ADDISABBABA UNIVERSITY

COLLEGE OF NATURAL SCIENCE

IMPACTS OF HIV CO-INFECTION AND MDR-TB ON THE TREATMENT OUTCOME OF TUBERCULOSIS IN PATIENTS WHO ATTENDED THE TWO SHAMBU HEALTH CENTERS IN 2010- 2015.

MSC THESIS SUBMITTED TO THE DEPARTMENT OF ZOOLOGY, SCHOOL OF GRADUATE STUDIES, ADDISABABA UNIVERSITY IN PARTIAL FULFILLMENT FOR THE DEGREE OF MASTERS OF SCIENCE IN BIOLOGY

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AUGUST, 2017.

Declaration

This study (thesis) is my original work done and has not been presented for degree in any University. All references materials (sources) used for this study have been duly acknowledged.

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Acknowledgement

Primarily, I would like to express my deepest gratitude and appreciation to my advisor, Dr.Fassil Assefa for his professional, consecutive deep advice, unreserved support and critical remarks from the time of preparation of the proposal to the completion of this thesis.

Besides to this, I would like also to express my heart-felt thank to the professional worker of Shambu Referral Hospital in the DOTs registry site especially Ato Mesfin Mosisa who deeply showed me co-cooperativeness in providing me recent related documents and available data.

Furthermore, I would like to extend my gratitude to Wollega University Campus ICT instructors, Shambu Secondary School administrators, Shambu Medium Clinic Health workers for their support in many valuable aspects in this paper work.

I also appreciate and would like to extend deep respect to my external examiner Mekuria Lakew (Dr.) for his final comment to make my thesis logical and acceptable. Finally, I owe especial respect to my wife w/o Bizunesh Dereje, for her encouragement to my graduate study and support and giving due attention for me.

ACRONYMS AND ABBREVIATIONS

AFB_ Acid Fast Bacilli Smear

AIDS_Acquired Immunity Deficiency Syndrome

ARVD_Antiretroviral Drugs

BCG_Bacilli Calmette Guerin

CXR. _Chest x-ray

CSIS _Center for Strategic and International Studies.

DOTS_Directly Observed Treatment Short Course

DR-TB_ Drug Resistant TB

DST _Drug Susceptible Testing

EPTB _ Extra Pulmonary Tuberculosis

EHNRI_Ethiopian Health Nutrition and Research Institution

FTTT_Fast-track treatment targets

FMOH _Federal Ministry of Health

GHE_Global Health Education

HF_Health Facility

HIV_Human immunity Virus

HSDP_Health Sector Development Program

MDR-TB_ Multi Drug Resistance Tuberculosis

MOHG/GHS_Ministry of Health of Ghana/Ghana Health Service

NTLCP_National Tuberculosis and Leprosy Control Problem

NAAT Nucleic Acid Amplification Test

OIS _ Opportunistic Infections

ORHB_Oromia Region Health Burea

RF_Rifampicin

PCR Polymerase Chain Reaction

PLHIV_People Living with HIV

PTB_Pulmonary Tuberculosis

SSM-Sputum Smear Microscopy

Sm^{+}PTB_ Sputum Positive Pulmonary Tuberculosis

Sm^{-}PTB_ Sputum Negative Pulmonary Tuberculosis

TB_Tuberculosis

TB/HIV_Tuberculosis and HIV Co-infections

TST_Tuberculin skin test

WHO_World Health Organization

XDR_TB-Extreme Drug Resistance Tuberculosis

Abstract

Tuberculosis (TB) is one of the major public health problems worldwide and typically attacks the lung. The disease has been later compounded with Multi-Drug Resistance TB (MDR-TB) and with a complex relationship between Human immunodeficiency virus (HIV) (TB/HIV co-infection. The problem is worse in Africa region, where our country is situated and the country is ranked 10th of the world's 22 high burden countries. In Oromia Regional State the Case Detection Rate and Treatment Success Rate was 37% and 83% respectively. However, there is little information about TB in ShambuWereda (Western Oromia). To this end a retrospective study was made using secondary data collected from TB patients attending DOTs Clinic Service at Shambu Health Centers between2010-2015. The result showed that out 1364 TB patients, 54.84% were males and 45.16% were females with male to female ratio of 1.2:1; with a case detection of 30% smear positive (SPTB), followed by 49% smear negative Pulmonary TB (SNTB), 21 % extra-pulmonary TB (EPTB), and 0.36% MDR-TB cases. Although TB affects all age groups, the highest prevalence of 33.65% of TB occurred in the age group of 11-30; followed by 30% infection of the age group of 31-50 indicating that TB affected more than 6o% of the most active age groups. The prevalence of total TB patients slightly varied from year to year ranging from 15% -17.8% over the years with an average prevalence of 16.8% a steady prevalence of total TB in all the years without showing a trend of decrease along the years in spite of DOTS interventions in the area as a function of time. The prevalence of TB/HIV co-infection amongst all TB patients registered and screened for the same at the DOTs clinic was 18.8% with similar pattern of male to female infection of 1.3:1and similar pattern of 11% infection of the active age groups. The average treatment success rate (TSR) of TB cases was 72% and did not meet the WHO international updated targets of 85% for the period 2011 to 2015. It is yet a formidable task to achieve the same in the area, under the circumstances, with a new post-2015 Global TB Strategy called-End TB Strategy between 2015 and 2035 unless a serious DOTS intervention plan is introduced.

Key words*: Case detection rate(CDR),Extra Pulmonary Tuberculosis(EPTB),Smear Positive TB(SPTB),Smear Negative TB(SNTB), Treatment success rate(TSR), TB/HIV co-infection, MultidrugResistanceTB(MDR-TB)*

1. INTRODUCTION

Tuberculosis is an infectious air borne disease that typically attacks the lung, but can also affect other parts of the body and has become a major global health problem. It is caused by by*Mycobacterium tuberculosis* and occasionally by *M.bovis, M.africunum* and *M.canetti* (MOHE, 2016). It is clinically diagnosed as pulmonary tuberculosis (PTB) and extra-pulmonary tuberculosis (EPTB), contributing to 80% and 20% of the TB infections, that patients suffer from them, respectively. The PTB is also categorized into smear positive TB that account for 75-80% of all PTB cases whereas 20-25% cases were smear negative PTB (Randal Reves,2016).It is estimated that one third of the world population was infected by *Mycobacterium* of which 10% of them are sick with active TB (Francis, 2014). It is one of the top 10 causes of death worldwide and the second leading cause of death due to an infectious disease (after AIDS). Consequently, 1.5millionTBmortality was recorded from more than 9 million TB cases, affecting the most disadvantaged social groups and low-income countries in 2014. It is the major problem of children in poor countries where it kills over 100,000 children each year (Francis V., 2014).

The problem of Tuberculosis has been compounded with HIV infection, for other opportunistic infections occur as a result of the interaction between HIV and TB (Global TB report, 2014). In fact the number of TB cases is increasing (5-10% per year) which consequently leads to an increase in the transmission of TB within the community (MOHE, 2016). Among 9 million new cases of TB, close to 3.6 million of them were HIV confected. Up to 81% of all TB patients are reported from 22 high burden countries (HBCs).Multiple Drug-resistant TB (MDR-TB) is one of the problems facing the world today. The occurrence of multiple drug resistance in the strains of *Mycobacterium tuberculosis* in Africa poses a problem in the control of TB in several countries of Africa, Asia, and Europe. Africa alone accounted for one third of all relapse cases and the same proportion of new smear positive cases in 2007 (Maher D., 2013)).

In 2008, an estimated 390,000 to 510,000 MDR-TB cases emerged globally (best estimate was 440,000 cases). Among incident TB cases globally, 3.7% of new cases and 20% of previously treated cases were implicated with (MDR-TB) and caused an estimated 150,000 deaths, (WHO, 2012). In Africa, data on MDR-TB is scarce. However, a total of 65,422 MDR-TB cases were

reported by 15 countries between 2007 and 2012 and the MDR-TB burden is significant in some regions, especially in South Africa (Global TB Report, 2014)

Global awareness for the control of TB has been strengthened in 1991 that necessitated a globally recommended TB control strategy known as Directly Observed treatment short course (DOTS) (WHO, 1994). Accordingly, the global plan for TB control targeted 70% successful case detection rate and 85% of cure to eliminate TB as a public health problem by the year 2015. Thereafter, Ethio*p*ia adopted it in 1992 as a standardized and well organized TB program. The STOP TB partnership that had been established in 2000 as a global and political action to stop the spread of TB around the world (Stop TB partnership, 2000).The programs were subsequently endorsed by the WHO STOP TB Strategy in 2006 (FMHE, 2008). In spite of all these efforts, eight to nine million new cases emerged each year, and approximately 100.000 people die from the disease each year between 2000 and 2010 (WHO,2014).

The partnership's goal is to eliminate TB as a public health problem, and to secure a world free of TB. This strategy was developed by WHO and designed to guide tuberculosis control efforts during 2006 to 2015. Consequently, a new post Global TB strategy called 'end TB strategy' has been recently introduced (WHO, 2016). This strategy aims to end the global TB epidemic, with targets to reduce TB deaths by 95% and to cut new cases by 90% between 2015 and 2035, and to ensure that no family is burdened with catastrophic expenses due to TB.

1.1. Statement of the Problem

In Ethiopia, Tuberculosis has been a major public health problem since 1950s. In the context of global TB in 2014, WHO estimated that there were 200,000 new TB cases and the country ranked the 10^{th} of the world's 22 high burden counties for TB, and second after Nigeria in Sub-Saharan Africa (Global TB Report 2016). The Global TB report also revealed that Ethiopia is one of the highly affected countries by the HIV co-epidemic and is among the 41 high TB/HIV co-infected countries in the world.

Likewise, in Ethiopia, MDR-TB has been reported since 1996. A nationwide drug resistance surveillance project was under taken from 2003-2006 and showed 1.7% and 11.8%MDR-TB cases in new and previously treated cases, respectively (Kebede Worku, 2016). Thus, TB and

HIV co-infection, and MDR-TB are becoming constraints for patients and a heavy burden for the healthcare system, and additional problems in the control of TB in the country.

For many years now, different efforts have been initiated to put TB under control. After the introduction of the concept of National TB Control Program by the World Health Organization, the Ethiopian Ministry of Health (MOHE) adopted the concept and subsequently established National TB Control Program in 1976 **(**MOHE,2001**)** . In 1992 the country has adopted a standardized and well organized TB program, incorporating Directly Observed Treatment Short-course (DOTS), and begun implementing in few areas of the country, which has now reached a geographical coverage of 71% of the entire country and internationally recommended Tuberculosis control strategy developed in the mid-1994 (MOHE ,2001 and 2016).

Ethiopia has claimed to have achieved the millennium development goals for TB in 2015 and now adopted new post Global TB strategy called 'end TB strategy'. This strategy aims to end the global TB epidemic, with targets to reduce TB deaths by 95% and to cut new cases by 90% between 2015 and 2035, and to ensure that no family is burdened with catastrophic expenses due to TB (WHO, 2016).

Although the country claimed to have achieved the millennium development goals for TB in 2015 and now adopted new post Global TB strategy called 'end TB strategy' (MOHE, 2016), the country is yet among the 30 high TB, HIV and DR-TB burden countries, that accounted for 80% of all estimated TB cases worldwide, with annual TB incidence of 207/100, 000 populations and death rate of 3.3 per 100,000 populations for 2014 (Global TB report, 2014).

TB is one of the major diseases affecting the population in Oromia Regional State. All strategic plans of the country have been introduced in the Region. Accordingly, Shambu Wereda Horo-Guduru Wollega Zone has been a beneficiary of programs such as DOTs. However, there is limited information regarding the prevalence of pulmonary TB, TB/HIV co-infection and the existence of drug-resistance TB in the wereda and its status in relation to the national strategy of TB control. These, therefore, necessitated the assessment on the control and diagnosis targets of TB in DOTS at Shambu area in relation to the national projection of reducing or stop the prevalence of TB, PTB/HIV co-infection by the year 2015.

1.2 Research Questions

To analyze this, the research questions were:

- What was the prevalence of pulmonary tuberculosis, TB/HIV co-infection as a function of time?
- What was the prevalence of Tuberculosis, TB/HIV co-infection and MDR-TB among different age groups, sex of TB patients that attended DOTS program at the study site?
- What proportion of TB patients registered at DOTS service has known their HIV status?
- What case detection rate and treatment success rate were achieved among patients according to DOTS strategy?
- What did the trend look like for the burden of TB, TB/HIV Co-infection and MDR-TB? Increase or decrease over the years in relation to the Regional and National DOTS Strategy (2010-2015)?

1.3 Research Objectives

1.3.1 General objective

The general objective of the study was to assess the prevalence of Pulmonary tuberculosis and co-infection with HIV/AIDS, and the impact of Drug-Resistant Tuberculosis on treatment success rate based on secondary data from TB outpatients attended and registered with DOTS strategy (program) at Shambu Referral Hospital and other one health center service for six years (2010-2015).

1.3.2 Specific Objectives

The specific objectives were:

- To determine the prevalence of TB cases by sex and age categories
- To assess the associated risk factor of pulmonary tuberculosis that leads to weakening the immune system among patients (PTB/HIV) attended DOTS service at the study area.

- To determine the prevalence of PTB/HIV co-infection.
- To assess case detection rate for Smear Positive TB and treatment outcome especially treatment success rate of PTB patients in relation to DR-TB.

1.4 Limitations

The study was limited to secondary data produced by the technicians of the health centers and the write up of the thesis was done in short period of time.

1.5 Significance of the study

The study will serve as the base line data to estimate the prevalence of TB; whether it was constant, ascending, or descending for the last ten years in relation to efforts for TB control in the study area, and fulfilled the goals of the national and regional global stop target of 2015. The study also serve as a source for information and as a starter for other researchers who want to assess similar study based on primary data in the area and as a reference material for comparison with other similar works in the country.

2. REVIEW OF LITERATURE

2.1 Tuberculosis

Tuberculosis is a chronic infectious disease caused by members of the genus *Mycobacterium.* It includes the obligate pathogens *M.tubercculosis, M.bovis, M. africunum and M.canetti* and the opportunistic pathogens; *M.avium*-intracellular complex (MAC), *M.kansassi, M.simiae*and *M.fortuitum*. In most cases pulmonary and extra pulmonary disease is caused by M. tuberculosis and occasionally it can also be caused by *M.bovis, M.africunum* and *M.canetti* (MOHE, 2016).

M. tuberculosis is an acid fast bacillus (AFB), a rod shaped bacillus 0.8-5 micrometer in length and 0.2-0.6 micrometer in thickness, having a waxy cell wall due to its high lipid content, which is killed by direct sun light, by boiling, and pasteurization but which persist for several days to months in a dark area. The bacilli appear red in color, straight or curved scattered in a single or groups.

Tuberculosis is a disease with diverse clinical manifestation which can be either Pulmonary tuberculosis(PTB) that accounts for 80% of all TB cases (smear-positive PTB, comprises 75-80% of all PTB cases and smear-negative PTB, that comprises 20-25% of all PTB cases) or Extra Pulmonary tuberculosis(EPTB) that comprises 20 %of all TB cases(WHO,2014).

2.2 Epidemiology

Tuberculosis is a major global public health problem throughout the world. It causes illness among millions of people each year and is ranked as the second leading cause of death from an infectious disease worldwide (Nayoma M., 2013). Nearly one-third of the world's population is infected with tubercle bacilli and hence at risk of developing active disease. About 8.8 million people develop active TB every year and 2 million die.

It accounts for 2.5% of the global burden of disease, for 26% of preventable deaths and is a leading infectious cause of death among young children (EHNRI,2009).Among the 22 high TB affected countries in the world nine are in Africa of which Ethiopia ranks 8th.According to WHO (2013), there have been 9 million new TB cases and 1.5 million TB deaths (1.1 million among HIV-negative people and 0.4 million HIV-positive people.

The proportion of TB cases co-infected with HIV is higher in countries in the Africa region, 79%.the proportion of new cases with multidrug-resistant TB (MDR-TB) was 3.5% in 2013 (WHO,2013).Of the estimated 9 million people who developed TB in 2013, 56% were in South-East Asia and Western Pacific Regions. Indians and China alone accounted for 24% and 11% of total cases respectively. About 60% of TB cases and deaths occur among men, but the burden of disease among women is also high. In 2013, an estimated 510,000 women died as a result of TB, more than one-third of whom were HIV positive. An estimated 1.1% million (13%) of the 9 million people who developed TB in 2013 were HIV positive

Ethiopia is one of the 22 high burden tuberculosis countries that account for more than 80% of total global cases to tuberculosis level since 2000.Moreover, Ethiopia is one of the 27 MDR-TB high burden countries,(WHO, 2013).Compounded with HIV/AIDS, TB has become a formidable threat to the country. The burden of TB in Ethiopia is estimated at 168 new smear-positive cases per 100,000 population according to the World Health Organization global TB report 2008 (WHO,2008). There has been a successful fight against TB/HIV to enable all people living with HIV/AIDS benefit from packages of TB diagnosis and care including counseling, testing and subsequent services,(FMHE, 2008**).**

2.3 Pathogenesis and Transmission

Tuberculosis is mainly transmitted by inhalation of infections droplets produced by persons with pulmonary or laryngeal tuberculosis (Kenneth and Rothman, 1998) and/or person-to-person by infected droplet nuclei, which are expelled in to the air when an untreated infections of PTB patients coughs or sneezes and discharges the bacilli..

Figure 1Illustration of the release of droplets during coughing (left) and how transmitted to another person during inhalation of droplets (Right).

Two factors determine an individual's risk of factors: the concentration of droplet nuclei in contaminated air and the length of time spent breathing that air. The risk infection of a susceptible individual is therefore high with close, prolonged, indoor exposure to a person with a sputum smear-positive PTB.

The *Mycobacteria* enter the host by air, and once in the lungs, are phagocitized by macrophages. A large number of different virulence factors have evolved in MBTC members as a response to the host immune reaction (virulence htm).Among the unique features of this organism is its slow growth and ability to establish persistent infection, requiring prolonged antibiotic treatment in order to achieve clinical cure (Anastasia,S.,2009)

MBTC species have evolved several mechanisms to circumvent the hostile environment of the microphage, such as inhibiting phagosome –lysosome fusion and to escape acidic environments inside the phagosome. MBTs can prevent both the fusion of a phagosome with a lysosome and the proper acidification of digestive enzymes. The microbes then multiply within the phagocyte, almost completely filling it. In most cases, the phagocytes dies and the microbes are released by autolysis to infect other cells. Concomitantly, virulent MBTs had enveloped strategies to avoid or modulate the immune response in their favor (Tortora, 2010).

Tuberculosis affects individual of all ages and both sexes. There are, however, groups, which are more vulnerable to develop the disease: Poverty, malnutrition and overcrowded living conditions have been known for decades to increase the risk of developing the disease HIV infection has been identified as a major risk factor for developing tuberculosis. The age group mainly affected is between 15 and 54 years (Kebede Worku,2016).

2.4 Impact of HIV on Tuberculosis

Globally, 34 million people are living with HIV infection currently and at least 1.8 million people died from AIDS in 2009 and there were 0.4 million deaths resulting from TB disease among people living with HIV in 2015. (GHE,2017). In Sub-Saharan Africa, where the majority of new HIV infections continue to occur, an estimated 1.8 million people became infected in 2009. Among there an estimated 1.3 million people died of HIV related illness which makes markedly different regions of the world. People, who have both TB and HIV when they die, are internationally classified as having died from HIV in TB /HIV co-infection. In Ethiopia, with an estimated 1.1million people living with HIV, has one of the largest populations of HIV infected people in the world. Adult HIV prevalence in 2009 was estimated to be between 1.4% and 2.8 percent.

Infections with HIV destroy the immune defense mechanism of the body and are therefore an important risk factor for the development of TB. In non HIV infected persons, the risk of development from latent infections to disease is 10% during the entire lifetime of that person. In HIV-infected persons the risk of developing TB is much higher (10 times compared to an individual who is not infected with HIV, (MOHE, 2001).Tuberculosis occurs in the early stages of HIV infection, often before other opportunistic infections occur as a result of the interaction between HIV and TB ,the number of TB, cases is increasing (5-10% per year) which consequently leads to an increase in the transmission of TB within the community ,(EHNRI,2009).In Ethiopia, among TB patients tested for HIV, in 2000,15% were HIV positives.HIV also increases the likely hood of re-infections and relapses of Tuberculosis(Fest stein F.,1999). Generally, Tuberculosis is an obstacle to Socio-economic development; 75% of people affected by TB are within the economically productive age group of 15-54 years. The HIV epidemic worsened the TB situation by, (MOHE, 2016).

2.5 TB and HIV co-infection

In Africa, the total population is 989,000,000. According to the WHO TB statistics estimate for 2015, the total TB individuals were 2,720,000 (GHE, 2017).Furthermore, mortality due to HIV negatives TB and HIV were 450,000 and 300,000, respectively. In this Report, 834,000 HIV^{+} individuals were registered.

Ethiopia is one of the highly affected countries by the HIV co-epidemic. TB and HIV co-infection is an additional problem in the control of TB in the county whereby 10-15% of TB patients were found to have HIV co-infection every year (FMOHE, 2016).

The WHO Global Report 2008 estimates that in Ethiopia 40% of TB patients tested for HIV are HIV positive. The most common manifestation of tuberculosis in adults infected with HIV is Pulmonary Tuberculosis, which occurs at various stages of HIV infection. As it is reported by Federal Ministry of Health of Ethiopia, 2008, the Human Immunodeficiency Virus (HIV) pandemic presents a massive challenge to the control of tuberculosis. The synergy between TB and HIV/AIDS is strong: in high HIV prevalence populations, TB is a leading cause of morbidity and mortality, and HIV is fueling the Tuberculosis epidemic in Ethiopia.

HIV increases a susceptibility to infection with *M.tuberculosis*, the risk of progression to TB disease, and the incidence and prevalence of TB. It also increases the likely hood of re-infections and relapse of TB. Latent TB-infection in HIV-positive persons reactivates at a rate of 10% per year (as opposed to 5%-10% over a life time for HIV-negative persons, (FMHE, 2008).

It worth remembering that there is a TB/HIV link where the latter is the strongest risk factor for progression from latent to active TB (reactivation), sero-prevalence , modifies the clinical, radiological and lab. Findings as, TB allow HIV to multiply more quickly increasing the viral load which may result in fastened rate of HIV disease progression, (ORHB, 2014).

2.6 Epidemiology evidence of MDR-TB in Ethiopia

Drug resistant tuberculosis is a man made problem. The emergence of Drug Resistant TB in an individual could be microbial, clinical and programmatic. However, largely being the consequence of human error following an inadequate or improper administered treatment which is further exacerbated by human immunodeficiency virus (HIV)(WHO,2013). Multidrug resistant tuberculosis (MDR-TB) has become a major public health problem and presents new barriers to the control of TB, (WHO, 2013). The emergence of MDR-TB is defined as resistance to the first line drugs isoniazed and rifampicin. Inadequate and incomplete treatments lead to a newer form of drug resistance.

According to the first DRS survey conducted in 2003-2005, the MDR-TB prevalence of 2.3% among new cases and 7.8% among previously treated cases, which indicates increasing trends in TB drugs resistance burden,(National DR-TB Sentinel Report ,2013). Nearly half a million cases of MDR-TB emerge every year, but only 3%of them get treatment. Consequently, 150,000 die annually (WHO, 2010).Globally, due to MDR-TB, 450,000 new cases and 170,000 deaths occur in 2012(WHO, 2013).The incidence of MDR-TB strains is a continuing challenge to the TB control program.

In Africa, between 2007 and 2012 a total of 65,422 MDR-TB cases were reported from 15 countries of which South Africa contributed to 87.9% of the African burden of MDR-TB (TLCP, 2012). The current WHO estimate of MDR-TB prevalence among all cases in South Africa is 15,419(WHO, 2013). In Ethiopia, the first national surveillance data during the 2003-2005 study periods showed 1.5% MDR-TB (Jango and Demeke,*et al*.,(2013). Likewise, a total of 1144 MDR-TB cases were reported between 2007-and 2012(WHO, 2013). After falling from 145 to 130 in 2008, it rose to 284 in 2012, indicating a proportional increase of MDR-TB with time. Among the TB cases in 2014, 1300 (1.6%) of new cases and 11.8% of previously treated TB cases were estimated to harbor DR-TB (Yaregal Z.2014 and MOHE, 2016). In general, the country is among the 30 high TB, HIV and DR-TB burden countries, that accounted for 80% of all estimated TB cases worldwide, with annual TB incidence of 207/100, 000 populations and death rate of 3.3 per 100,000 populations for 2014(M0H,2016). The appearance and spread of drug-resistant TB strains in new and previously treated cases also worsens the TB problem in Ethiopia **(**WHO, 2010).

The value for the estimated number of TB cases in Ethiopia has varied between 431 in 1998 and 247 in 2012 and its highest TB case detection rate and TB treatment success rate was observed in 2011.Likewise, TB case notifications also increased over the years and reached their highest level in 2011. The appearance and spread of drug-resistant TB strains in new and previously treated cases worsens the TB problem in Ethiopia,(WHO,2010). In Ethiopia, a total of 1144 MDR-TB cases were reported between 2007-and 2012, WHO (2013).After falling from 145 to 130 in 2008; it rose to 284 in 2012, indicating a proportional increase of MDR-TB with time. Accordingly, the proportion of MDR-TB among all TB cases varies from place to place (Lemma E., *et al*., 2013).

In Addis Ababa 12%MDR-TB cases reported (Abate G. and Miomer H., 1998).Another report on northwest Ethiopia showed a higher rate at 5% of MDR-TB patients (Tesema B., *et al*., 2012**).**MDR-TB in all of the reported studies indicate the spread of MDR-TB strains and that the local control measures for the prevention of this deadly disease facilities for early case detection and treatment of MDR-TB are unsatisfactory (Biadgeligne,*et al.,* 2014).

2.7 Clinical Manifestation of Tuberculosis

Tuberculosis is a disease with diverse clinical manifestation. Smear-positive PTB comprises 75-80% of all PTB cases while Smear-negative PTB comprises 20-25% of all PTB case,(MOHE,2001).This shows that, TB is most commonly the result of involvement of the lungs (more than 80% of cases).However, organ specific presentations may be seen, most commonly lymph nodes, pleura, spine ,joints, genitourinary tract, nervous system or abdomen(National TB, Leprosy and TB/HIV Training Manual, 2016).

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2.7.1 Pulmonary Tuberculosis

Pulmonary Tuberculosis refers to any bacteriologic ally confirmed or clinically diagnosed case of TB involving the lung parenchyma or trachea bronchial tree and it accounts for 80% of all TB cases(MoHE,2016).Once a person develops the disease, there will be several suggestive clinical features, especially 2 weeks or above duration of cough, sputum production and weight loss are important for the diagnosis of PTB. Other respiratory symptoms like chest pain, Haemoptysis , breathlessness and/or constitutional symptoms like fever, night sweats, tiredness, loss of appetite can also occur (WHO,2004) .However, cough might not be the predominant presentation for people living with HIV, young children, and severely malnourished. Some patients may present coughing up sputum or blood and/or localized wheeze due to local Tuberculosis bronchitis (National TB, Leprosy and TB/HIV Training Manual, 2016**).**

2.7.2 Extra Pulmonary Tuberculosis

Globally, there were 8.6 million new TB cases in 2012, and an estimated 1 million people developed EPTB. In Africa, the proportion of EPTB infection was reported as 17.7% by the year 2013.In Ethiopia, 32.5% EPTB proportion was reported by the year 2012 among the total TB cases (Alemu Fanosie.2016).

EPTB refers to any bacteriologicaly confirmed or clinically diagnosed case of TB involving organs other than the lungs (pleura, lymph nodes, abdomen, genitourinary tract, skin, joints and bones meninges,(National TB, Leprosy and TB /HIV Training Manual,2016). EPTB contributes to 20-30% of all TB cases.Lymphtic system and pleural membrane involvement constituent around 60% of all EPTB cases. EPTB involvement is more commonly seen in HIV patients with advanced immune-suppression and young children. There is no standard protocol to diagnose TB in organs other than the lung (MOHE, 2016).

In EPTB, patients may present with non specific symptoms (unintentional weight loss, night sweats, and fever for more than 2 weeks. Other symptoms depend on the site or organ affected. The most common types of EPTB are lymphadenitis, pleural effusion, bones (most commonly affects the vertebral column, milary TB, and central system.

2.7.3 Latent TB Infection

LTBI is a state of persistent immune response to stimulation by Mycobacterium tuberculosis antigens without evidence of clinically manifested active TB. One- third of the world's population is estimated to have latent TB infection (LTBI**), (**WHO, 2016).

According to National TB, Leprosy and TB/HIV Training Manual (2016), thegreat majority (90-95%) of persons infected with Mycobacterium tuberculosis, the immunological defense either kills or keeps them suppressed the inhaled bacilli. Only 5-10% of such infected persons develop active disease. Following primary infection, rapid progression to disease is more common in children less than 5 years of age. Patients with HIV infection, are at greater risk of developing TB disease.HIV positive people with latent TB infection have a 10% annual and 50% life time of developing active TB disease,

2.7.4 Active Tuberculosis

Active TB disease arises from progression of the primary process a continuous within a year or so after infection or from endogenous reactivation of latent foci, which remained dormant since the initial infection or exogenous re-infection. Post primary TB usually affects the lungs (more than 85%) but can involve any part of the body (MOHE, 2016).

3. Diagnosis of Drug Sensitive Tuberculosis

3.1 AFB Smear microscopy and Culture

All suspects of any form of TB must be examined according to the standardized diagnostic procedures of which the microscopic examination of sputum is the most important and reliable. (TB and Leprosy Prevention and Control Programme Manual, 2001).

Early detection of the cases and prompt treatment are crucial for TB control. TB diagnosis mainly depends on the clinical presentation of the disease and identification of the offending bacilli. Many TB diagnostic tests are available although no single diagnostic test for TB exits that can be performed rapidly, simply inexpensively, and accurately as a standalone test. Thus, the diagnosis of active TB is a clinical exercise, and sputum microscopy remains the main stay of diagnosis because of its availability, operational feasibility and ability to identify the highly infectious forms of TB, the smear-positive PTB case (Hershfield, 2007).

For pulmonary tuberculosis,sputum is the most critical sample for laboratory testing.The diagnosis of PTB in adult is mainly done by collecting a sputum sample.Conventional light microscopy of Ziehl-Neelsen-stained smears prepared directly from sputum specimens is the most widely available test for diagnosing TB in resource-limited settings.Ziehl-Neelsn microscopy is highly specific,but its sensitivity is variable(20%-80%).Convectional fluorescence microscopy is more sensitive(10%)than the Ziehl-Neelsen and takes less time,but it is limited by the high cost of Mercuric vapour light sources, the need for regular maintenance, and the dark room requirement(Yon Ju Ryu,M.D,2015).

Due to the nature of waxy coat of Mycobacterium cell wall,M.tuberculosis retains a dye known as Carbolfuchsin even after decolrization with acid and alcohol; they are named Acid Fast Bacilli(AFB).This characteristics enables us to detect them by microscopy.

For acid fast staining, the two commonly used procedures are: Carbolfuchsin method that include Ziel-Neelsen method(light microscopy) and Floro chrome procedure using auramine-rhodamine dyes(Flouroscent microscope).

Mycrobacteria, which do not stain well by Gram stain, are stained with Carbolfuchsin combined with phenol. In the ZN-technique, the phenol-Carbolfuchsin stain is heated to enable the dye to penetrate the waxy Mycobacterial cell wall. Reagents required in ZN-staining procedure are: Carbolfuchsin stain, Acid alcohol 3% VV,Malachite green 5g/l,or Methylene blue 5g/l

Detection:Ziehl-Neelson acid fast staining detection procedure

1. Pipet 10 µl MTB/BCG culture on a glass microscope slide and heat on top of a Bunsen flame until it is completely dry to fix the bacteria.

2. Flood the slide with the Carbol fuchsin stain (BD kit reagent A).

3. Heat the slide gently until it steams (5 minutes).

4. Pour off the carbol fuchsin.

5. Wash slide thoroughly with tab water (5 minutes).

6. Decolorize with acid-alcohol (5 minutes).

7. Wash slide thoroughly with tab water (5 minutes).

8. Flood the slide with methylene blue (BD kit reagent B) counter stain (1 minute).

9. Wash with tap water.

10. Blot excess water and dry in hand over Bunsen flame.

11.The slide is now ready to observe under a standard light microscope.

That means, using Oil Objective Immersion Objective lens (100X), examine the smear microscopically. Acid Fast Bacillus seen as red, straight on slightly curved rods, occurring singly or in small groups with background appearing as blue for Methylene blue or green for Malachite stain (Acharya T., 2013).

Generally, smear microscopy uses two staining methods: Ziel-Neelsen staining (ZN) or fluorescent auramine staining (10% more sensitive than ZN).In microscopic examination of sputum smears, three sputum specimens must be collected and examined in two consecutive days, as a result PTB+ is confirmed when there are at least 2 AFB positive smear results, (TB and Leprosy Prevention and control programme Manual, 2016).But, The diagnosis of smear negative PTB primarily relies on patients' response to broad spectrum antibiotics and Chest Radio graphic evidences(Tesfaye W., *et al.*,2005).For this reason, the diagnostic capacity for TB in the country remains a challenge to improving case detection rates.

Cultureis a complex and sophisticated tool for bacteriological confirmatory test for MTB and is highly sensitive technique that can detect 10-100 viable bacilli per ml of sputum in specialized laboratories for patients with PTB and EPTB and is important in the nationwide surveillance of drug resistance (FMOHE, 2009).

Pathology plays a complementary role in confirming the diagnosis of TB. Multiplication of tubercle bacilli in any site of the human body causes a specific type of inflammation, with formation of characteristic granuloma that can be found on histo-pathological examination. Due to the scarcity of facilities, this procedure is not routinely practiced, but Chest X-ray Radiological Examinations a rapid and convenient method to evaluate patients who cannot produce sputum or who have negative results from bacteriological tests, and to diagnose extra PTB.As it is indicated in TB and Leprosy Prevention and Control Program me Manual (2016), it is a major error to diagnose TB on X-ray findings and omit examining the sputum.

Ultra sonography studies can be used as a supplementary investigation in the diagnosis in the diagnosis of EPTB particularly abdominal and pericardial TB.

Methods for the diagnosis of tuberculosis have been improved in recent years, and several molecular techniques have been introduced for clinical use:

DNA and RNA amplification method:-This method have been shown to be sensitive and specific for rapid detection of Mycobacterium tuberculosis in sputum and other body fluid samples(Schluger, *et al.*,2005).This methods provides several advantages over culture, including confirmation of the presence of *M.tuberculosis* within 1-3 days compared with 2 to 6 weeks with culture techniques. The use of DNA amplification for detection of *M.tuberculosis*

in formalin-fixed, paraffin-embedded tissue samples would be useful for patients in whom diagnosis depends on tissue examination rather than detection of *M.tuberculosis* in body secretions(Chin D.R.,*et al* (2009).Compared with AFB Smear microscopy, the added value of nucleic acid testing lies in its grater positive predictive value >95% with its ability to rapidly confirm the presence of *M.tuberculosis* in 50%-80% of AFB Smear negative, culture positive specimens. Compared with culture, NAA tests can detect the presence of *M.tuberculosis* bacteria in a specimen weeks before culture for 80%-90% of patients suspected to have PTB whose TB is ultimately confirmed by culture (WHO Global TB Report, 2014).

Polymerase Chain Reaction (PCR) method:

- PCR is an alternative method for diagnosis of PTB among HIV positive and HIV negative individuals besides the culture with the advantage of a rapid, sensitive detection and simultaneous identification of Mycobacterium tuberculosis in tissue specimens, but the disadvantage of a higher cost. The technique is advantageous when compared with conventional methods for the diagnosis of smear negative PTB (James A., 1998).
- The PCR technique can reduce the diagnosis time and may increase the detection of *Mycobacteria* in smear negative TB.
- PCR amplification of *M.tuberculosis* methodology can detect *M.tuberculosis* in tissue samples even though the tissue has been preserved in Formalin or other substance that preclude the possibility of culture. However, variations in procedures for in-house PCR could explain the wide variability of sensitivity and specificity reported in several studies (Assis N.C.S, 2007).

3.1 Diagnosis of Multi drug-resistant Tuberculosis

Drug Resistant tuberculosis is a man made problem and is caused by organisms that are resistant to the most effective anti TB drugs (JCDR, 2015).It results from either infection with organisms which are already drug-resistant or may develop in the course of patient's treatment. (Amina J., 2004, and WHO, 2013).

Early diagnosis is vital for DR-TB patients. A delayed diagnosis can result in progressive lung destruction, higher bacillary loads, a worsening clinical condition and ongoing transmission. Late diagnosis of DR-TB results in lower treatment success and failure rates (Mukherjee,*et al.*, 2004).Drug- Resistant TB is a laboratory diagnosis. This means the diagnosis of MDR-TB is made only by reference laboratories performing culture of TB strains, with additional testing of anti TB drug sensitivity (DST: Drug Sensitivity Test) (FMHE, 2008).

4. Treatment

4.1 Latent TB Treatment

Treatment of latent TB infection benefits those population groups known to have higher risk of progression to active TB if infected. Isoniazed Preventive Therapy (IPT) is given to individuals with latent infection with *M.Tuberculosis* in order to sterilize the infection and hence, prevent progression to active disease and resulting in a substantial benefit for both the individual and the community. Screenings for exclusion of active TB in HIV infected persons is the single most important step that should precede the decision to initiate IPT (National TB, Leprosy and TB/HIV Training Manual, 2016).

Currently available treatment options allow reducing by at least 60% the risk of developing active TB. Regimens recommended for the treatment of LTBI ,using one medicine to kill the TB,are:6-month or 9-month isoniazed daily,3-month rifapentine plus isoniazed weekly,3-or 4-month isoniazed plus rifampicin daily or 3-or 4-month rifampicin alone daily (WHO,2016).

Latent TB infection lasts for a short time or many years. The standard treatment of active TB begins with four medicines given for 2 months, continuing treatment for 4 to 9 months or longer if needed, using Directly Observed Therapy (DOT) and using different treatment programs for people infected with HIV, People infected with TB bacteria that are resistant to one or more medicines, pregnant women and children (WHO, 2016).

5. Tuberculosis Strategies

5.1 The DOTs Strategy

As indicated in Manual of Tuberculosis and Leprosy prevention and control program of Ethiopia (2016) tuberculosis has long been recognized as a major public health problems since the 1950s and declared as a Global Emergency Disease in 1953. It needs globally recommended TB control strategy. The global plan for TB control is to eliminate TB as a public health problem. In Ethio*p*ia, it was in 1992 that a standardized and well organized TB program, incorporating Directly Observed treatment short course (DOTS) was introduced.

It has been implemented in few areas of the country, which has now reached a geographical coverage of 71% of the entire country and internationally recommended Tuberculosis control strategy developed in the mid-1994 (MOHE, 2001). Directly Observed Treatment Short – course is a proven, cost effective strategy recommended by World Health Organization for countries with limited resources(EHNRI,2009) Because, DOTS strategy is a comprehensive strategy which insures cure to majority of tuberculosis patients presenting to primary health care services.

5.2 Stop TB Strategy

The STOP TB partnership was established in 2000 as a global and political action to stop the spread of TB around the world. The partnership's goal is to eliminate TB as a public health problem, and to secure a world free of TB (Stop TB partnership, 2000). This strategy was developed by WHO, designed to guide tuberculosis control efforts during 2006 to 2015.It built on DOTS strategy. Nearly 92% of Hospitals and 95% of health centers implemented DOTS – Based Services in 2011.

Global plan To Stop TB 2011-2015 sets targets to screen 20% of all new bacteriologic ally-positive TB cases and all previously treated cases with DST for at least rifampicin and isoniazed, and planned to perform DST for all patients with MDR-TB. In Ethiopia DST was performed for 469(<1%) new and 180(4%) retreatment TB cases, respectively (KebedeWorku, 2016).

In addition, TB treatment follow-up under DOTS was given in 2100 health parts across the country. Overall, there are 4577 public DOTS facilities and 317public private mix DOTS facilities. MDR-TB has been identified as a priority public health problem. A total of 218 patients have begun MDR-TB treatment in hospitals in Addis Ababa (HSDP IV, 2011).The DOTS strategy has six major components:

1. Pursuing high quality DOTS Expansion and enhancement, which needs political commitment
2. Addressing TB/HIV, MDR-TB and other challenges;
3. Contributing to health system strengthening (HSS)
4. Engaging all care providers
5. Empowering people with TB and communities, and
6. Enabling and promoting research.

This strategy aimed to end the global TB epidemic, with targets to reduce TB deaths by 95% and to cut new cases by 90% between 2015 and 2035, and to ensure that no family is burdened with catastrophic expenses due to TB(WHO,2015). Ethiopia claimed to have achieved the millennium development goals for TB in 2015 and now adopted new post Global TB strategy called 'end TB strategy'.

6. Definition of Operational Terms

- TB Prevalence: the number of people in the population who are living with active TB (GHE, 2017).
- Case Detection (CD): the activity of identifying active tuberculosis cases through sputum examination.
- Case Detection Rate (CDR**)-** The percentage of smear positive TB cases detected among the total number of TB cases estimated to occur. In context of this research it is concerned to smear positive pulmonary TB.
- DOTS(Directly Observed Therapy- Short course):is the 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.

- Extra Pulmonary Tuberculosis (ETB):Refers to any bacteriologic ally confirmed or clinically diagnosed case of TB involving organs other than the lungs.
- HIV-Positive TB patient**:** any bacteriologic ally confirmed or clinically diagnosed TB case that has a positive result from HIV testing conducted at the time of TB diagnosis.
- Multi Drug Resistance (MDR-R): Resistant to at least both isoniazed and Rifampicin.
- New TB Cases: A patient who has never had treatment for TB or has been on anti-TB drugs for less than 4 weeks.
- Previously Treated TB Cases**:** Refers to the patients that have received 1 month or more of anti-TB drugs in the past.
- Pulmonary Tuberculosis (PTB): Refers to any bacteriologic ally confirmed or clinically diagnosed case of TB involving the lung parenchyma or the tracheobronchial type.
- Smear Negative Pulmonary Tuberculosis (Clinically diagnosed TB case**):** 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.
- Smear Positive Pulmonary Tuberculosis(Bacteriologic ally confirmed TB **case)**:a patient with at least two sputum specimens which are positive for acid fast bacilli (AFB)by microscopy, or a patient with one sputum specimen positive for AFB by microscopy, and chest radiographic abnormalities consistent with active pulmonary TB.
- Treatment Outcome Variables**:**
- Completed Treatment- a TB patient who completed treatment without evidence of failure but with no record to show that sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either between tests were not done.
- Cured- a pulmonary TB patient with bacteriological confirmed TB(if his/her smear/culture was positive at the onset of treatment and have completed a full course of anti-tuberculosis chemotrapy and their smear is smear negative at 5 or more months of treatment and at the end of treatment.

- Lost to Follow up – a TB patient who did not start treatment or whose treatment was interrupted for two consecutive months or more.
- Successfully Treated- a TB patient who was cured or who completed treatment- provides treatment success rate.
- Transfer Out-Patients who have been transferred before the completion of his/her treatment to another recording and reporting unit and for whom the treatment outcome is not known.
- Treatment Failure**:** a patient who, while on treatment remained smear-positive or became again smear-positive at the end of the 5 months.
- Treatment Success (TS)-the sum of patients who are declared cured and those who have completed treatment.
- Tuberculosis Treatment Success Rate-is the percentage of all new tuberculosis cases registered in a given year that successfully completed treatment, with or without bacteriological evidence of success(cured and treatment completed respectively, or the sum of patients cured and those who have completed treatment.
- Died – a TB patient who died from any reason during the course of treatment

3. RESEARCH METHODS AND MATERIALS

3.1 Scope of the Study

The study was conducted in Horo Guduru Wollega Zone (Shambu Town), which is one of the Oromia Regional State West Ethiopia; this is 325 Km far from Addis Ababa. This town has an Astronomical Location 933'00N-935'25'' latitude and 3705'05"E-3707'45''E longitude and an elevation of 2503 meters above sea level. Shambu is a seat for HoroWoreda and Shambu town woreda in addition to the Zonal Service and has an estimated total population of 67,279, of those 32,614(48.48%) are male and 34,665(51.52%) are Female (Shambu Administrative Office, 2016).

3.2 Study Population and Sampling Technique

The study involved a retrospective cross-sectional survey design using Secondary data of TB cases from two health care centers (Shambu Referral Hospital and Shambu Health Center) in which the centers have TB centers that provide DOTS service of TB control program.

The target population for the study was all TB attending DOTS service where all patients diagnosed with active TB disease(Smear positive and smear negative)are put on anti-TB treatment regimens and monitored throughout the course of treatment and the selection of these health center facilities was done by using purposive sampling technique, because TB patients were registered in an organized manner in these centers compared to many private health facilities available in the town and the study conducted from 2010 to 2015.

3.3 Data collection procedure

All TB patients treated from 2010-2015 were included in this study. The data was collected from the two government health care centers providing DOTs services. The variables on the record were names of TB patients, socio-demographic characters such as sex, age, HIV status, type of TB (smear positive TB and Smear negative TB and extra pulmonary TB), TB category (new case, retreatment, susceptible or drug resistance, treatment date started and completed,

treatment outcome (completed treatment, lost to follow up, cured, died) were collected from the DOTs registration unit from the study area.

3.4 Data processing and Analysis

Primarily the availability of the needed data and the feasibility of the methodology were checked with necessary modifications. The data was collected step by step manually and checked for completeness and accuracy. Then, the prevalence of TB was determined in coherence with the variables studied. The data of all patients of the years(2010-2015)in terms of case detection rates and treatment out comes were processed to assess the proportion of PTB,PTB/HIV co-infection and drug resistance and finally analyzed using descriptive statistics in percentages and ratios then the data was illustrated in tables and graphical expression.

4. RESULTS AND DISCUSSIONS

4.1 Prevalence of Tuberculosis Cases by Sex

From a total of 1364 TB patients registered and attended DOTs service in the two governmental health care facilities in the year 2010-2015, 748(**54.84%)** of the TB patients were males and 616(**45.16%)** were females, which showed a male to female ratio of 1.2:1. Out of these, almost 30% were smear positive (SPTB), 49% smear negative Pulmonary TB (SNTB) and 21 % extra-pulmonary TB (EPTB) patients (Table 1).

Table 1.Prevalence of Tuberculosis cases by Sex in Shambu Town Health Facilities (2010-2015).

Sex	Total TB Patients (%)	Pulmonary Tuberculosis(TB)			EPTB (%)	MDR-TB
		SPTB (%)	SNTB (%)	Total (%)		
M	748(54.84)	233(17.08)	341(25)	574(42.1)	171(12.54)	3(0.22)
F	616(45.16)	171(12.54)	331(24.2)	502(46.8)	112(8.21)	2(0.14)
T	1364(100)	404(29.62)	672(49.27)	1076(78.9)	283(20.75)	5(0.36)
M:F	1.2:1	1.4:1	1:03	1.14:1	1.5:1	1.5:1

Note: SPTB=Smear positive TB, SNTB=Smear negative TB, EPTB=Extra Pulmonary TB, MDR-TB=Multidrug tuberculosis

Although the male to female ratio of TB was generally 55%:45%, (1.2:1) the ratio of EPTB and SNTB was 1.5:1, and 1:1, respectively indicating variations in the infection of the different forms of TB. A research carried out at Nekemte town nearer to the same study site showed that out of 1246 total TB cases registered 144(smear positive male) and 122(smear positive female) with the ratio of 1.2:1, EPTB (1.2:1) (Ajama, 2015).Globally, the ratio of male to female total tuberculosis including MDR-TB cases was that Smear positive TB occurred more in males than females(1.4:1) (WHO, 2013).

The detection of multi-drug TB was very low (0.36%) where males were more infected than females (1. 5:1),indicates that fewer TB patients were registered as re-treatment cases and it was in the DOTS program that TB still spread in the study area.

The male to female ratio in this study was similar to the study in Nekemte Town nearby to the present study (Ajema, 2015), and Gambella (Fekadu,2015),1.2:1(Table 2).However, the male to female ratio was much lower than the ones reported from Africa(1.4:1), South East Asia(1.5:1),Global report(1.6:1), America(1.7:1), Europe(1.9:1), Western Pacific(2.2:1), and China(2.6:1) with a range of male: female ratios of 1.4:1 to 2.57:1 (Table 2). Globally, the ratio of female to male tuberculosis of MDR-TB cases was1.5-2.1% and more smear positive male than female TB cases were diagnosed every year (WHO, 2013).However, in fewer cases the male to female ratio is almost similar as reported in Eastern Mediterranean (WHO Global Report, 2014). This shows that gender-based plan is necessary to STOP TB because males were more burdened than females. .

In general, TB infection was more aggravated in males than females both at the national and global levels. It is unclear why more males than females are diagnosed with tuberculosis (Cann A., 2013).

Table 2.Pattern of Male to Female Tuberculosis Cases from Global to Local and National Level of Ethiopia.

Study area	Period of the study	M:F	References/sources
Shambu	2016	1.2:1	This study
Nekemte	2015	1.2: 1	Ajama,2015
Ethiopia	2013	1.2:1	Global TB Report 2014
Europe	2013	1.9: 1	WHO Global REPORT 2014
SouthEastAsia	2013	1.5: 1	WHO Global REPORT 2014
Gambela	2015	1.2: 1	Fekadu,2015
China	2015	2.6:1	Mengeshichen,2014
WesternPacific	2013	2.2: 1	WHO Global REPORT 2014
Americans	2013	1.7: 1	WHO Global REPORT 2014
E.Mediterrnean	2013	1:1	WHO Global REPORT 2014
Africa	2013	1.4 : 1	WHO Global REPORT 2014
World/Global	2013	1.6 :1	WHO 2013

4.2 prevalence of Tuberculosis along the Age Category

The data on TB profile of the different age groups is summarized in Table 3. Accordingly, the highest prevalence of 33.65% occurred in the age group of 11-30; followed by 30% in the age group of 31-50 indicating that more than 60%infection was in most active age group of 11-50 years.The pattern of infection with SPTB and SNTB was similar to the pattern of overall TB infection across the different age groups. However, the prevalence of SNTB of the two active age groups contributed to 33.42% compared to the SPTB that showed a prevalence of 18.18% of all the infections.

The National report on TB also showed TB affected 60% of age group among the TB patient widespread in the most active age group of 11-50 years. (FMHE, 2016).Even the limited data on MDR-TB showed also showed that the three individuals that were positive to the same were in the age group. All MDR-of 11-30, and 1 patient each was from age group of 31-50 and age group of 51-70 (data not shown).

Ajema (2015) also reported that almost 90% of the TB patients attending the DOTs program in Nekemte Hospital in one of Oromia Regional State were within economically active age group of 15-64 years .At the National level, TB affects 62% of people that were within the same age groups(FMHE,2016).Other studies also indicated that TB is mainly the disease of adults with age >15years(Ellner ,2011.This is because of increasing number and frequency of contacts that made the risk of getting TB infection with age(Fayers,1975).This also goes with report that the risk of acquiring the disease tuberculosis increases as age increases to adult hood (Global TB Report, 2016). The data also showed the 11-30 age group showed higher infection compared to the age group of 31-50 with ratio of 1.12:1; 1.42:1with regard to the total TB and SPTB infections, respectively. However, there was no significant difference between the males and females with SNTB (1:1 ratio).

Table 3.The Prevalence of PTB patients (SPTB and SNTB) in different age groups for Males and Females in the study site (2010-2012).

Age group	Total TB Patients			Pulmonary TB patients						Extra TB patients		
	M (%)	F (%)	T (%)	SPTB			SNTB					
				M%	F(%	T(%	M%	F(%	T(%	M%	F(%	T(%
1-10	6.82	6.45	13.27	2.35	1.83	4.18	3.23	3.08	6.3	1.25	1.54	2.79
11-30	20.6	13.05	33.65	6.7	4	10.7	9.8	7.5	17.3	4	1.53	5.53
31-50	15.47	14.5	29.97	4.55	2.93	7.48	7.4	8.72	16.1	3.5	2.9	6.4
51-70	7.55	6.89	14.44	2.5	2.2	4.7	3.67	3.31	6.97	1.4	1.7	3.1
>70	4.4	4.25	8.65	1.17	1.69	2.86	1.05	1.69	2.74	2.3	0.5	2.8
Total	54.84	45.16	100	17.3	12.7	30	25	24.3	49.3	12.5	8.2	20.7

Generally, the highest PTB recorded was 28% for the groups 11-30 followed by 23.6% of the age group 31-50.As age increased the prevalence increased and decreased as age exceeds 51 onwards. Accordingly, the male PTB case in the age group (11-50) had higher prevalence than the female. The total Prevalence of PTB in children (10.49%) showed similar trendreport of WHO (2013) that 11% of the TB cases are children less than 15 years(Figure 2) and the data also showed the prevalence of TB cases in children (1 -10 years) was very low that may indicate BCG vaccination provides a certain degree of protection against serious forms of TB, especially amongst children (MHOE, 2002).

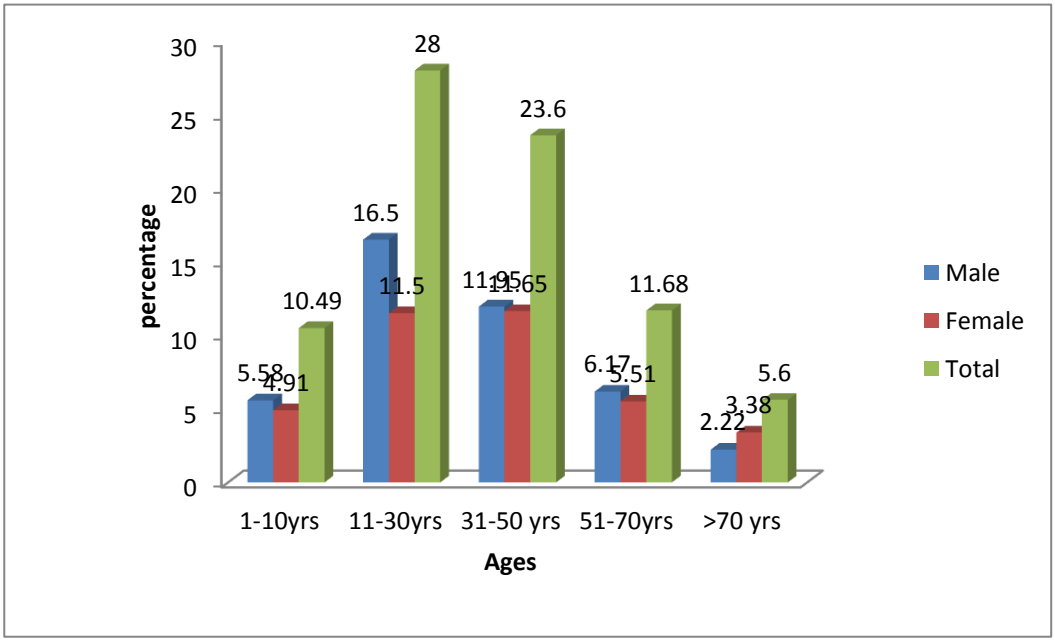

Figure 2.Prevalence of PTB patients in the study area (2010-2015) in different age groups for males and females.

4.3 Prevalence of TB, PTB and EPTB among Male and Female TB patients in each year from 2010-2015

In this study, the prevalence of total TB patients varied over the years from 15% in 2012 to 17.8% in 2011 with over all of 16.8 %(Table4). Likewise, the occurrence of Pulmonary TB was recorded between 15.1% and 18.5%, with the overall prevalence of 16.7%; whereas the EPTB infection fell within the 12%-22% with average infection of 15.2% (table 4).

In general, the data showed a steady prevalence of total TB in all the years at 17% mark, except a slight decrease to 15% in the years 2012 and 2014.

Table 4.Prevalence of TB, PTB and EPTB between Males and Female patients (2010-2015)

Years	Sex	Total TB	Prevalence M:F	PTB	Prevalence M:F	EPTB	Prevalence M:F
2010	Male	120	51%	90	51%	30	50%
	Female	116	49%	86	49%	30	50%
		236	17.3	176	16.4%	60	21%
2011	Male	139	57%	106	53%	32	74%
	Female	104	43%	93	47%	11	26%
		243	17.8%	199	18.5	43	15%
2012	Male	118	58%	94	55%	24	73%
	Female	86	42%	77	45%	9	27%
		204	15%	171	15.9%	33	12%
2013	Male	124	53%	93	57%	31	51%
	Female	100	47%	70	43%	30	49%
		234	17.2	163	15.1%	61	22%
2014	Male	117	**54%**	88	49%	29	81%
	Female	99	**46%**	91	51%	7	19%
		216	15.9	179	16.6%	36	13%
2015	Male	130	**54%**	103	55%	25	50%
	Female	111	**46%**	85	45%	25	50%
		241	17.7	188	17.4%	50	18%
Total	Male	748	**54%**	574	53%	171	**60%**
	Female	616	**46%**	502	47%	112	**40%**
		1364	16.8%	1076	16.7%	283	15.2%

The male to female ratio showed a consistent trend of male to female ratio of 54:46(1.2:1), except the case of EPTB that showed a wider range of male to female ratio of 60:40(1.5:1) indicating that higher proportion of the male population was vulnerable to extra-pulmonary tuberculosis (Table 4).

The MDR detection in Shambu was very low given the country is one of the 27 high MDR-TB burden countries, with MDR-TB prevalence of 2.3% and 17.8% among new and previously treated TB cases, respectively between 2011-2014 (KebedeWorku, 2016).The first patient was detected in 2011; followed by another in 2014; whereas 3 patients were diagnosed in the year 2015(data not shown) indicating a slight increase in MDR-TB over the years.In general, MDR-TB was detected in 3 males (0.22%) and 2 females (0.14%) with a total of 0.36% over the years(Table 5).It is interesting that the low MDR TB detection of only 0.36% was by far less than the global (23.6%),National(20.1% and 12.4%) detection rate(National DRS 2013 Report and FMHE,2016 respectively) Table 6.This gives the impression that it was an achievement that most patients in the study site were not abused with misuse of antibiotics and completed their medication/ treatment.

Table 5.Characteristics and Prevalence of MDR-TB/HIV Co-infection (2010-2015).

Characters		Drug Susceptible		MDR-TB		Total TB cases	
		HIV+	HIV⁻	HIV+	HIV⁻	HIV+	HIV–
Sex	Male	138 (10.12%)	607 (44.5%)	3 (0.22%)	-	141 (10.34%)	607 (44.5%)
	Female	108 (7.92%)	506 (37.1%)	2 (0.14%)	-	110 (8.06%)	506 (37.1%)
	Total	246 (18.04%)	1113 (91.6%)	5 (0.36%)	-	251 (18.4%)	1113 (91.6%)

Note: HIV+=HIV positive, HIV–=HIV Negative

Table 6.Multidrug-Tuberculosis Cases from Global to National and different Local areas of the countries

Country and Study site	New cases	Previously treated patients	Total	Source
Shambu	-	0.36%	0.36%	THIS STUDY
Global	3.6%	20%	23.6%	FMHE,2016
Ethiopia	1.6%	11.8%	12.4%	FMHE,2016
	2.3%	17.8%	20.1%	National DRS Report, 2013
Nigeria	2.9%	14%	14%	WHO 2013
South Africa	1.8%	6.7%	8.5%	WHO 2013
Belarus	>30%	>70%		FMHE,2015
China and India	-	-	50%	FMHE,2015
Addis Ababa	-	-	12%	Demissie M. *et.al.*,1997
Bangladish	1.4%	29%	30.4%	WHO 2013
Bahir Dar(North West Ethiopia)	-	-	11.8%	Hssein B., *et al*.,2013
Eastern Amhara	-	-	6.5.%	Esmael *et al*,2010-2011

It is as equally intriguing to assume the contrary that detection for MDR-TB is made only by state-of-the art reference laboratories that perform culture of TB strains, with additional testing of anti TB drug sensitivity (DST: Drug Sensitivity Test). According to the second round National TB Drugs Resistant Survey Report the Treatment of MDR-TB was more complicated, longer and more expensive than treatment of TB with no resistance and involves second line of drugs (FMHE, 2008). Under the circumstances, the latter argument could not support the low MDR-TB in the study area because the DOT centre did not have such a laboratory for diagnosis.

A cross sectional study at GamoGoffaZone, Southern Ethiopia with mean(14.37%) showed a trend of year specific PTB prevalence where from16.57%(2008) to 11.43%(2014)with steady decrease of TB by 5% over the period of 2008 to 2014.That means, 16.57%,15.64%,15.43%,15%,14.64%,11.93%, and 11.43% cases were detected in

2008,2009,2010,2011,2012,2013, 2014 years respectively(Zerihunand,Girmay,*et al*.,(2014). But, when the trend is seen in Shambu Woreda (the study site) there was a slight increase of PTB cases from 2010 (12.9%) to 2015(14%) (Fig.3)

In this study the trend in year-specific prevalence of TB case was 17.3%, 17.82%,15%, 16.4%, 15.84%, and17.7% for the years 2010-2015 respectively. The mean total prevalence was 16.68%.A research carried out on the prevalence of TB patients at Yirga Chafe Health Center from 2008-2013 showed a trend of year specific prevalence of TB as 223 cases in 2008,219 cases in 2009,216 cases in 2010,205 cases in 2011,167 cases in 2013.This trend shows a clear decrease in prevalence of the cases across the year 2008 to 2013(Fikadu Alemu, 2015). However, in case of Shambu town(this study),the prevalence of TB along the years showed little variation except for the year 2012 and 2014 with mean prevalence of 16.68% in which its occurrence seemed increasing.).This shows there was a fluctuation concerning the burden of PTB cases in the study site in which planning to control the cases was not achieved as much as anticipated(Figure 3).

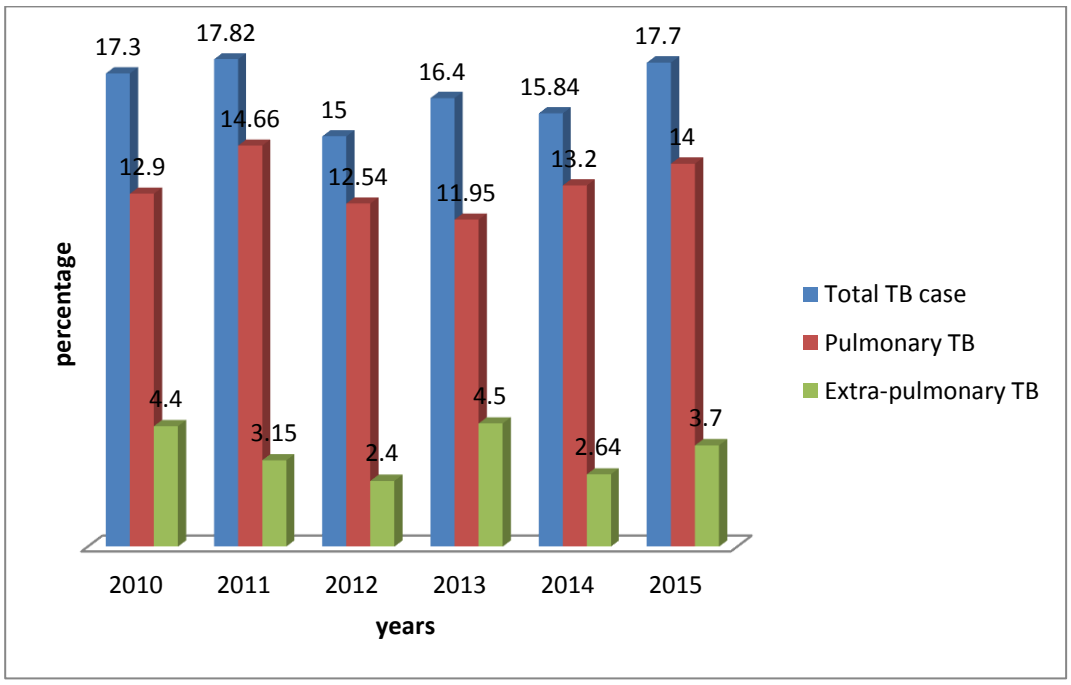

Figure 3.Trend in year-specific prevalence of TB cases in Shambu town(2010-2015).

4.4. Case Detection Rate of PTB Cases

In this study, the case detection rate showed that 30.8% TB patients attending DOTS program were smear positive and 48.5% Smear negative (Table 7).Case Detection Rate indicated whether there was adequate coverage of diagnosis of smear positive TB cases.

Table 7 Case Detection Rate (Smear Positive PTB cases) and Clinical diagnosis of TB patients (Smear Negative TB) in the Study area (2010-2015).

Year	Total TB patients			Pulmonary TB patients						EPTB		
				SPTB			SNTB					
	M	F	T	M	F	T	M	F	T	M	F	T
2010	120 8.8%	116 8.5%	236 17.3%	39 2.9%	37 2.7%	76 5.6%	51 3.7%	49 3.6%	100 7.3%	30 2.2%	30 2.2%	60 4.4%
2011	139 10.2	104 7.6%	243 17.8%	30 2.2%	17 1.2%	47 3.4%	77 5.6%	76 5.6%	153 11.2	32 2.3%	11 .8%	43 3.2%
2012	118 8.7%	86 6.3%	204 14.9%	50 3.7%	38 2.8%	88 6.5%	44 3.2%	39 2.9%	83 6.1%	24 1.8%	9 .7	33 2.4%
2013	124 9.1%	100 7.3%	224 16.4%	60 4.4%	44 3.2%	104 7.6%	33 2.4%	26 2%	59 4.3%	31 2.3%	30 2.2%	61 4.5%
2014	117 8.6%	99 7.3%	216 15.84	61 4.5%	37 2.7%	98 7.3%	27 2%	55 4%	82 6%	28 2.1%	8 .6%	36 2.6%
2015	130 9.5%	111 8.1%	241 17.7%	7 .5%	-	7 .5%	98 7.2%	86 6.3%	184 13.5	28 2.1%	22 1.6%	50 3.7%
Total	748 54.8	616 45.2	1364 100%	247 18.1	173 12.7	420 30.8	330 25%	331 24.3	661 48.5	173 13	110 8%	283 21
				30.8%			48.5%			20%		

The Case Detection Rate (CDR) at Shambu Health Centers (30.8%) was much lower than the data obtained from the different parts of the country (FMHE, 2016). Accordingly, case detection was much lower than the high CDR in Harrar (95%), Dire-Dawa (81%), and Addis

Ababa (63%) comparable to the CDR registered in Tigray (26%), Amhara (23%), Somali region and Benshangul (19%), and Nekemte(38.9%)(Table 8).This might be due to poor quality of diagnosis, co-existence of TB/HIV infection, etc.

According to the Global Stop TB partnership, 70% cases detection rate was projected as a reference point for its achievement during 2015(Global Stop TB Report, 2010). In 2013, 64% CDR was recorded at a global level where Ethiopia, Nigeria and Kenya achieved CDR of 62%, 16% and 75% respectively. In the case of Ethiopia, it seems impractical to achieve that at a national level, given several sites above achieved CDR of 19%-30.08%, including Shambu Health Centre. Therefore, CDR can be increased in the study area if the methods of diagnosis are improved so that the transmission of TB can be hindered.

Table 8 Summary of the Case Detection Rate from this study area to Global Level.

Study area	CDR	GRP	Global	National	Africa	Keniya	Nigeria	Reference
Shambu	30.8%	**70%**	**64%**	**62%**	52%	75%	16%	This study
Ethiopia	62%							FMOH,2016
AddisAbab	63%							FMHE,2016
Afar	59%							FMHE,2016
Amhara	23%							FMHE,2016
Benshangul	19%							FMHE,2016
DireDawa	81%							FMHE,2016
Gambella	39%							FMHE,2016
Harar	95%							FMHE,2016
Nekemte	38.8%							Ajama,2015
Oromia	37%							FMHE,2016
Somalia	19%							FMHE,2016
SNNPR	39%							FMHE,2016
Tigray	26%							FMHE,2016

Note: GRP=Global Reference Point Projected for CDR

4.5. Prevalence of PTB/HIV Co-infection at the study site (2010-2015).

In the study site, the prevalence of TB/HIV co-infection at the DOTs clinic was 18.8% of which 13% and 5.8% were smear positive (SPTB) and smear negative (SNTB) patients, respectively (Table 9a).The pattern of infection was more on the males (10.6%) than females (8.2%) meaning that the prevalence of TB/HIV co-infection among males was 1.3 times higher than females.

Table 9. Prevalence of TB co-infection amongst the different category of TB patients under DOTs registration at Health Centers between 2010-2015).

Table9a).

Sex	Total TB	Pulmonary Tuberculosis						EPTB
		HIV Positive			HIV Negatives			HIV
		SPTB	SNTB	TOTAL	SPTB	SNTB	TOTAL	Negatives
M	748 (54.84%)	99 (7.09%)	45 (3.3%)	144 (10.6%)	137 (10.04%)	296 (21.7%)	433 (31.74%)	171 (12.5
F	616 (45.16%)	81 (5.8%)	31 (2.27%)	112 (8.2%)	92 (6.7%)	300 (22%)	392 (28.74%)	112 8.2%
T	1364 (100%)	180 (12.83%)	76 (5.57%)	256 (18.8%)	229 (16.8%)	596 (43.7%)	825 (60.48%)	283 20.7%

The TB/HIV co-infection in this study was higher than most local areas of the country and the prevalence did not show significant difference along the years ranging from 2.71% to3.74% (2010-2015) with male to female ratio of (157/94,1.7:1),(the data did not shown). Amongst the age groups, the highest prevalent of PTB-HIV patients of 5.79% and 5.65% were recorded from age groups of 11-30 and 31-50, respectively (Table 9b). Although the overall male to female co-infection was 1.3:1, there was a fluctuating trend in infection ranging from 1.8:1 in the 51-70 age group to that of 1:1 in the age group of 31-50 and >70 age groups. Considering the combined co-infection rate of the two age groups (11-30 (31%) and -31-50 (30%) it can be calculated that 61% of all the infections occurred at the active age groups.. This was slightly similar to the 76.7% co-infection recorded from 15-44 age groups in Western Ethiopia (Eyasu,

2014). High prevalence of co-infection in the age group of 15-45 might be partly due to active sexual activity and high HIV transmission (Tessema,*et al*., 2012,FMHE, 2015). Interestingly, the high proportion (20.75%) of EPTB patients did not show co-infection with HIV at the DOTs registry of the study site.

Table-9b)

Character			Total TB	HIV+	Total HIV Positives
Age	1-10	M	93	10(0.74%)	16(1.17%)
		F	88	6(0.43%)	1.7:1
	11-30	M	281	46(3.37%)	79(5.79%)
		F	178	33(2.42%)	1.4:1
	31-50	M	211	39(2.86%)	77(5.65%)
		F	198	38(2.79%)	1:1
	51-70	M	103	28(2.05%)	44(3.23%)
		F	94	16(1.17%)	1.8:1
	>70 years	M	60	18(1.32%)	35(2.57%)
		F	58	17(1.25%)	1:1
	Total	M	748	141(10.37	251(18.8%)
		F	616	110(8.06%	1.3:1

In general, the TB/HIV co-infection rate of 18.8% in this study was similar to the prevalence of 18.7%from Nekemte Town in Oromya Region (Ajema 2015), and average global record of 18%, but was significantly higher than the national average of 11% recorded in 2013 (Global TB Report, 2014), and the prevalence of co-infection of 11.4% recorded from Dabat, North Gondar, Northern Ethiopia (Sebsebe Tadesse, 2013). However, the result was closer to the 20% infection (FMHE, 2016).

However, the prevalence of TB-HIV co-infection in this study was significantly lower than the record (27%) from some areas of Gondar; 58-69% recoded from several countries from Southern Africa (Table 10).

Formerly another research was carried out at prisons of Gamo Gofa Zone in 2009 showed 45% of the TB patients were co-infected which was higher compared to the preset study (Zerihun and Girmay,*et al*.,2014).The difference in the pattern of co-infection can be attributed to many socio-economic factors and technical factors such as sample size, sampling time, short term and long term studies, study methodologies, secondary and primary data and technical expertise in the diagnosis of the infections (Global TB Report, 2014).

Although there has been a concerted activity to control TB and TB-HIV co infection with DOTS strategy, there was still high infection and co-infection rate lagging behind the projected target to control the TB menace in the study area. Consequently, high TB/HIV collaborative activities are required to identify HIV positive TB patients for further treatment, because in the HIV infected persons the risk of developing TB is much higher (10 times compared to an individual who is not infected with HIV) (FMOHE,2016).

Table 10 .Summary of the Prevalence of TB/HIV Co-infection among TB patients from Global to National up to Local areas of this study (2010-2015).

Study area	Study period	TB/HIV co-infection	Sources
Shambu	**2015**	**18.8%**	**THIS STUDY**
Global	2013	18%	Global TBreport;2014
South Africa	2013	62%	Global TB report,2014
Zimbabwe	2013	69%	Global TB report,2014
Mozabique	2013	58%	Global TB report,2014
Ethiopia	2013	11%	Global TB report,2014
Dabat	2013	11.4%	Sebsibe Tadesse,2014
Nekemte	2015	18.7%	Ajama,2015
Gonder University	2016	27%	Alemu Fanose,2016

4.6 Treatment Outcome of TB patients from 2010-2015 in the study site (Shambu Town).

The treatment outcome of the TB patients in the DOTs clinic at Shambu Health Centers was shown, (Table-11). Accordingly, 46% of the TB attendants completed their treatment and, 26% were successfully treated indicating a 72% success in the treatment (considering the patients

completing medication). This was far from the comprehensive DOTS strategy which ensures cure to majority of tuberculosis patients presenting to primary health care services (EHNRI, 2009). From the treatment failure and the transfers, 14% of the attendants were not tasked to the treatment discipline. The pattern of treatment also showed that the highest percentage of 13.6% of the patients completed their treatment in 2015; followed by 10.3% patients in 2011, contributing to almost 24% of the subjects that completed their treatment over five years. However, the successfully treated (CURED) in those years was 0.5% and 1.8%, respectively. This means that only 2.3% of the patients were diagnosed and bacteriologic ally confirmed indicating 36% treatment success in those years. On the contrary a higher percentage of 6.0-6.5% successfully treated recorded in 2012, 2013, and 2014, with a cumulative percentage of 19% of cured patients and 3.7%-5.8% of them completed their treatment in the same years (14.8% completed treatment)with treatment success rate of 33%.This indicated that the absence of continuity in diagnosis in the study area.

Table 11. Treatment Outcome of TB patients from those attended DOT service (2010-2015).

			Periods of study						
			2010	2011	2012	2013	2014	2015	Total
Treatment out Come	Total TB	N	236	243	204	224	216	241	1364
		%	17.3	17.82	15	16.4	15.9	17.7	100%
	Treatment completed	N	98	141	79	51	72	186	627
		%	7.2	**10.3**	**5.8**	**3.7**	**5.3**	**13.6**	**45.97%**
	Transferred out	N	29	26	6	21	19	18	119
		%	2.1	2	.4	1.5	1.4	1.3	8.72%
	Failed treatment	N	7	9	12	16	15	12	71
		%	.5	.7	.9	1.2	1.1	.9	5.21%
	Lost to follow up	N	27	31	21	23	17	9	128
		%	2	2.3	1.5	1.7	1.2	.7	9.38%
	Cured	N	61	25	81	87	89	7	350
		%	4.5	**1.8**	**6**	**6.4**	**6.5**	**.5**	**25.66%**
	Died	N	14	11	5	26	4	9	69
		%	1	.8	.4	2	.3	.7	5.06%

Although the overall death rate record of the study area was 5% over the period of 5 years, it did show a fluctuating trend over the years, without showing any pattern of decrease pursuant to the national strategic goal. Even if it was slightly lower than the Nekemte record nearby Shambu town (6.6%) (Ajama ,2015), yet it was slightly higher than the death rate of 4% in Addis Ababa (Kebede Worku,2014) and 3% of national projection in the country.

The treatment success rate of TB cases at Shambu town was evaluated interns of the national and global target (Table 12). Accordingly, the treatment success was 72% which was similar to 70-80 success that included Addis AbAba (72%) and Tigray (79%), but slightly lower than the 83-92% success recorded at many sampling sites in various regions in the country (Table 12) . From the national report, it was concluded that all regions achieved treatment success of 79-92% ,with an average national treatment success of 85% (Table 12) (FMOH, 2014). However, the Global TB report estimated the Ethiopian treatment success at 81%, in comparison to the global success of 86% in 2012 (Global TB report, 2014).

Thus, it is tempting to argue that given the treatment success of TB in the Oromia Regional State was 83% in 2011 (FMOH, 2014), the treatment success of 72% TB in Shambu town at the end of 2015 may indicate a decline in the treatment of TB over the years at district levels despite the claim of achieving the national goals of controlling TB. Although the treatment success rate in Ethiopia was improved to 91% from 61%, after introducing the DOTS program (KebedeWorku, 2016**)** the achievement was not homogenous in all regions in the country. From this it can be concluded that, the work towards achieving treatment success rate to a projected level in the study area is a long way to go and it must be accelerated by monitoring and close follow up against loss of patients from the site and transfer out.

Table 12. Treatment Success Rate (TSR) from the study site to Global.

Study area	Study period	TSR	Sources
Shambu	2015	72%	This study
Ethiopia	2012	81%	Global TBReport,2014
AddisAbaba	2011	72%	FMOH,2014
Afar	2011	92%	FMOH,2014
Amhara	2011	84%	FMOH,2014,Moges et al.,2015
Benshangul	2011	88%	FMOH,2014
Gambella	2011	89%	FMOH,2014
Oromia	2011	83%	FMOH,2014
Somalia	2011	85%	FMOH,2014
S. Region	2011	88%	FMOH,2014
Tigray	2011	79%	FMOH,2014
Africa	2012	91%	Global TBReport,2014
China	2009-2013	>85%	WHO,2014
Peru	2009-2013	83%	WHO,2014
St. Lucia	-	100%	Global TB Report,2015
Luxembourg	-	0.00	Global TB Report,2015
Global	2012	86%	Global TBReport,2014

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary and Conclusion

This study showed that out of 1364 TB patients 748(54.84%) were males and 616(45.16%) were females with a ratio of 1.2:1 that showed close narrow gender disparities similar to the national level .

The pattern of TB infection fell into different categories in that the majority (49%) displayed smear negative Pulmonary TB (SNTB); followed by 30% smear positive (SPTB) (case detection rate), and 21 % extra-pulmonary TB (EPTB), respectively. The case detection rate (CDR) of 30% was much lower than national level of 62%, (Ethiopia). The low CDR indicates the inefficiency of the diagnostic system in the laboratory. Although the male to female ratio of TB was generally 55%:45%, (1.2:1) the ratio of EPTB and SNTB was 1.5:1, and 1:1, respectively, indicating variations in the infection of the different forms of TB.

TB affects all age groups notwithstanding, the highest prevalence of 33.65% of TB occurred in the age group of 11-30; followed by 30% infection of the age group of 31-50 indicating that TB affected 64% of the most active age groups contrary to the long held perception that TB mostly attacked very young (<5years), and old aged people >60years. The reduction in the youngest age group may have been associated with good feeding and appropriate BCG vaccination.

The prevalence of total TB patients slightly varied from year to year ranging from 15% in 2012 to 17.8% in 2011 with an average of 16.8% over the years. In general, the data showed a steady prevalence of total TB in all the years at 17%, except a slight decrease to 15% in the years 2012 and 2014. Thus, the data did not show a trend of decrease along the years in spite of DOTS interventions in the area along the years.

In the study site, the prevalence of TB/HIV co-infection amongst all TB patients registered at the DOTs clinic and took a mandatory screening was 18.8%. Pattern of infection was more on the males (10.6%) than females (8.2%). The TB-HIV co-infection followed that same pattern with the prevalence of total TB in that the two sexually active age groups (11-30; 31- 50) contributed to prevalence of more than 60% of all the infections.

The average treatment success rate of TB cases at Shambu town over 5 years was 72% in which the Treatment Success Rate (TSR) in the study area was lower than the achievement at Oromia State (83%), and National (81%), thus did not meet the WHO international updated targets for the period 2011 to 2015.

Given that the study area was under DOTS and the Global plan to stop TB by improving CDR and Treatment success of TB by 85% by 2015, the Shambu area was slightly behind the national claim of achieving the goal. It is yet a formidable task to achieve the same in the area, under the circumstances a new post-2015 Global TB Strategy called-End TB Strategy. The country has adopted and launched this strategy that aims to end the global TB epidemic with targets to reduce TB deaths by 95% and to cut new cases by 90% between 2015 and 2035.

5.2 Recommendations

From this study, the following recommendations are forwarded:

- The prevalence of MDR-TB was very low due to technical limitations. This requires further work using state of the art methods based on primary data
- The Cases Detection Rate (CDR) in the study area was very low (30.8%). To improve the CDR of the study area, the DOTS clinic must be equipped with necessary diagnosing instruments and making quality diagnostic and treatment services accessible to all communities of surrounding citizens.
- So the high proportion of males to female's case showed further gender related intervention. This can be achieved through giving serious attention during screening of TB cases in males.

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Annex-1: Total TB patients, PTB, EPTB, MDR-TB and TB/HIV co-infections in the study area(2010-2015)

Sex	Total TB cases	PTB	EPTB	MDR-TB	TB/HIV^{+}
Male	748	574	171	3	144
Female	616	502	112	2	112
Total	1364	1076	283	5	256
M:F	1.2:1	1.14:1	1.5:1	1.5:1	1.3:1

Annex-1: The first 3 groups of Anti-TB drugs

First line oral TB agents	Group
-Isoniazed(H) -Rifampicin(R) -Ethaambutanol(E) -Pyrazinamide(Z)	1
Injectable TB agents	2
-Streptomycin(S) -Kanamycin(Km) -Amikacin(Am) Capromycin(Cm)	
Fluoroquinol ones	3
-Levofloxacin(Lfx) -Moxifloxacin(Mfx)	