detected in 2012 contributing to 27.6 % (152). This was higher compared to the number of patients in the next consecutive years 116 (21.1%), 100 (18.1%), 94 (17.1%) and 89 (16.1%) in 2013, 2014, 2015 and 2016 respectively as shown in (table 1). The total number of cases in 2012 was 152 which was not known whether it was retreatment or new cases. However, three, one and two retreatment cases are added in 2013, 2014 and 2015 respectively.

The reported of all forms of TB cases decreased from 2012-2016 by 11.5%, which was 2.3% per year. This fantastic and radical change TB report may makes Motta and surrounding peoples joyful and happy. This study was inconsistent with a research carried out on the prevalence of MTB and HIV infections among patients visiting Dil-Chora Referral Hospital (Aster Teshome, 2014) showed a increasing trend from 2006/7(27.7%)-2012/13(72.1%). The decline rate of TB of this study by 11.5% was agreed with the work of Daniel Mekonen *et al.* (2015) for PTB patients were decreased across the year 2008-2013(18.74-13.44) by 5.3%. Besides this, the assessment of the prevalence of PTB patients at Yirga Cheffe Health Center from 2008-2013 showed a decline in the prevalence of TB from 223 cases in 2008, to 160 cases in 2013 by 5.3% (Fekadu Alemu, 2015).

The declining trends in prevalence and incidence rates follow the adoption of the Stop TB strategy in 2006/7 by the National TB Control Program (NTP). During the same period, there has been massive expansion of DOTS centers in the country with 100% geographical coverage and 95% health facility coverage. TB mortality rate has also been declining steadily since 1990 and reached a level of 18 per 100000 deaths in 2011 showing the country's achievement of 2015 target for reducing TB related mortality rate (FMOH, 2014).

As it was indicated in (table 1) below, variations in the report of smear positive pulmonary TB; smear negative pulmonary TB and extra pulmonary TB observed at different years. 6.8% of SPPTB and 93.2% of SNPTB cases were registered in North-west Ethiopia (Daniel Mekonen, 2015). In contrarily, 22.1% of SPPTB and 34.7% Of SNPTB was recorded in this study. The

highest reported of SPPTB case was 27.6% in the year 2016 and 16.1% was the lowest rate registered in the year 2012; whereas the highest and lowest infections of SNPTB was recorded in years 2012 and 2016 with the prevalence of 28.8% and 11.5% respectively. This result was comparable to the research done by Hassen Ali *et al.* (2012) with the percentage of smear positive pulmonary tuberculosis cases showed gradual decrease from 19.5% in 2006 to 5.8% in 2010. The percentages of smear positive increases in 2016 than 2012 by about 11.5% and the percentages of smear negative pulmonary TB decreased in 2016 than 2012 by 17.3%. This might be due to the establishment of DOTS and improvement of TB diagnosis and treatment.

The proportion of pulmonary TB of this study was higher than extra pulmonary TB by 13.6%. Unlike this study, a research conducted in Somalia in Minnesota, EPTB was more common than PTB (Talbot, 2000). The prevalence of EPTB among all foreign-born tuberculosis patients in the United States is considerably lower than that reported among Somalis in Minnesota and elsewhere which suggests that the unique characteristics of tuberculosis in this population may reflect host factors or differences in geographically endemic strains of *Mycobacterium tuberculosis*.

The percentages of extra pulmonary TB in 2015 of this study was less than by 25.7% to the research done on TB/HIV co-infection and associated factors among patients on directly observed treatment short course in North eastern Ethiopia (Daniel Mekonnen *et al.*, 2015). According to Rahel Iwnetu *et al.* (2009), up to 15% of all EPTB cases could be wrongly diagnosed. One possible reason for too high EPTB cases was registered in North Eastern Ethiopia than this study; it might be due to zoonotic transmission of TB and genetic features of the pathogen and or the host population. It means having regular and direct contact with live animals was a significant risk factor for lymph node when compared to pulmonary TB (Berq, 2015).

## **4.2 REPORTED TB CASES BY SEX ATTENDING DOTS SERVICES**

From medical records of the total TB patients which were registered in the study health care facilities of five years were reviewed. Out of 551 patients who were registered on the TB Registry Unit, and attended their DOTS service from the years (2012 to 2016), 313(56.8%) were males and 238(43.2%) were females. The proportion of females slightly lower than males which was not significantly associated ( $p = 0.262$ ).

The proportion of male to female ratio of TB of the present study which was more comparable to a research conducted at Dire Dawa Hospital on the prevalence of MTB and HIV infections with 1.3:1 ratio of males and females (Aster Teshome, 2014). But the result of this study was differing to some extent in other studies conducted in Ethiopia as well as in the world. Another research studied in Gambella region also revealed out of a total 2,303 TB patients registered at Gambella Regional Hospital within five years (2006- 2010),54.5% were males and 45.5% were females with a ratio of 1.2:1(Damte Demeke *et al.*, 2014). Research on trends of Case notification and Treatment Outcome in the Sidama Zone reported that, out of 37,070 total TB cases registered 54.5% were male and 45.5% were females with a ratio of 1.2:1(Mesay Hailu *et al.*, 2014). According to WHO (2014) world global report, 5.2 million men, and 3.2 million women estimated to fallen in with TB. In all study cases, the data showed that males were more susceptible to TB than females. A similar distribution of TB patients was reported in Nigeria in which the number and proportion of male TB patients (55%) were higher to that of female TB patients (Makpa *et al.*, 2011). Besides this, the higher number male of TB patients than female ones might be due to the fact that men are usually chew chat, share cigarette and cups for drinking water while chewing, moving from place to place for various purposes, sharing utensils, and exposure to dust (Mengistu Legesse *et al.*, 2010).

In contrary to this, different researchers reported that women account for high proportion of TB cases than men (Ottmani and Uplekar, 2008). This was explained by sex biological determinant in which progression from TB infection to disease is likely to be faster for women compared with men in their reproductive years and gender (socio-cultural determinants influencing access to TB care leading to differential access to health care) that compromise the women's ability to utilize the available health service (Hamid *et al.*, 2004). In addition, higher risk of HIV infection among women makes them susceptible to develop active TB. TB is the leading infectious cause of death in young women in developing countries (Uplekar *et al.*, 2001).

Table 1 Reported TB cases of YMH and MHC from 2012 to 2016, (N=551).

Characteristic	Year						p-value
	2012,n(%)	2013, n(%)	2014,n(%)	2015,n(%)	2016, n(%)	Total,n(%)	
<b>Sex</b>							
Male	91(56.5)	72(62.6)	70(54.3)	42(53.2)	38(56.7)	313(56.8)	0.262
Female	70(44.5)	43(37.4)	59(45.7)	37(46.8)	29(43.3)	238(43.2)	
<b>Age</b>							
0-14	2(1.2)	0(0)	3(2.3)	2(2.5)	8(11.9)	15(2.7)	0.000 □
15-24	26(16.1)	19(16.5)	16(12.4)	5(6.3)	3(4.5)	69(12.5)	
25-34	30(18.6)	29(25.2)	24(18.6)	24(30.4)	24(35.8)	131(23.8)	
35-44	51(31.8)	31(27)	28(21.7)	30(38)	40(59.7)	180(32.7)	
45-54	35(21.7)	25(21.7)	22(17.1)	29(36.7)	11(16.4)	122(22.1)	
55-64	5(3.1)	7(6.1)	6(4.7)	3(3.8)	2(3)	23(4.2)	
≥65	3(1.9)	5(4.3)	1(0.8)	1(1.3)	1(1.5)	11(2)	
<b>TB cases</b>							
SPPTB	34(21.1)	22(19.1)	29(22.5)	20(25.3)	17(25.4)	122(22.1)	0.081
SNPTB	57(35.4)	42(36.5)	34(26.4)	29(36.7)	29(43.3)	191(34.7)	
EPTB	70(43.5)	51(44.4)	66(51.1)	30(34)	21(31.3)	238(43.2)	
<b>CDR</b>							
SPPTB	34(37.4)	22(34.4)	29(46)	20(40.8)	17(37)	122(39)	0.01 □
SNPTB	57(62.6)	42(63.6)	34(34)	29(59.2)	29(63)	191(61)	

TB: tuberculosis, SPPTB: smear positive pulmonary tuberculosis, SNPTB: smear negative pulmonary tuberculosis  
 EPTB: extra pulmonary tuberculosis, n: number of people, %: percentage, \*: statistically significant, CDR: case  
 detection rate, YMH: Yeshgaw Motta Hospital, MHC: Motta Health Center.

### 4.3 CDR OF SMEAR POSITIVE PTB

Among the total 313 PTB cases, 122(39%) were smear-positive and 191(61%) smear-negative. The detection rate of smear-positive cases was between 37.4% in the 2012 and 37% in 2016 showing a statistically significant ( $p=0.01$ ) increase as function of year (table 1).

According to the global TB report of 2014 the global trend of estimates of CDR for new and relapse cases from 1995 -2013 showed an improvements in that in 1995 CDR was (39%), in 2000 (40%), in 2005(54%),2010(63%) and 2013 (64%). This shows presence of improvement in diagnosis capacity of laboratory facilities (WHO, 2014). In contrary to this, there was no significant change of CDR in 2012 (37.4), 2013 (40%), 2014 (46%), 2015(40.8%) and 2016(37%) as shown in (table 1). This low TB case detection could be due to Poor quality and examination of a sub optimal number of sputum-smears could partly be contributing to the high diagnosis of smear negative PTB diagnosis (Hawken, *et al.*, 2001).

The reported SNPTB 191(61%) cases of this study were significantly higher than SPPTB 122(39%). This may due to DOTS pays little or no attention to smear negative cases yet these patients can and transmit TB infection to others (Tostmann *et al.*, 2008). The diagnosis of smear-negative pulmonary tuberculosis is the biggest challenge to detect it especially in areas where there is lack of diagnostic facilities like bronchoscope and broncho-alveolar lavage in addition to skilled man power. As a result, patients with SNPTB, do not receive a diagnosis in a timely manner, thus, disease may further develop initiation of treatment may be delayed, and further TB transmission may occur.



#### **4.4 THE REPORTED TB CASES AMONG DIFFERENT AGE GROUPS**

As in shown (table 1) below, the reported cases of TB with the age group of 0-15 were increased from 2012 (12.5%) -2016 (56.3%) in both sexes. This increasing rate was consistent to the assessment reported by Fekadu Alemu (2015) that showed the prevalence of children less than 14 years increased from (2009) 11.7% to 2013 (26.7%). According to the report of Tuberculosis and Leprosy control program of Ethiopia (2002) described that the incidence of tuberculosis was increasing. The incidence of TB in children is less compared to adults, but they are likely to suffer from more serious forms of TB and may die if not treated properly (FMOH, 2008). There are several studies reporting the prevalence of childhood tuberculosis, estimates indicate that there are very few cases among 0–14 year olds, even in areas of high transmission (10% of all new cases in Africa in 2004, but only 2% in the established market economies) (Dye, 2006).

This low reported TB cases in children's (2.7%) was agreed to FMOH (2008), where one million (11%) of the total TB cases are children less than 15 years of age. This may be due to the vaccine Bacille-Calmette-Guerin (BCG) given at infant age, which decreases the risk of getting the infection by 20% and the risk of infection turning in to disease by nearly 60%. The efficacy of the current TB vaccine BCG is consistent in protecting infants, especially from the most severe forms of meningeal and miliary TB (Mangtani *et al.*, 2014).

TB cases occur mainly among young adults (16-49 years) where around 6-8 million cases were in the economically most productive age group (Johnson and Ellner, 2000; Dye, 2006). The age group mainly affected is between 15 and 54 years (91.1%) in the study area, and this leads to grave socio-economic consequences in a country with a very high prevalence of the disease (FMOH, 2012). It affects mostly young adults in their most productive years living in the developing world (WHO, 2013). TB infection increases with age from infancy to early adult life, probably, because of increasing number and frequency of contacts to the causative agent.

#### **4.5 TB PATIENTS CO-INFECTED WITH HIV**

All patients registered in the five years in Motta town health care facilities were tested to know their HIV status by DOTS program. In the present study, all of the TB patients were tested and knew their HIV status and met the global target for TB patients to know their HIV status by

2015. This is also better than the 48% of TB patients attended DOTS service knowing their HIV status worldwide in 2013, and also 76% and 71% TB patients knowing their HIV status from Africa and Ethiopia, respectively (WHO,2014). On the other hand, this could be indicated that HIV screening practice was better in Amhara region and particularly in the study area. Moreover, it seems that there was better commitment from health professionals and local administrative bodies in terms of screening, communication and social mobilization. Among the 148 of TB/HIV co-infected patients, about (57.4%) of them were males; while about (42.6%) were females. This was inconsistency to nearly two-thirds of the HIV co-infected TB patients were females as reviewed by (Yetayh Wondimeneh *et al.*, 2012). One probable reason for patients highly vulnerable to TB/HIV in the study area, as a result of drinking traditional alcohol such as ‘Tella and Areqe’ in large amount which might be leads to exposed to unsafe sex particularly in this study area.

From 551 TB patients, 148(26.9%) were HIV co-infected. This results was not coincides with a study done at Nekemte town on evaluation of Millennium Development Goal for control of TB (2010/11– 2014/15) (Ajema, 2016), out of 1246 notified TB patients, 233 (18.7%) were HIV-infected. Global TB report (2015) was also showed that 11% of co-infection from 5.9 million men, 3.5 million women and 1 million children incident TB cases and recent national survey 20% (FMOH, 2013) was not highly comparable to this study. The prevalence of TB/HIV of the present study was not be exaggerated when compares to the rate of TB/HIV co-infection was 95% (270/284) among TB patients admitted to inpatient ward of Helen Joseph Referral Hospital in Johannesburg town in South Africa (John *et al.*, 2007). Similarly, the prevalence of TB/HIV co-infection was 43% in Africa and as high as 50–80 % in parts of sub-Saharan Africa in 2012 (USAID, 2015).

The prevalence of TB/HIV co-infection of this result was in consistent to the findings of other studies conducted in Oromia and Harari with 14.4% and 4.8% co-infection rate respectively. Surprisingly, the co-infection percentage of this study was agreed with the prevalence of TB/HIV of Amhara which was 26.5%. Among Ethiopian regional states, the highest proportion of people living with HIV/AIDS was seen in Amhara (FMOH, 2011). The proportions of TB/HIV co-infection were higher in the study area which might be indicated that the awareness of peoples on transmission and control mechanism of TB and HIV was low.

As to this research finding, the prevalence of TB/HIV co-infection revealed a decreasing trend from 2012 which was 21.6% to 16.9% in a year 2014 and then increased to 23% in 2016. This finding indicates that there was a significant association to 2012 WHO report on the trends of HIV among TB patients from 2004-2011 (WHO, 2012). Such fluctuation in years and minimal variation may indicate that the burden of the disease is still high in the study area that is, the transmission rate was not tackled as needed.

As to this study revealed that, the level of TB/HIV co-infection among extra pulmonary tuberculosis patients (48%) was almost equal to among pulmonary cases (52%). This was in contrast to previous studies documented with high prevalence of HIV among extra pulmonary tuberculosis patients. The risk of extra pulmonary tuberculosis increases with concurrent AIDS and tuberculosis. Extra pulmonary tuberculosis constitutes about 15% to 20% in immune competent tuberculosis patients and accounts for more than 50% of tuberculosis cases in HIV-positive individuals (Mohan and Sharma, 2004).

The proportion of HIV positivity was lower among smear-positive TB cases (19.6%) than those with smear-negative TB cases (32.4%) and extra pulmonary TB cases (48%) as indicated in (table 2). One probable justification for this could be the diagnosis of smear positive TB disease in HIV infected person is difficult, because patients with HIV associated TB have fewer bacilli in their sputum than do HIV uninfected patients with PTB (Brindle *et al.*, 1993). On the other hand, this might be due to the variation in the concentration of AFB in the sputum.

Table 2 Reported TB/HIV co-infections and treatment outcome among patients attending DOTS in YMH and MHC (2012-2016).

Characteristics	Year						p-value	
	2012, n(%)	2013,n(%)	2014,n(%)	2015,n(%)	2015,n(%)	Total		
Total new TB cases	152(27.6)	116(21.1)	100(18.10)	94(17.1)	89(16.2)	551(100%)	0.01 □	
Tested for HIV	152(27.6)	116(21.1)	100(18.1)	94(17.1)	89(16.2)	551(100%)		
HIV sero positive	32(21.1)	28(24.1)	25(25)	29(19.6)	34(23)	148(26.9)		
SPPTB	2(6.3)	16(21.4)	6(24)	6(20.7)	9(26.5)	29(19.6)		
SNPTB	12(37.5)	5(17.6)	9(36)	11(32.4)	11(32.4)	48(32.4)		
EPTB	18(56.2)	17(60.7)	10(40)	12(41.4)	14(41.1)	71(48)		
HIVsero negative	120(78.9)	88(75.9)	75(75)	65(69.1)	55(61.80)	403(73.1)		
SPPTB	30(25)	19(21.6)	18(24)	15(23.1)	11(20)	93(23.1)		
SNPTB	42(35)	32(36.4)	27(36)	22(33.8)	20(36.4)	143(35.5)		
EPTB	48(40)	37(42)	30(40)	27(41.5)	24(43.6)	167(41.4)		
Treatment outcome								0.013*
Success rate	128(84.2)	99(85.3)	93(93)	89(94.7)	87(97.8)	496(90)		
Died	7(4.6)	4(3.4)	1(1)	1(1.1)	0(0)	13(2.4)		
Lost follow-up	5(3.3)	4(3.4)	1(1)	1(1.1)	1(1.1)	12(2.2)		
Failure	3(2)	1(0.9)	2(2)	0(0)	0(0)	6(1.1)		
Transfer	9(5.9)	8(7)	3(3)	3(3.1)	1(1.1)	24(4.3)		

TB: tuberculosis, SPPTB: smear positive pulmonary tuberculosis, SNPTB: smear negative pulmonary tuberculosis, YMH: Yeshgaw Motta hospital, MHC: Motta health center, EPTB: extra pulmonary tuberculosis, n: number of people, %: percentage, \*: statistically significant, DOTS: directly observed treatment short-course.

#### 4.6 TREATMENT OUTCOME OF TB PATIENTS

The treatment outcome of TB patients attended DOTS service from 2012 up to 2016 in Motta town, 90% of the patients were successfully treated, whereas 2.4% of the patients died, 2.2% lost to follow the treatment, 1.1% treatment failure and 4.3% of the patients were transferred to other area. The treatment success rate among the years was showed an increasing trend 84% in 2012 to

97.8% in 2016 (table 2). The TSR of this study was significantly associated ( $p = 0.013$ ) as year increases.

This study showed that Motta town has achieved the treatment success rate of the global target before the dead line (85% by 2015). This TSR was significantly associated to the national treatment achievement (91%) of the country. To enhance the achievement of TSR, minimizing the number of deaths, loss to follow up and transfer out patients.

As this study revealed that, 2.4% death rate of Motta town which was slightly lower than 3% of death in Sidama zone of Southern Ethiopia (Mesay Hailu, *et al.*, 2014), 3.1% in Dabat district (Sebsibe Tadesse and Takele Tadesse, 2014) and 3.6% in Gambella, 4% in Addis Ababa and 3% of the national level in Ethiopia (Damete Demeke *et al.*, 2013). This may indicate that the proper care and treatment of health workers in Motta health care facilities.

## **5. CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 CONCLUSIONS**

This study showed that the proportion of male and female patients was 1.1:1 indicating presence of a gender difference in TB transmission among the sex. Even if the trend of reported TB cases decreased by 11.5% from 2012-2016; the problem was not highly diminished in Motta town and surroundings. The majority of the patients (91.2%) were in age group from 15 to 55 which was highly affected. This due to the degree of highly exposed to MTB, in turn this leads to economically and socially crisis of the country. But it does not mean that infants below age 15 and older persons above age 55 were not infected by TB. Even though, all TB patients were tested for HIV in this study area which achieved the global target of 2015, but 26.9% of patients were co-infected with HIV which was higher than national level (11%) of TB/HIV co-infection. The CDR of SPPTB of the present study which was far below to the national CDR (62%). This shows that the chance of transmission of SPPTB 5 to 10 times higher than SNPTB due to Poor quality and examination of a sub optimal number of sputum-smears. In this study, the TSR(90%) which was more comparable to national TSR(91%) and was slightly higher than 86% of in Africa.

## 5.2 RECOMENDATIONS

HIV screening in the study area was 100% effective. This should be continued in the future, too minimize the simultaneous infection of an individual by MTB and HIV.

Low reported TB cases in infants (2.7%) of this study area due to the vaccination of BCG could relieve and decrease the transmission of pediatric TB. Ethiopian researchers should be tried to create a modified and effective vaccine against all forms of TB that affect infants, adults and older persons.

To enhance CDR(39%) of the study area which far below WHO target, using of recent and sensitive diagnostic tools such as fluorescence microscope than light microscope, culture in liquid media and gene Xpert MTB/RIF are recommended.

The TSR of this study was 90%. To improve it more, the health care workers should be carefully advice and monitoring the patients about regular taking and swallowing anti-TB drugs. Such supervision is so vital to minimizing transfer out cases and to make it death rate nearest to nil.

Strengthening the implementation of the TB/HIV collaboration activity is so vital to overcome the persistently high TB/HIV co-infection (26.9%) transmission in the study area.

Eventually, similar studies should be conducted in other regions particularly in rural part of Ethiopia where the awareness of peoples to TB and TB/HIV is minimal.

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