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Prevalence of TB-HIV Co-infection Among Patients Attending Debre Elias Health Center, East Gojjam, Ethiopia, from September 1, 2010-January 30, 2017.

By

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A Thesis Submitted to the School of Graduate Study of Addis Ababa University College of Natural and Computational Sciences Department of Zoological Sciences in Partial Fulfillment of the Requirements for the Degree of Master of Science in Biology

Addis Ababa University

Addis Ababa, Ethiopia

August, 2018

Acknowledgment

First of all, I would like to give great thanks to my Supreme God by standing from my set for giving me; health, potential, knowledge, skill, and art, naturally how to complete my work.

Secondly, I would like to express my deepest gratitude to my advisor, Dr. Tegenu Gelana for his constructive professional advice and/ professional support to complete this thesis.

Thirdly, I would like to thank my colleagues who work at Guay General Secondary School for their work and moral support me, especially, Endegena Dessie and Desalegn for helping me in developing computer skill.

Fourthly, I would like to thank to the Debre Elias Health Center administration office for allowing me to collect necessary data for this research.

Fifthly, I express my heartfelt thanks to Debre Elias Health Center DOTS workers for their valuable assistance to collect data from the Standard National Medical Registry for the completion of this study.

Sixthly, I would like to thank Debre Elias Woreda Agricultural, and Cultural and Truism bureau for giving me necessary data.

Lastly, I would like to thank for my wife Muluken Demelash and my families for their moral and financial support to me to complete this work.

Table of contents

List of tables

List of figures

Acronyms/Abbreviations

AIDS-Acquired Immune Deficiency Syndrome

ARV-Anti-Retrovirus

ART- Anti retro viral Therapy

CMD- Common mental disorder

MOH- Ministry of health

D.f- Degree of freedom

HIV- Human immunodeficiency virus

DOTS-Directly Observed Treatment Short-course

EPT-Extra Pulmonary Tuberculosis

GPS- Global positioning system

HR- Hazard ratio

MDR-TB- Multiple-drug resistant TB

XDR-TB- Extensively drug resistant tuberculosis

NIAIA- National institute of allergy and infectious diseases

OIS- Opportunistic infections

OR- Odds ratio

PLWHA- Peoples living with HIV/AIDS

PLWHIV- Peoples living with HIV

PMTCT- Prevention of mother to child transmission

PT- Pulmonary TB

SPSS- Statistical package for social science

TB- Tuberculosis bacillus

TST- Tuberculin skin test

UNAIDS- Joint United Nations programmed on HIV/AIDS

UNAIDS- United Nations program of HIV/AIDS

UNGASS- United Nations general assembly special session

WHO- World Health Organization

Abstract

Tuberculosis is prominent cause of mortality next to human immune deficiency disease caused by human immune deficiency virus in the world. HIV/AIDS disease is the main risk factor for the development of TB as the major opportunistic disease for it. When TB and HIV/AIDS diseases infect humans together, their effects become extreme. Therefore, the main objective of this study was to assess the prevalence of TB-HIV co-infected patients who attended Debre Elias Health Center East Gojjam, Ethiopia, from September 1, 2010-January 30, 2017. The study done retrospectively based on secondary data registered on Standard National Medical Registry. As I assessed the Standard National Medical Registry purposively, totally, there was 2348 TB and HIV case related patients attended the health center from September 1, 2010-January 30, 2017. From 2348 patients, 1368 peoples HIV positive only, 360 TB patients only, and 620 patients were TB-HIV co-infected. In this study 2348 patients were study population and 620 TB-HIV co-infected of them were sample size selected by purposive sampling technique. Necessary data with important socio-demographic characteristics collected purposively from Standard National Medical Registry. Data checked manually and manipulated by crosstab chi-square descriptive statistics in SPSS version 20 software then, interpreted and expressed in percentage by using Table and graph. In this study the prevalence of TB-HIV co-infected patients were 247/620 (39.8%) males and 373/620 (60.2%) females, totally 620/2348 (26.4%). This prevalence was medium as compared with the prevalence done by different research at different area in different time. In this study statistically high risk factors, sex (p=0.003), age (p=0.000), marital status (p=0.000), educational status (p=0.000), occupational status (p=0.000) and residence (p=0.000) with the other factors had significant correlation to the development of TB-HIV co-infection. Since TB-HIV co-infection was great health challenge in the study area, integrated efforts from all stalk holders to reduced TB and HIV concomitant effect should implemented automatically.

Keywords: *Standard National Medical Registry, SPSS (Statistical Package for Social Science), HIV/AIDS, Prevalence, Tuberculosis*

1. Introduction

1.1 Background of the study

Human immunodeficiency virus and tuberculosis respectively are the first and the second leading causes, of death globally (WHO, 2015). It has now three decades since the AIDS pandemic had recognized. According to the UNAIDS report at the end of 2009 there were 33.2 million people living with HIV/AIDS globally. During the same years, 2.5 million new infection and 2.1 million deaths reported (Gedlu Beshah, 2011).

Tuberculosis is an infectious disease caused by bacilli belonging to the *mycobacterium tuberculosis* complex (Laheij *et al*., 2011). This complex consists of seven species including *M. tuberculosis, M. Canetti, M. africanum, M. pinnipedii, M. microti, M. caprae, and M .bovis.* Tuberculosis has a long history and co-existed with human since ancient times. It reported that all modern members of *M. tuberculosis* complex had a common African ancestor (Daniel, 2006). *Mycobacterium tuberculosis* is a fastidious, slow growing, lipid rich, rod shaped bacterium. The bacterium has slow growth rate of 12-16 hours compared to most other bacteria, which their generation time measured in minutes (WHO, 1993). The cell wall of *M. tuberculosis* is rich in lipids, which contributed to fasten, and hydrophobicity. The wax coat also contributes to the resistance too many disinfectants, common laboratory stains as well as to antibiotics (Riley *et al.*, 1995). Tuberculosis is predominantly a disease of the lung (pulmonary tuberculosis) accounting 70% of the cases. Extra pulmonary disease sites include lymph node, bone, and meninges (Harries, 1997).

According to John *et al* (2007), TB increases the progression of HIV to AIDS stage. This indicates that tuberculosis (TB) and human immunodeficiency virus (HIV) infections potentiate the deleterious effects of each other both in terms of morbidity and in terms of mortality (Getahun, 2010). Tuberculosis (TB) is one of the leading bacterial opportunistic infections that speed up the rate of mortality in HIV patients. There has been a drastic rise of tuberculosis infection across the world associated with the pandemic occurrence of HIV/AIDS. It is among and shares about twenty-five percent of all causes of the death (Safwat *et al*., 2011). Globally,

more than 13 million people co-infected with TB/HIV, of which; about seventy percent are living in Sub-Sahara Africa (Harling *et al*., 2008). Of the global total population who are living with HIV infection, 95% live in developing countries (Shreevida and Dias, 2012). People with advanced stage of HIV infection are vulnerable to secondary infections (opportunistic infections). Because of progressive decline in immune response, these patients are extremely susceptible to variety of common as well as opportunistic infections (Anant *et al*., 2012). Of the global total 22.5 million living with AIDS, 1.7 million new infections and 1.6 million deaths were in sub-Sahara Africa (Gedlu Beshah, 2011).

Ethiopia ranked seventh among the twenty-two high TB burden countries in the world (WHO, 2009). Hospital data indicates that TB is the leading cause of morbidity and the third cause of hospital admissions in the country (WHO, 2009). Some studies showed that HIV infected people develop TB while others do not. This phenomenon indicates that being HIV positive is not a mere factor for infected with TB, but various determinant factors contributed to the TB/HIV co-infection (Azuonwu *et al*., 2011). Virus is one of the greatest challenges facing humankind. HIV infection is a global pandemic, with cases reported from virtually every country. Despite the available evidence, it was not until 1997 that concrete attempts was made to explore collaboration between TB and HIV programs via the pro TEST initiative in Malawi, Zambia and South Africa (WHO, 2004). Successful implementation of TB-HIV collaborative access should addressed to reduce the co-morbidity and mortality of patients. The initiative established that TB and HIV programs could collaborate successfully in joint service delivery. Subsequently, the World Health Organization in 2004 recommended collaborative activities between TB and HIV programs in order to decrease the burden of both infections in populations affected by the co-epidemic. In Ethiopia national independent operation of TB and HIV, programs (both structurally and functionally) have integrated in to a TB/HIV collaborative activity in different regions of the country (WHO, 2004).

1.2 Statement of the problem

There are still many obstacles, which hinder patients from achieving good adherence to antiretroviral therapy while enough HAART is available. It estimated that 19% of adult patients not retained on antiretroviral therapy after 12 months, while for children 20% are lost after 12 months in poor countries. This will lead to treatment faller and development of drugs resistance mutation not merely at the individual level but consequently at a global level as stated by WHO "drug resistance may result in the failure and of the immense global and national efforts to provide hope to people living with HIV "(Zuurmond, 2008). Therefore, it is of necessary to identify and overcome the factor that rude adherence to antiretroviral therapy for prolonged viral load suppression (Chesney, 2000).

Tuberculosis still represents an important global public health threat and it is one of the world's leading causes of death among HIV patients. The cumulative human suffering and economic losses caused by TB and HIV in Ethiopia is high. The country ranked seventh on the list of 22 high burden tuberculosis countries in the world (WHO, 2009). The HIV/AIDS epidemic has substantially altered the epidemiology of tuberculosis. Many persons with *Mycobacterium tuberculosis* and HIV have a 5 - 10% annual risk of developing active TB. The double impact of TB and HIV co-infection is keeping large number of people trapped in poverty (WHO, 2009).

An estimated 170 million working days are lost each year because of TB and the health sector burdened by cost of drugs and treatment (MOH, 2010). Surveillance of TB/HIV co-infection, immune hematological marker and MDR-TB requires well-developed laboratory networks, expensive equipment and trained personnel that are not widely available in Mombasa Country, tuberculosis and HIV co-infection ranks first among the ten most common diseases morbidity and mortality. It accounts for 40% of outpatient visits and 45% of inpatients admissions (Odhiambo, 2008).

The increased burden of the disease has attributed to informal settlement, poverty. The magnitude of TB and HIV co-infection is increasing despite progress made in the ART/directly observed treatment, short-course implementation and control programs. This verifies that there could be several reasons for this situation including deficiencies in the health system that leads to

lack of access to TB and HIV control interventions and low effectiveness of these interventions than expected. Thus, it is essential that a research conducted to identify the gaps. There is no sufficient knowledge on TB and HIV co-infection and effect on immune system since immune hematological cell counts not routinely carried out on TB patients. There is need to examine clinical symptoms of both TB and TB/HIV co-infection, enumerate the distribution of CD_4 T-helper cell count, full blood count and Erythrocyte sedimentation rate which are not known in these patients. This is critical in developing interventions and formulating policies for TB and TB/HIV control (Cohen and Maartens, 2004).

The difficulties in diagnosing tuberculosis in HIV infected patients are among the challenges, which are facing the national tuberculosis control programs in Ethiopia. Lack of rapid and effective methods for TB diagnosis is also a major problem in developing countries. This complicates means of addressing the prevalence of HIV/AIDS and tuberculosis co-infection in resource-constrained areas. Given this worrying trends, there was a clear need to assess the prevalence of TB and TB/HIV co-infection and their effect on immunological markers among newly diagnosed tuberculosis patients (Cohen and Maartens, 2004). TB-HIV co-infection is great challenge in the world including this study area in East Gojjam zone, Debre Elias Woreda at Debre Elias Health Center that is why this study assessed the prevalence of TB/HIV co-infection there.

1.3. Objectives of the study

1.3.1 General objective

The overall objective of this research was to provide a comprehensive and up-to-date assessment of the prevalence of TB-HIV/AIDS co-infection at Debre Elias Health Center from September 1, 2010- January 30, 2017.

1.3.2 Specific objectives

- Assess the prevalence of TB-HIV/AIDS co-infection at Debre Elias Health Center from September 1, 2010- January 30, 2017.
- To determine the risk factors that increases the development of TB infection among TB-HIV/AIDS co-infected patients.

1.4 The research questions

- What is the prevalence of TB-HIV co-infected patients at Debre Elias Health Center?
- Which age of the community at Debre Elias area mostly affected by TB-HIV co-infection?
- How many male and female individuals mostly affected by TB-HIV co-infection at Debre Elias Health Center?

1.5 Significance of the study

The study would contribute great contribution in determining the prevalence of TB in TB-HIV co-infected individuals who attending Debre Elias Health Center from September 1, 2010-January 30, 2017 and used to determined which socio demographic characteristics (sex, age or residences…) were mostly induced TB-HIV co-infection. It also used as the base line for further deep and basic researches that will conducted there for the future. Since this research mainly focused on the assessment of prevalence of TB, as a whole it plays great role to create awareness about the prevalence of TB-HIV co-infection, Whether it is increasing ,decreasing or stable; it is also important for planning and decision making in preventing and controlling TB and HIV diseases locally, nationally and globally.

1.6 Limitation of the study

Since this research was based on data recorded on Standard National Medical Registry agenda in limited period from September 1, 2010-January 30, 2017, it faced with great limitation in getting enough back ground information to make wide decision about the prevalence of TB-HIV co-infection around the study area.

2. REVIEW OF RELATED LITERATURE

2.1 Tuberculosis

2.1.1 Epidemiology of tuberculosis

Tuberculosis is an infectious disease caused by bacilli belonging to the *mycobacterium tuberculosis* complex (Laheij *et al*., 2011). This complex consists of seven species including *M. tuberculosis, M. Canetti, M. africanum, M. pinnipedii, M. microti, M. caprae, and M .bovis. Mycobacterium tuberculosis* is a fastidious, slow growing, lipid rich, rod shaped bacterium, which resists decolourization with alcohol.

The bacterium has slow growth rate of 12-16 hours compared to most other bacteria, which their generation time measured in minutes (WHO, 1993). The cell wall of *M. tuberculosis* is rich in lipids, which contributed to fasten, and hydrophobicity. The wax coat also contributes to the resistance too many disinfectants, common laboratory stains as well as to antibiotics (Riley *et al.*, 1995). Tuberculosis is predominantly a disease of the lung (pulmonary tuberculosis) accounting 70% of the cases. Extra pulmonary disease sites include lymph node, bone, and meninges (Harries, 1997). TB spread when the bacterium enters the air through coughing, sneezing, or speaking. People living with HIV (PLHIV) are much more likely to become sick with TB than people who are HIV negative. If not treated properly, TB can be fatal, especially the leading causes of death among PLHIV globally (CDCP, 2012). Tuberculosis has a long history and co-existed with human since ancient times. It reported that all modern members of *M. tuberculosis* complex had a common African ancestor (Daniel, 2006).

TB can exist itself in two ways. Latent TB Infection: Not everyone infected with the bacterium that causes TB becomes sick. When person has TB but does not exhibit symptoms and/or feel sick, s/he considered to have "latent TB infection." s/he is not infectious and cannot spread it to the other people (CDCP, 2012). Active TB disease: approximately 5-10% of latent TB infection progress to TB disease. This happens when the immunity of an infected person is not strong enough to protect against the bacteria (MOH, 2010). A person who infected with active TB disease feels sick and exhibits symptoms that may include a bad cough for multiple weeks, chest pain, coughing blood or mucus, weakness, fatigue, weight loss, decreased appetites, chills, fever, and night sweats. Both latent TB infection and active TB disease can diagnose through either a

skin or blood test. To discern latent TB from active TB, along x-ray or sputum test I is required. Latent TB often requires one type of medication. Active TB entails several treatments at once. Common TB treatments include Isoniazid, Rifampin, Ethambutol, and Pyrazinamid, which used as first line medications. Possible side effects of these medications include nausea, vomiting, jaundice (yellow skin), lose of appetites, dark urine, and fever for long days (CDCP, 2012). Some strains of the bacterium that causes TB have become resistant to the most commonly used medications, making them very difficult to treat. Multi-drug resistant TB (MDR-TB) and extremely drug resistant TB (XDR-TB) are types of active TB that may resistant the use of second line TB medications. These medications are more expensive than first line treatment and are known to have amplified and more serious side effects, including hepatitis depression, and hallucinations. In 2010, there were 650 000 active TB cases; out of these, 9% of all active TB cases are classified as MDR-TB or XDR-TB (WHO, 1993**).**

2.1.2 Burden of tuberculosis

In 2009, it was estimated that 9.4 million new TB cases were recorded globally; 1.1 million (12%) of these were reported to be co-infected with HIV. Asia and Africa accounted for the majority of all the TB cases 55% and 30% respectively. In addition, there were an associated 14 million prevalent TB cases (WHO, 2010). It also, estimated that 440,000 cases of multiple drug resistant TB (MDR-TB) reported in 2008 with China, India, the Russian Federation, and South Africa having the highest number of these cases. In terms of mortality, 1.7 million TB deaths reported amongst the new TB cases in 2009, which is equivalent to 26 deaths per 100,000 populations. An estimated 1.3 million of these deaths occurred in HIV negative TB cases while, 0.4 million (24%) of all the TB deaths were HIV-related (WHO, 2010).

There are 22 high burden countries, which account approximately 80% of the estimated number of new TB cases (WHO, 2009). The consequence of TB on society is immense. Worldwide, it has estimated based on positive tuberculin skin test (TST) that one person out of three infected with *M. tuberculosis* (WHO, 2007). Tuberculosis re-emerged as global threat in the late 1980s following the HIV/AIDS pandemic (Johnson, 2007).

Tuberculosis is a highly contagious disease that mainly transmitted from via inhalation of small cough droplets. In 2009, there were 9.4 million new cases of TB and 1.7 million deaths,

including 380,000 deaths from TB among people with HIV/AIDS worldwide. Each person with active TB if it left untreated will infect an average between 10 to15 people each year **(**Laheij *et al.*, 2011).

Tuberculosis is continuous to be leading causes of illness and death among people with HIV/AIDS in resources poor area of the world. The yearly risk of a patient with HIV to develop TB is about 5%, which is similar to the lifetime risk for immune competent patient (Harling *et al*., 2008). Sub-Sahara Africa remains most severely affected, with nearly one in every 20 adults (4.9%) living with HIV, harboring 69% to the people living with HIV worldwide (Cobbert *et al*., 2006).

Of the 8.7 million TB cases in 2011, 1.1 million (13%) were among people living with HIV (Safwat *et al*., 2011**).** Tuberculosis is one of the major public concerns in Ethiopia fueled by the expansion of HIV pandemic since the 1990s. According to the 2012 WHO TB report, Ethiopia ranked seventh among world's 22 high burden countries with an estimated incidence of 258 per 100,000 populations, and a TB mortality of 18 per 100,000 individuals. The prevalence of HIV and the incidence of TB cases were 17 per 100,000 individuals (WHO, 2011-2015**).** In addition to a high TB burden, Ethiopia has been seriously affected by HIV/AIDS, with an estimated 1.5 million people living with HIV (UNAIDS, 2009). The high rate of chronic malnutrition, poverty and overcrowding in combination with high prevalence of HIV infection created an environment making TB a very serious health problem in Ethiopia (Harling *et al*., 2008).

2.1.3 Clinical presentation of tuberculosis

From the time of HIV infection, the individuals' susceptibility to tuberculosis is increased, and as the HIV epidemic in South Africa progress, the incidence of new cases of TB will continue to increase **(**Cohen and Maartens, 2004). Tuberculosis is one of the early manifestations of HIV infection and the pattern of clinical presentation depends on the degree of immunosuppression (Charles and Pape, 2006**).** In the early stages of HIV infection when the patients' immunity is only partially compromised the clinical features are characteristic of post-primary TB and resemble those seen in HIV negative individuals such as localized disease with extensive lung destruction and cavitations, upper lobe involvement and positive sputum smears (Harries, 1997). As the $CD4^+$ cell counts decline, HIV positive patients present with typical pulmonary disease (i.e., pulmonary infiltrates with no cavities, lower lobe involvement, intrathoracic

lymphadenopathy and negative smear) or extra pulmonary / disseminated disease affecting many parts of the body such as lymph nodes, abdomen, pericardium and haemopoietic system in the form of bone marrow involvement (Mwandumba *et al.*, 2008**).**

The classic symptoms include fever, night sweats, anorexia, weight losses and weakness; however, these symptoms are non-specific, sometimes redulting in delayed diagnosis or even misdiagnosis (Keshinro and Diul, 2006**).** In HIV positive patients, cough is a symptom reported less frequently than HIV negative patients are probably because there is less cavitations, inflammation and endotracheal irritation (Harries, 1997). Similarly, hemoptysis, which results from caseous necrosis of the bronchial arteries inside the activities, is less common in HIV positive patients (Harries, 1997).

2.1.4 Risk factors for tuberculosis

Predisposing factors to TB include exposure to active TB, immigration from high prevalence country, homelessness, living in institutions infancy, old age HIV infection, silicosis, diabetes renal insufficient, malignant lung or other tumors, post- gastrostomy, alcoholism, massive weight losses, steroid, immunosuppressive therapy (Johnson, 2007). Globally the incidence of TB is increasing, fuelled in part by the concurrent epidemic of HIV/AIDS currently worst affecting sub-Sahara Africa (Harling *et al*., 2008**)**.

Traditionally TB regarded as a disease of poverty and many aspects of low socioeconomic status for example overcrowding and malnutrition, are recognized individual and household risk factors for the disease (Harling *et al*., 2008). Although for centuries, TB has called the white plague, in South Africa it is predominantly a disease of black Africa, a byproduct of poverty, poor health care and high HIV infection rate (Koening 2008). In the old South Africa, people previously classified as 'colored' (mixed race group), Africa, White and Asian. TB rate were extremely high in the colored and African communities compared to the whites and Asians; a reflection of their poor socioeconomic circumstances (Wood *et al*., 2000). A South Africa population study showed that TB was associated with lower individual household and community level, socioeconomic status. Low level of personal education, unemployment, and low level of household wealth were associated with development of TB (Harling *et al*., 2008). This analysis showed alcohol abuse, cigarette smoking and low body mass index (BMI less than 18.5) each is independently risk

factor for TB in South Africa. The hypothesis for alcohol consumption and cigarette smoking to be risk factor is that in addition to their biological effects, they may be proxies for frequenting locations that put one at raised risk of close contact with infectious individuals, such as neighborhood bars (Harling *et al*., 2008).

Advanced HIV disease on WHO clinical stages III and IV and increased erythrocyte sedimentation rate (ESR greater than 75mm/hour) were shown to be independently associated with risk of developing TB (Wood *et al.*, 2000). The multidrug resistant tuberculosis (MDR-TB), largely caused by non-adherence of drug regimens, is further aggravated the problem. According to the world health organization (WHO) report of 2009, the TB treatment success rate in 2006 was 67%, with 12% defaulting treatment and 9% failing it. The number of laboratory confirmed cases of MDR-TB more than tripled from 2,000 cases in 2005 to 7350 in 2007. Among all the TB cases, 1.8% was MDR-TB, and among the previously treated TB cases, MDR-TB comprised 6.7%. Since 2007 South Africa has increasingly reported patients with extensively drug resistant tuberculosis (XDR-TB), and the actual reported XDR-TB had increased from 74 in 2004 to 536 in 2007 (WHO**,** 2009). From 2004-2008 more than 24,000 cases of MDR-TB diagnosed, of which 7% infected with XDR-TB (Kapp, 2009). The combination of drug resistant TB and HIV infection is especially dangerous because the weakened immune system of HIV infected persons make them more vulnerable to TB and more difficult to treat (Koening, 2008**).**

2.1.5 Global tuberculosis control

The aim of TB control is to reduce transmission, morbidity, mortality of the disease, and preventing the development of drug resistance strains of Tuberculosis. The essential strategies to control TB include preventing the infection, stopping the progression from latent to active TB, treating the active disease (Raviglione, 2010), and prior to the development of anti-TB drugs. However, TB control focused mainly on prevention (Daniel, 2010). The discovery of anti TB drugs in the 1940s revolutionalised TB control and since 1950s, truly effective public health measures became possible with treatment to cure the disease as a global goal of TB control (Daniel, 2006). Initially, treatment consisted of a standard 18 months regime with a combination of anti TB drugs. This subsequently reduced to 6 months duration following the development of improved anti-TB drugs in the 1970s (Daniel, 2006).

Because of improved living conditions and availability of anti TB drugs, TB control became effective in most industrialized countries. Subsequently, TB slipped from the international agenda and effective control became the responsibility of each country. The emergency of HIV in the 1980s leads to the resurgence of TB and especially MDR –TB cases globally. The WHO eventually declared TB a global emergency in 1933 (WHO, 1993) and later developed the directly observed therapy, short-course strategy in1994.

The aim of this strategy was to guide nations towards effective TB control after acknowledging that TB had been a neglected and poorly managed disease that was associated with HIV (WHO, 1994).The strategy remains the core intervention for TB control recommended by WHO globally. The strategy subsequently adopted by most WHO member states, but its scale –up was constrained by weak political commitment (Atun, 2010). This led to the launch of the stop TB initiative in 1998 after conceding that TB was a public health concern with political, social and economic dimensions.

This initiative comprised of all key partners and countries with heavy TB burdens. The stop TB partnership eventually established in 2000 as a global movement to accelerate social and political action to stop the spread of TB around the world (WHO, 2010). The partnership's goal is to eliminate TB as a public health problem and ultimately, to secure a world free of TB. In 2001, the stop TB "partnership" launched the global plan to stop TB from 2001-2005 (WHO, 2006). Building on the success of the first plan, the "stop TB partnership" launched the second plan from 2005-2015. Its targets are in line with the millennium development goals (MDGS) that aim to reduced TB prevalence and deaths to 50% by 2015 compared to the 1990 levels (WHO, 2006). In addition to expanding and enhancing directly observed treatment short –course coverage, the second plane also covers the directly observed treatment short course plus approach, which addresses MDR-TB and provides strategies and policies for countries to implement and monitor.

2.1.6 Tuberculosis treatment approaches

Many South Africans who test positive for TB started on first line drugs while being investigated for drug resistance (Koening, 2008). XDR-TB patients are involuntarily isolated or confined to isolation wards, a move that is controversial, but it has to done as the disease poses an immediate

threat to public health (Koenig, 2008). South Africa has 100% directly observed treatment for short course implementation strategy for TB control. The strategy includes case detection through quality assured bacteriology, standardized short course (6-8 months) treatment with direct observation of doses to ensure adherence, an effective drug supply, and management, monitoring, evaluating, and allowing treatment results (WHO, 2009).

Before the implementation of directly observed treatment for short course, TB treatment was in many resource poor countries chaotic, non-standardized and poorly monitored and consequently had little epidemiological impact on the incidence of TB. Therefore, the introduction of the directly observed treatment for short course strategy has led to implements in treatment outcomes for many patients (Cox and Morrow, 2008). South Africa adopted the stop strategy launched by WHOM (Kapp, 2009). The cause of this strategy often directly observed treatment for short course. It responds to access, equality and quality constraints and adopted evidence based innovations in engaging with private health care providers, empowering affected people and communities, strength health systems and promotes research (Raviglione and Upleker, 2006).

2.2 HIV

2.2.1 Burden of HIV

Despite enhanced global efforts to curtail the HIV/AIDS epidemic, 2.5 million new HIV infections occurred globally in 2009. Although the overall incidence has fallen by more than 25% between 2001 and 2009 in 33 countries, 22 of which were in sub-Saharan Africa, the continent continues to bear the overwhelming brunt of the infection. An estimated 1.8 million new infections (almost 70% of the global cases), were recorded in sub –Sahara Africa in 2009 (UNAIDS, 2010). Despite the significant decrease in the number of new infections globally, the number of people living with HIV/AIDS (PLWHA) continues to rise. At the end of 2009, there were 33.3 million PLWHA; sub-Sahara Africa bore the majority of this global burden with 22.5 million cases (68%) (UNAIDS, 2010).Globally, the number of AIDS- related deaths have also declined steadily after the peak in 2004 (2.1 million) to an estimated 1.8 million in 2009. These figures above are explained by the increasing availability of anti-retroviral therapy (ART), and HIV care/ support services especially in low and middle income countries (UNAIDS, 2010).

2.2.2 Risk factors for HIV

Multiple sexual partners, early sex debut, unprotected sex, intergenerational sex particularly younger females having sex with older males were shown to contribute to the spread of HIV (Katz and Lower-Beer, 2008). In South Africa, the most at risk populations were include, African females aged 20-34, African males' aged 25-49; males aged above 50, men who have sex with men, and peoples who use drugs for recreational purposes are affect mostly (Shisana *et al*., 2009).

2.2.3 Global HIV control

HIV was first reported in the united states in 1981, and the virus was later isolated in 1983. By 1985, more than 17,000 cases of AIDS from 71 countries had reported to WHOM (Merson, 2008). Since the virus recognized the response to HIV /AIDS has developed in four phases: from danger to alerted, to a problem of individual behavior, to a socially contextualized behavioral issue, and finally to a human rights-linked challenges (Mann, 1998). Due to the initial lack of knowledge about the modes of spread and difficulty in diagnosis during the early stages of the infection, emphasis rather placed on warning the public about the "danger" of the infection (Mann, 1998). When the modes of transmission and diagnosis identified, specific risk- reduction programs designed to change individual behaviors. The focus was mainly on information, education and communication about HIV/AIDS and providing counseling and testing and distribution of condoms. Later on, in the epidemic, it recognized that socio-economic, political and cultural factors including gender in equality, poverty and marginalization of specific groups of population were associated with HIV/ADIS (Merson, 2008). Despite this increasing knowledge about the infection, there was lack of a coherent response from nations to address the infection (Merson, 2008).

Nonetheless, its rapid spread and the global threat it posed prompted the WHO to launch the global programme on AIDS (GPA) in 1987, which tasked with supporting and strengthening national AIDS programs and providing global leadership (Mann, 1991). In that same year, the world health assembly declared HIV a "worldwide emergency" that required urgent and globally

directed action. The human rights framework later championed by GPA to analyses and address individual and societal factors including discrimination and other human rights violations directed towards PLWHA, and also to protect at risk and vulnerable populations to HIV. Because of GPA lack the ability to engage the required political response from both affected and donor countries, and because of the rivalries between other United Nations (UN) agencies and HIV/AIDS experts regarding priority on HIV prevention issue (Merson, 2006).

The joint United Nations program on HIV/AIDS (UNAIDS) was established in 1996 to replace GPA this new body given the mandate to lead an expanded, coordinated, and multi-sectorial global response in 1996. ART became available, as the standard of care, through its access was initially limited mainly to developed nations. This increasing global threat of HIV/AIDS generated more coordinated and enhanced approaches with in the global community. In Africa, the situation was referred to as a "state of emergency" and led to the Abuja Declaration (OAU, 2001), where, Africa union member states committed themselves to allocate at least 15% of the health sector budget to tackle HIV/AIDS, TB and other related infectious diseases. In that same year, the UN convened a General Assembly Special Session on HIV/AIDS (UNGASS) where political leaders adopted a declaration of commitment, setting up targets for affected countries and funding level for donor governments (OAU, 2001).

The global fund to fight AIDS, TB and malaria was subsequently established in 2002 as a public/private partnership which sources for funds and provides money to supports countries in preventing and treating HIV/AIDS,TB and malaria (Global fund, 2011). The united states government also announced the president's emergency plan for AIDS relief (PEPFAR) in 2003 which then has provided funds for preventive, community outreach, and prevention of mother-to-child transmission (PMTCT) of HIV activities, and increased access to ART in 15 countries (Merson, 1998).

The fight against HIV/AID has continued to receive global support since it is regarding as part of the commitments to achieve global health goals at highlighted in the MDGs. Since WHO launched the "treat 3 million by 2005" initiative in 2003 to scale up ART to PLWHA in developing countries, the number of PLWHA on ART has increased steadily (WHO, 2003). This increased coverage prompted the commitment to scale up universal access to HIV prevention, treatment, care and support services (WHO, 2010). At the end of 2009, an estimated 5.2 million

people were on ART in low and in middle-income countries that represented a 30% increase compared to the previous year. In Sub-Sahara Africa, almost 37% of all eligible patients were on treatment in the region. However, there were regional variations with some countries like Botswana, Namibia and Rwanda achieving 80% to coverage (UNAID, 2010).

The incidence of new HIV infections has declined globally, with much of this decline partly attributed to behavioral change including increased condom, use delayed sexual debut and reduction in multiple partnerships (UNAIDS, 2010). Since it is estimated that only 22% of all AIDS spending in 106 low and middle countries is on prevention (UNAIDS, 2010), much efforts is still needed in scaling –up HIV preventive strategies as it has been questioned "if we can only treat our way out of HIV '' (Johnston, 2010).

2.3 TB-HIV co-infection

2.3.1. Epidemiology of TB-HIV co-infection

HIV causes new TB infections to progress rapidly to the active disease (Daley, 1992). In addition, it is the most power full risk factor for reactivation of latent TB infection (LTBI). It has been shown that people with LTBI infection and co-infected with HIV have a higher risk (>20 times) of developing active TB with increasing immunosuppression compared to HIV-negative people (Announce, 1995). The risk for TB in PLWHA compared to the general population is 20-37 times higher depending on the HIV prevalence in the population (WHO, 2010). In this regard, TB is the most common opportunistic infection in PLWHA, with approximately 30% of PLWHA said co-infected with TB, usually LTBI globally (Getahun, 2010). In addition to the adverse effect of HIV on TB, an adverse effect of TB is suggested by studies which show that the host immune response to *Mycobacterium tuberculosis*, the causative agent of TB enhance HIV replication in vivo (Goletti, 1996) and in vitro models (Toossi, 2001) which may accelerate the natural progression of HIV infection. TB is also the commonest cause of morbidity and mortality in PLWHA in Africa and significant cause globally (Raviglione, 2010). It is also documented that PLWHA, and co-infected with active TB have higher early mortality compared to those without TB (Badri, 2001).

2.3.2 The burden of TB-HIV co-infection

Mycobacterium tuberculosis and atypical *mycobactrial* infections are very common in individuals who are immunocompromised because of HIV infection (Karstaedt *et al*., 2001**).** The TB-HIV co-infection rate in South Africa was high, and according to WHO report of 2009, an estimated 73 % of new TB patients co-infected with HIV. An estimated 32% of all TB-HIV co-infection cases in Africa were in South Africa. Mortality rates were 38 and 193 deaths per 100,000 population in HIV negative and HIV positive people respectively (WHO, 2009). The HIV and TB co-infection at a public hospital in Johannesburg found to be 95% **(**John *et al.*, 2007).

2.3.3 Effect of TB on TB- HIV/AIDS co-infection

A study conducted from February to April 2009 in selected hospitals (Adama, Nekemte and Jimma) in Oromia regional state, Ethiopia. The study consisted of 467 HIV patients and 124 TB-HIV co-infected patients. The objective of the study was to assess the quality of life of TB-HIV co-infected patients. The result obtained suggested that TB-HIV co-infected patients had lower quality of life in all domains as compared to HIV infected patients without active TB. In co-infected patients, individuals who had depression were 8.8 times more likely to have poor physical health as compared to individuals who had no depression, with odd ratio [(OR)=8.8 (95 CI:3.2, 23)]. Self-stigma or being discriminated was associated with a poor quality of life in the psychological domain (Deribew *et al*., 2009). Another cross sectional study was done in three Oromia regional state hospitals (Adama, Nekemte and Jimma), Ethiopia from February to April 2009. The study consisted of 155 TB-HIV co-infected and 465 non co-infected HIV patients. The aim of the study was to investigate the relationship between TB-HIV co-infection and common mental disorders (CMD). The study compared the occurrence of CMD in TB-HIV co-infected and non-co-infected HIV patients. The result obtained by using logistic regression showed that TB-HIV co-infected patients had significantly (p value-0.001) greater risk of CMD (63.7%) than the non-co-infected patients (46.7%) did [OR=1.7, (95 CI: 1.0, 2.9) (Deribew *et al*., 2010**)**.

A Meta-analysis of cohort studies conducted by selected relevant articles. The purpose was to assess the effect of TB mortality in people living with HIV. Pooled overall analysis of fifteen

studies estimating the effect of tuberculosis on mortality in PLWHIV has a hazard ratio (HR) of 1.8 (95 CI: 1.8-3.6) that indicated the impact of TB on HIV in co-infection (Straetemans *et al*., 2010). In Thailand, a team of physician conducted a prospective observational study and described the cause of death of patients living with HIV who have tuberculosis, after reviewing the verbal interviews of family members about event preceding death, laboratory data, and medical records. The result of the study indicated that 849 HIV infected, TB enrolled, 142 (17%) died, of which the cause of death was TB for 38 patients or 27% (Kevi *et al*., 2009**).**

A study conducted by employing logistic regression analysis to assess the clinical presentation and prevalence of TB-HIV co-infection among patients admitted at Muhimbili National Hospital in Dare Selaam, Tanzania between the year August 2008 and July 2009. Of the 300 TB patients tested for HIV, 175 (58.3%) were HIV infected and 97 (55.4%) of these on antiretroviral therapy (ART) at the time of admission. Overall, 104 (26.9%) of the TB patients admitted died. About two third of patients who died had PTB. There were significantly proportions of death among HIV infected TB patients (29.1% versus 15.2%) than in the HIV uninfected TB patients (p=0.005) (Kamenju and Abound, 2011**).**

A prospective cohort study conducted on adult (≥18 years of age) HIV infected patients attending two HIV clinics affiliated to the University of Cape Town (New Somerset and Groote Hospitals), South Africa. The study cohort consisted of 609 patients with 158 (25.9%) case of TB patients whose initial clinic visit was between 1992 and 1996. The objective of the study was to assess the impact of TB on the progression of HIV to AIDS and then to death in areas with high TB prevalence. Cox regression models fitted to determine the unadjusted risk of death associated with TB and adjusted to confounding variables. Other factors associated to the progression of AIDS were $CD4^+$ T-lymphocyte counts ≤ 200 cells/mm^3. Of the 609 patients, 105 (17%) died over the 5-years period: 50/158 (31.7%) TB cases and 55/451 (11.7%) in the comparison groups were have no TB (Kamenju and Abound, 2011**)**.

The Kaplan- Meier survival probability of TB cases was consistently less than that of the comparison group (69% vs. 92% at 1 year, p<0.0001; 49% vs. 82% at 2 years, p, 0.0001; and 28% vs. 64% at 3 years, p, 0.0001). The multivariate Cox proportional hazards regression revealed that after controlling for differences in baseline characteristics and known predictor of

mortality in HIV infection, TB conferred an independent risk of death in HIV infected patients. The association of TB with increased mortality persisted after removing the transient reduction in $CD4^+$ T-lymphocytes count that may have induced by TB (HR=1.90, 95% CI 1.16-3.1; p<0.01) (Badri *et al*., 2001).

2.3.4 Effect of ART on TB-HIV co-infection

The convergence of HIV and TB pandemics continue to be collectively the leading cause of morbidity and mortality worldwide. Highly active antiretroviral therapy (HAART) has been critical effect in combating the morbidity and mortality by TB-HIV co-infection worldwide. A retrospective cohort study conducted among HIV infected patients with TB between January 2000 and December 2004 in Thailand. The objective of the study was to establish the impact of antiretroviral therapy (ART) on survival of patients co-infected with HIV and TB. Patients were categorized in to ART+ group (received ART) and ART – group (did not receive ART) and were follow until April 2005, 1003 patients were identified; 411 in ART+ group and 592 in ART – group. The result indicated that based on the log –rank test the survival rates at 1, 2 and 3 years after TB diagnosis were 96.1%, 94.0%, and 87.7% for ART+ group and 44.4%, 19.2% and 9.3%for ART-group (p<0.001). From the study, it concluded that antiretroviral therapy substantially reduce mortality rate among TB-HIV co-infected patients (Weerawat *et al*., 2006**).**

In another study conducted in Thailand, the impact of ART on survival of HIV-infected TB patients was measured using propensity score analysis that adjusted for factors associated with receiving ART. The aim of the study was to document the impact of ART on HIV infected TB patients in public programs in resources limited settings. The study consisted of 626 TB patients who started ART and 643 who did not started ART. The result showed that out of 626 HIV infected TB patients who started ART during TB treatment, 68 (11%) died compared with 295 (46%) patients who did not receive ART (relative risk 0.24, 95% CI: 0.19 to 0.30). In patients with very low $CD4^+$ count (<10), 12 patients out of 56 (21%) who received ART died compared with 35 out of 43 (81%) who did not receive ART (relative risk 0.26, 95% CI: 0.16 to 0.44). After controlling for propensity to receive ART the hazard ratio of death among patients treated with ART was 0.17 (95% CI: 0.12 to 0.24), (Natpatou *et al*., 2008**).**

A retrospective cohort study also conducted on HIV patients who developed TB from January 1995 to December 2000 in Peruvian HIV reference center, Peru. The patients tracked for 24 months after TB diagnosis. One hundred patients were included in the study. The aim of the study was to estimate the survival of the TB-HIV co-infected patients and the effect of ART on mortality. Survival was estimated using Kaplan-meier method and the effect of ART on survival evaluated using Cox proportional hazards models. Out of the study population 53%, patients who received some form of ART: 31 mono/dual ART and 22 highly active antiretroviral therapies (HAART). The study showed that 77% (36/47) of patients died in the no ART group, 65% (20/31) in the mono/dual ART group, and 27% (6/22) in the HAART group (p=0.0001). Multivariable analysis revealed a reduction in the risk of death of 70% [HR: 0.3, 95% CI 0.1-0.6] among mono/dual ART group patients, and 90% [HR: 0.1, 95% CI 0.06-0.4] among patients who received HAART as compared to those in the no ART control group. The study suggested that patients with TB and HIV who did not receive ART have shorter survival; survival significantly improved with the addition of ART. The risk of death reduced due to mono/dual ART and HAART (Jaime *et al.*, 2010).

In the context of treatment with medications, adherence is defined as patient's ability to follow a treatment plan, take medications at prescribed times and frequencies, and follow restrictions regarding food and other medications (WHO, 2003). Adherence is primary determinant of the effectiveness of HAART treatment. It also considered as the major predictor of individuals living with HIV/AIDS. More than 95% adherence is required in HAART in order to prevent the emergence of resistant viral strains. In practice, this degree of adherence requires a patient on a twice-daily regimen to not miss or substantially delay more than three doses of antiretroviral medications per month (NCASC, 2009). Adherence to antiretroviral therapy (ART) has been strongly correlated with HIV durable viral suppression, reduced destruction of $CD4^+$ cells, reduced rates of resistance, increased in survival, and improved quality of life and also contributed to reduce the risk of Tb intentions (Chesney, 2006**)**.

There are various factors affecting adherence, which generally are related to characteristics of the patient (label of awareness about the disease mechanism of transmission and control), the regimen (patients allowed to use drugs in their life span), the clinical setting (availability of drugs for the disease), the society and the relationship between the service provider and the

patient (Chesney, 2006). Presently, poor adherence to treatment regimen remains a major obstacle in the fight against HIV/AIDS (Erah and Arute, 2008**)**. Without proper treatment and prophylaxis, HIV/AIDS presents a significant challenge to global tuberculosis (TB) control. Whereas, TB is a leading preventable cause of death among people living with HIV and it is estimated that without proper treatment, the life time risk of developing active tuberculosis among the people living with HIV is 30 times as compared to the people without HIV (UNAIDS, 2011).

HAART strongly correlated with HIV durable viral suppression, induced destruction of $CD4^+$ cells, increased in survival, to improve the quality of life and contributed to reduce the risk of TB intention **(**Chesney, 2006**).** The availability of antiretroviral treatment (ART) has reduces the rate of disease prognosis and death dramatically as well as improved quality of life for HIV/AIDS patients. However, increased access to ART accompanied by increasing unsatisfactory adherence levels and the potential risk of drug resistance. Maintaining an optimal adherence level of HAART levels for long term poses a significant challenge for both patients and health care providers (Wang and Wuz, 2007). Suboptimal treatment can lead to drug failure with latter resulting in spread of drug resistant mutation. Consequently, it can create dangerous public health situation and decrease the success of available HIV treatment (Molasiotis *et al*., 2002**).** Moreover, if people living with HIV required second line treatment, it can be ten times more expensive than first line drugs. It also leads to increased hospitalization rate, increased the cost of health care, effects on human resources productivity, disruption of family and communities and morbidity and mortality in developing countries (Steel *et al.,* 2007).

2.3.5 TB-HIV co- infection treatment approaches

Antiretroviral (ARV) therapy reduce the incidence of TB in HIV infected patients by more than 80% (Badri *et al.,* 2002).Both anti TB treatment and ARVs are indispensable in the management of patients with TB-HIV co-infection (Sharma *et al.,* 2005). The key therapeutic principles underlying the treatment of TB-HIV are treatment of TB always takes precedence over treatment of HIV infection. In patients who are already on ARVs, the same has continued with appropriate modifications both in ARVs and in anti-TB treatment. In patients not receiving ARVs, the need for and timing of initiation of ARVs have to decided after assessing the short term risk of disease

progression and death, based on $CD4^+$ cell count and type of TB, on individual basis (Sharma *et al.*, 2005).

There is an addictive risk of side effects and drug toxicity when ARVs and anti TB drugs are administered together. The common side effects include nausea, hepatitis, peripheral neuropathy and rash and this side effect may make adherence to treatment difficult (Cohen and Maartens, 2004). Patients with advanced TB-HIV co-infected commonly develop immune reconstitution illness when ARVs are commenced (Cohen and Maartens, 2004).

2.4 Bridging the gap between TB and HIV control

During the early stages of HIV, epidemic (1980s) researches had heralded the association between TB and HIV/AIDS and the devastating impact of the co- epidemic. However, there were marginal coordinated responses between TB and HIV programs globally to curb the associated morbidity and mortality. This was despite the alarming increase in the incidence of TB cases especially in high HIV-prevalent countries that were sometimes implementing good quality directly observed treatment, short –course programs (Getahun, 2010).

It was not until 1989 that WHO set the stage to discuss modalities for controlling both epidemics. It was concluded that countries with poor TB-control programs (mostly countries with increasing HIV prevalence) should give priorities improving TB treatment and cure through directly observed treatment, short-course (Getahun, 2010). After a decade of almost no action finally in 1997, the first steps towards exploring TB and HIV collaborative service delivery were piloted by WHO at the sub- district level in three Sub-Sahara Africa countries (Malawi, south Africa and Zambia); (WHO, 2004).

The objective of the project (pro TEST initiative) was to promote testing for HIV using voluntary counseling and testing (VCT) as an entry point to access a range of interventions aimed at decreasing the burden of HIV –related TB. The project demonstrated that TB and HIV programs could collaborate in service delivery at both the sub-district and national levels (WHO, 2004). The lessons learned from this projects prompted calls from participants at the "global directly observed treatment, short course expansion meeting" in Cairo, Egypt in 2000 for the creation of the Global TB/HIV working group (WHO, 2010).

In 2001, WHO form coordinated working groups at the member of global TB partnership. Its goal was to reduce the burden of TB in high HIV prevalent population (WHO, 2001). The group was instrumental in developing guidelines and strategy (WHO, 2003) and an interim policy in 2004 (WHO, 2007) towards TB and HIV collaborative activities. The term collaboration and integration have used interchangeably in relation to implementing joint TB and HIV control activities. However, collaboration implies that TB and HIV programmed work done together on set of activities in order to achieve certain goals or objectives. While integration infers that TB and HIV control programs brought under the responsibility incorporated and blended in to the general health services (Wang, 2007).

Therefore, the term collaboration better reflects the intention of the interim policy. The recommended activities carried out under the collaboration as part of the health sector response to the epidemic are: establish the mechanisms for collaboration, decrease the burden of TB in PLWHA, and decrease the burden of HIV in TB patients with providing HIV testing and counseling and introduce HIV prevention methods via anti- retroviral therapy (WHO, 2004).

3. RESEARCH METHODS AND MATERIALS

3.1 Study Area

This research was carried out at Debre Elias Health Center in Debre Elias Woreda located at North West Ethiopia, which is 342 km away from Addis Ababa in North West direction, 257 km away from Bihar Dare in South East direction and 42 km away from Debre Markos Town in South West direction. The health center provides health service for 15 tributary rural Keble and 3 tributary developing Keble Town which have 99,259 peoples who live in Debre Elias Woreda administration, of which 49,213 (49.6%) is males and 50,046 (50.4%) is females (Debre Elias Woreda Agriculture and Rural Development Office, 2011). The health center opened and started DOTS services in 2010 under the National Tuberculosis and Leprosy Program of Ethiopia. Gozamin bound Debre Elias Woreda and its Town in the east, Denbecha in the west, Machacle in north, and Oromia region East Wolega in the south direction. The Town has 85% level land, 4% mountainous, 0.5% plateaus, 1.5% vallious, and 9% up and down geographical features. It has 51.29% kola and 48.1% woyina dega weather; > 1500 ml average annual rainfall. It known with wheat, maize, teff, nug and other cultivated crops. It is the home of many heritages; such as, Debre Genet Elias Church, Sellase Monastery, Yeaba Fakie Mekabr and Mushra dingay are some of them.

Karta of Debre Elias Woreda and its Town with the health center are present below:

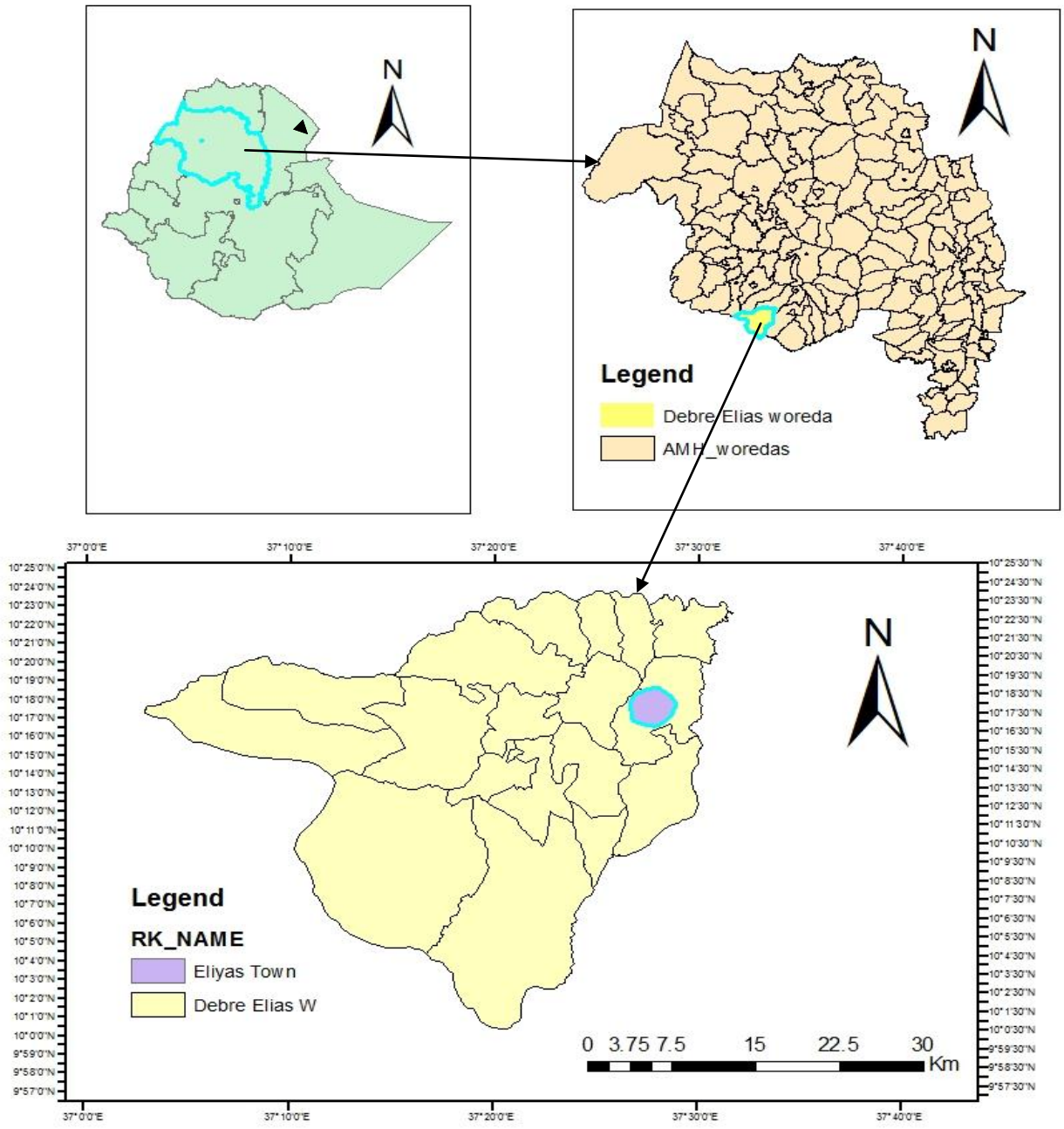

Figure 1 Location of the study area

3.2 Study population

The study population included all TB, HIV/AIDS and TB-HIV/AIDS co-infected patients who attended Debre Elias Health Center from September1, 2010-January 30, 2017 (n=2348).

3.3 Study period

The study carried out from September 2016-June 20017.

3.4 Study design/Sample size

The research done, using a retrospective study in Debre Elias Health Center, East Gojjam, Ethiopia. Retrospective study is a kind of study based on data with socio demographic characteristics such as, sex, age, residence, marital status, educational status and occupational status etc., recorded on Standard National Medical Registry, which have adopted by the ministry of health (MOH). In medical sense these are called ‘‘chart reviews’’ because of the data sources, which are medical records recorded for reasons rather than research. From the whole 2348 TB, HIV/AIDS and TB-HIV co-infected patients 620 TB-HIV/AIDS co-infected patients selected as the sample size to this study by purposive sampling technique based on 95% confidence level and 5% margin of error.

3.5 Study sampling technique and procedure

From 2348 TB, HIV/AIDS, and TB-HIV/AIDS diseases related patients records on the Standard National Medical Registry, 620 TB-HIV/AIDS co-infected patients with socio-demographic characteristics recorded from September 1, 2010 - January 30, 2017 in Debre Elias Health Center selected as sample size for this study by purposive sampling method (document review).

3.6 Inclusion and Exclusion criteria

All ages of TB-HIV, co-infected patients who tested in Debre Elias Health Center with complete socio-demographic clinical data such as, age, sex, marital status, educational status, occupational status, and residence included in this study. However, TB-HIV co-infected patients whose data missed and who had TB-HIV negative test not included in this study.

3.7 Data collection

For this study, data with full socio-demographic characteristics collected retrospectively from Standard National Medical Registry given by ministry of health (MOH) to Debre Elias Health Center in Debre Elias Town East Gojjam Zone Amhara Regional, State Ethiopia. Although the Health Center has no separate TB and HIV clinic unit it could give TB and HIV test services in the same unit for clients came from more than 11 tributary kebeles in Debre Elias Woreda started from September 1, 2010–January 30, 2017. The Health Center now has 1368 HIV patients alone, 360 TB patients alone, and 620 TB-HIV/AIDS co-infected patients. From these 2348, TB and HIV related patients, TB-HIV co-infected patients were the main concern of this study. Among collected data, being TB-HIV co-infected or not was dependent variable on socio-demographic characteristics, sex, age, educational status, marital status, occupational status and residence that were independent variables. Pen, exercise book and mobile phone used to collect necessary data for this research.

3.8 Data analysis

Collected data from the documentation center first checked manually and then it entered into computer to analyze by using the Statistical Package for Social Science (SPSS) version 20 software. The statistical model crosstab chi-square (x^2) used to determine the p-value less than 0.05 was statistically significant for the study. Results displayed in Table and figure based on percentage, chi-square, d.f, and p-value gained.

3.9 Ethical clearance

Ethical clearance obtained from the ethical committee of the college of natural science of Addis Ababa University. I gave to Debre Elias Health Center administration, and then the Health Center director gave me permission to proceeded data gathering. The Health Center director informed the Health Center worker participants about aim, methods, and benefits of the study and they assured of their rights to stop their participation when they feel uncomfortable.

3.10 Operational definitions

Retrospective study

Chart review

Inclusion

TB-HIV co-infected patients who were involved in the sample to this study

Exclusion

TB-HIV co-infected patients who were not involved in the sample to this study

Literate

TB-HIV co-infected patients who were learn in the school

Illiterate

TB-HIV co-infected patients who were not learn in the school

Ethical clearance

It is approval that given for somebody to do something before real application

4. RESULTS AND DISCUSSION

4.1 Socio Demographic Characteristics of TB - HIV Co – Infected Patients

Table 1: Socio-demographic characteristics of TB-HIV co-infected patients at Debre Elias Health Center from September 1, 2010- January 30, 2017 (n= 620) and their co-relation with TB-HIV/AIDS diseases as risk factors.

Socio-demographic Characteristics	Frequency	Percent	Chi-square	D.f	P-value
Sex					
Male	247	39.8	13.836	3	0.003
Female	373	60.2			
Age					
0-15	123	19.8	1.020	9	0.000
16-30	206	33.2			
31-45	191	30.8			
>45	100	16.1			
Marital status					
Single	306	49.4	6.082	6	0.000
Married	201	32.4			
Divorced	113	18.2			
Educational status					
Literate	394	63.5	5.509	3	0.000
Illiterate	226	36.5			
Occupational status					
Governmental employed	155	25	6.590	6	0.000
Private employed	160	25.8			
Others	305	49.2			
Residence					
Urban	323	52.1	4.581	3	0.000
Rural	297	47.9			

From 620 TB-HIV co-infected patients 247 (39.8%) were males and the rest 373 (60.2%) were females (Table 1). Percentage prevalence of TB-HIV/AIDS co-infected females were more than males, because of, they used their body as sources of income generation and more vulnerable to HIV/AIDS disease together with opportunistic diseases like TB than males by nature, low fitness and using female condom is not easy (UNESCO, 2014). According to ages sample patients were grouped in to four categories 123 (19.8%) of TB-HIV/AIDS co-infected patients were found between 0-15 years old, 208 (33.5%) were between 16-30 years old, 191 (30.8%) were between 31-45 years old and 98 (15.8%) were above 45 years old. Their high sexual activity make individuals more infected with HIV in age group of 16-30 years old, these supported by similar study done in Uganda country 35% more HIV infected individuals recorded in age group of 15-25 years old (UNAIDS (c), 2016). In relation to their marital status 306 (49.4%) of them were single due to they have high chance of joining many sexual partner, 201 (32.4%) were married since they had more than 1 wives with low faithful relationship, and the remaining 113 (18.2%) were divorced (Table.1). With the perspective of educational status of TB-HIV co-infected patients 394 (63.5%) were literate because of they had experience to check themselves for knowing themselves as well as to live alone or to live together and 226 (36.5%) were illiterate individuals, because, have low knowhow of checking themselves. Of these patients 155 (25%) were governmental employed, 160 (25.8%) of them private employed and the remaining 305 (49.2%) had other occupations due to the presence of enough fertile highland or Dega land and virgin desert land to engage most peoples in agriculture, raring animals honey bee, hen, and in country trade deriving car handcraft etc (Table 1). As the residence of patients showed that 323 (52.1%) were urban and 297 (47.9%) of TB-HIV/AIDS infected individuals were rural. Generally, (Table 1) showed that the prevalence of TB-HIV/AIDS co-infected patients were more distributed in females (60.2%), in age group 16-30 (33.5%), in single (49.4%), in literate (63.5%), in other workers (49.2%), and (52.1%) in urban dwellers in relation to different socio-demographic characteristics such as sex, age, marital status, educational status, occupational status and residence respectively. This result was almost agreed with similar study done at Arba Minch General Hospital age 25-34 (47.4%), married (64.7%), females (58.1%), (Mulugeta, and Alemu, 2015). Females are more vulnerable to HIV than males because of their biological make up, and social and cultural factors (UNESCO, 2014). In some literatures, married individuals more infected by TB-HIV concomitant diseases, as the result of overcrowding is good for the

transmission of TB disease. There was statistically significant correlation between the prevalence of TB-HIV/AIDS co-infection diseases and sex (p=0.003), because the two diseases more affected females than males and age (p=0.000), because it is well known that TB and HIV/AIDS diseases affect the reproductive age group of the population (WHO, 2014). Based on marital status (p=0.000) was statistically significant due to these diseases affected males and females with many sexual partners, since, they have no constant wife and husband respectively. It was the same for educational status (p=0.000) as those diseases more affected literate individuals, and residence (p=0.000) as the diseases more affected urban individuals at the study area. These two chronic diseases had also statistically significant association with occupational status (p=0.000) because, p-value <0.05 was statistically significant for this study.

P-value is the amount of error to <5% and >95% confidence level about the sampled data is significant for natural science researches like to this.

4.2 Comparison of TB-HIV Co-Infected Male and Female Patients at The Study Area Based on Age (n=620).

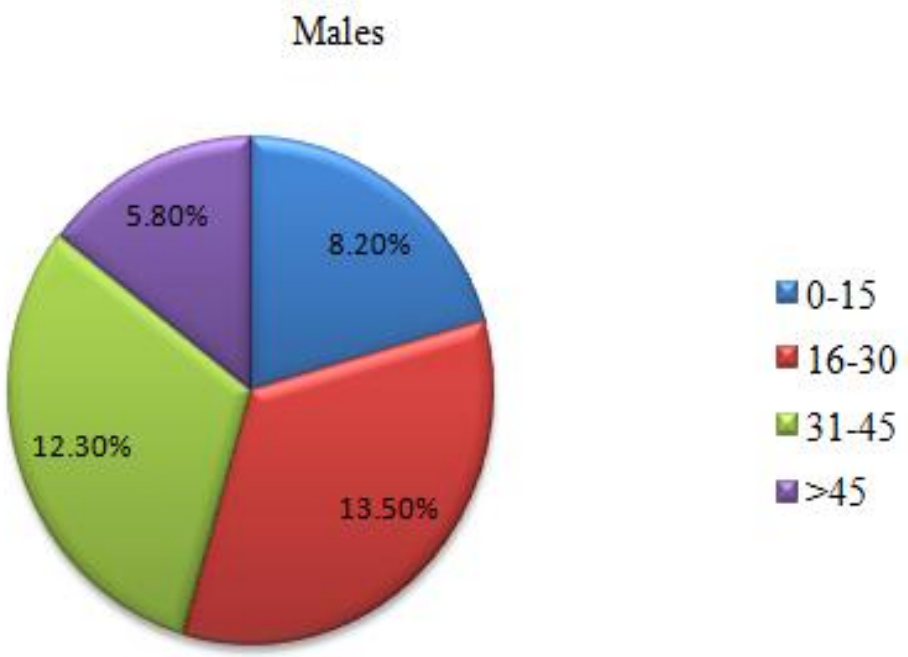

Figure 2: Percentage of TB-HIV Co-Infected Male Patients Based on Age (n=247)

The above figure showed that the percentage prevalence of TB-HIV co-patient male attended Debre Elias Health Center from September 1, 2010-January 30, 2017 based on age. As it showed the percentage prevalence of TB-HIV co-infected patients based on age group were; 8.20% in age group of 0-15 years old, 13.50% in age group of 16-30 years old, 12.30% in age group of 31-45 years old and 5.80% in age group of >45 years old. Relatively high TB-HIV co-infection percentage prevalence recorded on age group 16-30 years old than the rest age groups; because, age group 16-30 years old is fire age to sexual meeting; these agreed with similar study done in Uganda country (19.7%) individuals in age group of 15-25 years old which was more infected with HIV/AIDS (UAC, 2014). As UNAIDS (C) (2016) also studied 35% individuals who were within 15-24 years old infected with HIV more than the rest age groups.

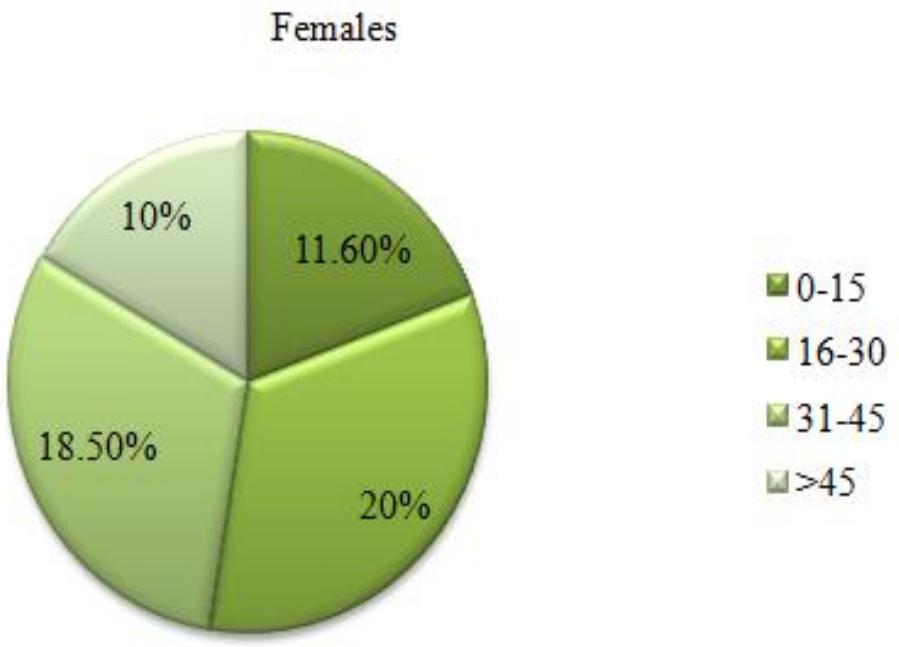

Figure 3: Percentage of TB-HIV Co-Infected Female Patients Based on Age (n=373**)**

As figure 3 showed that, the TB-HIV co-infected patients percentage prevalence of females attended Debre Elias Health Center from September 1, 2010-January 30, 2017 based on age groups were; 11.60% in age group of 0-15 years old, 20% in age grup of 16-30, 18.50% in age group of 31-45years old, and 10% in age group of >45 years old. Age group 16-30 years old have higher TB-HIV co-infcted patients percentage prevalence than the rest age groups listed above at the figure; because of, age group 16-30 is sexually active age which agreed with similar study done in Uganda country individuals in age group of 15-25 years old more infected with HIV/AIDS (UAC, 2014). As (UNAIDS (C), 2016), also studied 35% individuals who were found within 15-24 years old infected with HIV more than the rest age groups

Generally when I compared males and females who were TB-HIV co-infected patients each other with the same age groups;0-15 years old, 16-30 years old, 31-45 years old, and >45 years old :females were more vulnerable to TB-HIV co-infection than males by percentage of (8.20%: 11.60%), (13.50%: 20%), (12.30%: 18.50%), and (5.80%: 10%) respetivelly for age groups and (males:females) (figure 2 and 3). These phenomenon was due to their biological make up, and social and cultural factors (UNESCO, 2014). As UNESCO studied in 2014, 44% women and 42% men infected with HIV/AIDS disease.

Table 2: Socio-demographic characteristic comparison among TB-HIV co-infected patients and only TB infected patients at the study area (n=980)

Socio-demographic characters	TB-HIV co-patients frequency	TB-HIV co-patients percent	TB patients frequency	TB patients percent
Sex				
Males	247	25.2	121	12.3
Females	373	38.1	239	24.4
Age				
0-15	123	12.6	67	6.8
16-30	206	21	113	11.5
31-45	191	19.5	91	9.3
>45	100	10.2	89	9.1
Marital Status				
Single	306	31.2	111	11.3
Married	201	20.5	158	16.1
Divorced	113	11.5	91	9.3
Educational Status				
Literate	394	40.2	231	23.6
Illiterate	226	23.1	129	13.1
Occupational Status				
Governmental	155	15.8	95	9.7
Private Employed	160	16.3	106	10.8
Other workers	305	31.1	159	16.2
Residence				
Urban	323	33	207	21.1
Rural	297	30.3	153	15.6

Table 2: showed, comparison of TB-HIV/AIDS co-infected patients and TB patients' who attended at Debre Elias Health Center from September 1, 2010-January 30 2017.

With the same socio-demographic characteristics, sex, age, marital status, educational status, occupational status, and residence, the prevalence of TB on TB-HIV co-infected patients was more than the prevalence of TB on TB infected patients only at this study area. It was important to recognize the factors, which could aggravate the occurrence of TB and other opportunistic diseases. Therefore, sex, age, marital status, educational status, occupational status and residence socio-demographic characteristics are not the only risk factors for the development of TB; rather, HIV/AIDS disease is the main factor for it. The prevalence of TB-HIV co-infected patients and TB patients only respectively were; (25.2%:12.3%) males and, (38.1%:24.4%) females based on sex. Regarding to age (12.6%:6.8%) in age group 0-15 years old, (21%:11.5%) in age group 16-30 years old and (19.5%:9.3%) in age group 31-45 years old and (10.2%:9.1%) in age group of >45 years old. With perspective of marital status, (31.2%:11.3%) single, (20.5%:16.1%) married, and (11.5%:9.3%) divorced. According to educational status, (40.2%:23.6%) literate and (23.1%:13.1%) illiterate. Based on occupational status (15.8%:9.7%) governmental employed, (16.3%:10.8%) private employed, and (31.1%:16.2%) other workers, as residence (33%:21.1%) urban, and (30.3%:15.6%) rural (Table 2). Therefore, as I looked on the comparison above the main factor for more prevalence of TB in TB-HIV co-infected patients is HIV/AIDS disease virus that attacked white blood cells including T-cells and B-cells major part of natural immunity system in our body (Table 2). Because of progressive decline in immune response, these patients are extremely susceptible to variety of common as well as opportunistic infections like TB (Anant *et al*., 2012).

When our natural immunity system become weak and/ or totally destroyed different infectious diseases like TB have got good opportunity and become opportunist; that is why the prevalence of opportunist disease TB on TB-HIV co-infected patients was more than the prevalence of TB on TB patients only (Anant *et al*., 2012). According to John *et al* (2007), TB increases the progression of HIV to AIDS stage. This indicates that tuberculosis (TB) and human immunodeficiency virus (HIV) infections potentiate the deleterious effects of each other both in terms of morbidity and in terms of mortality (Getahun, 2010).

Prevalence of TB on TB-HIV co-infected and on TB infected individuals also commonly affected by; sex, age, marital status, educational status, occupational status and residence as risk factors even the prevalence difference was due to HIV/AIDS disease.

4.3 Annual Comparison of TB-HIV Co-Infected Male and Female Patients at the Study Area (n=620)

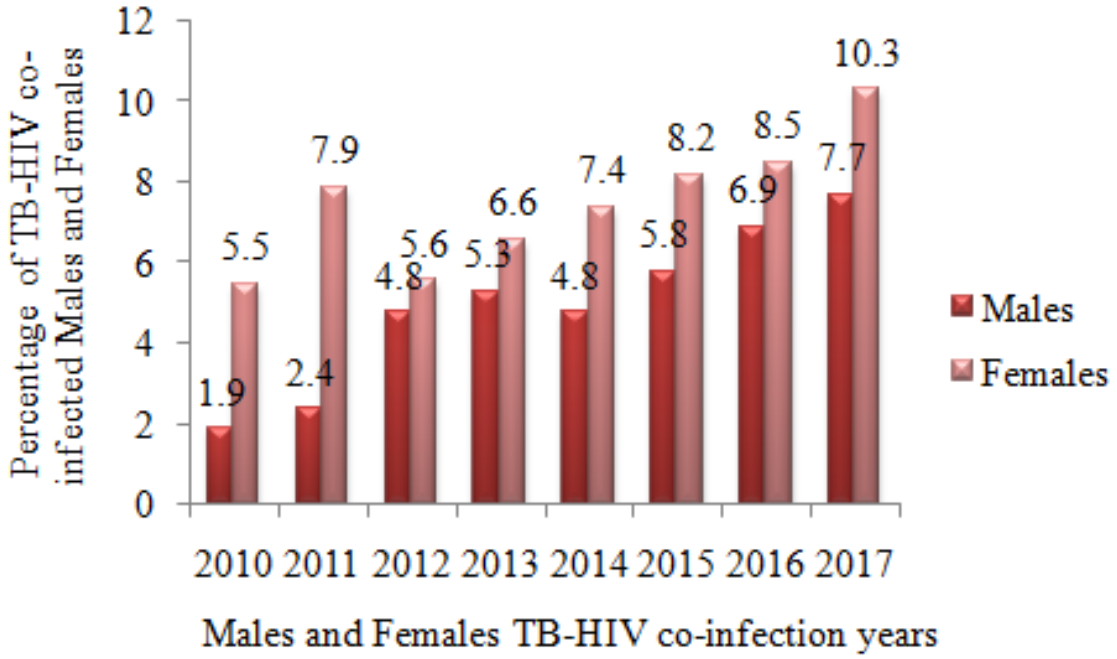

Figure 4: Annual percentage distribution of TB-HIV co-infected male and female patients from September 1, 2010-January 30, 2017 (n=620).

When I compared the percentage prevalence of TB-HIV co-infected male and female patients attended Debre Elias Health Center from September 1, 2010-January 30, 2017 in each year subsequently, more female TB-HIV co-infected patients registered than males. Because of different risk factors such as; they used their body as sources of income generation and more vulnerable to HIV/AIDS disease together with opportunistic diseases like TB than males by nature, low fitness and using female condom is not easy, work burden and lactation (UNESCO, 2014). The percentage prevalence of TB-HIV co-infection from 2010-2017 were; in 2010 (1.9%:5.5%), in 2011 (2.4%:7.9%), in 2012 (4.8%:5.6%), in 2013 (5.3%:6.6%), in 2014 (4.8%:7.4%), in 2015 (5.8%:8.2%), in 2016 (6.9%:8.5%), and in 2017 (7.7%:10.3%) respectively for (males: females) (figure 4). Totally, (60.2%) females were more TB-HIV co-infected than males (39.8%) at the study area. These are also agreed with the total prevalence with the 44% female and 42% male TB-HIV co-infected patients studied in 2014 (UNESCO, 2014).

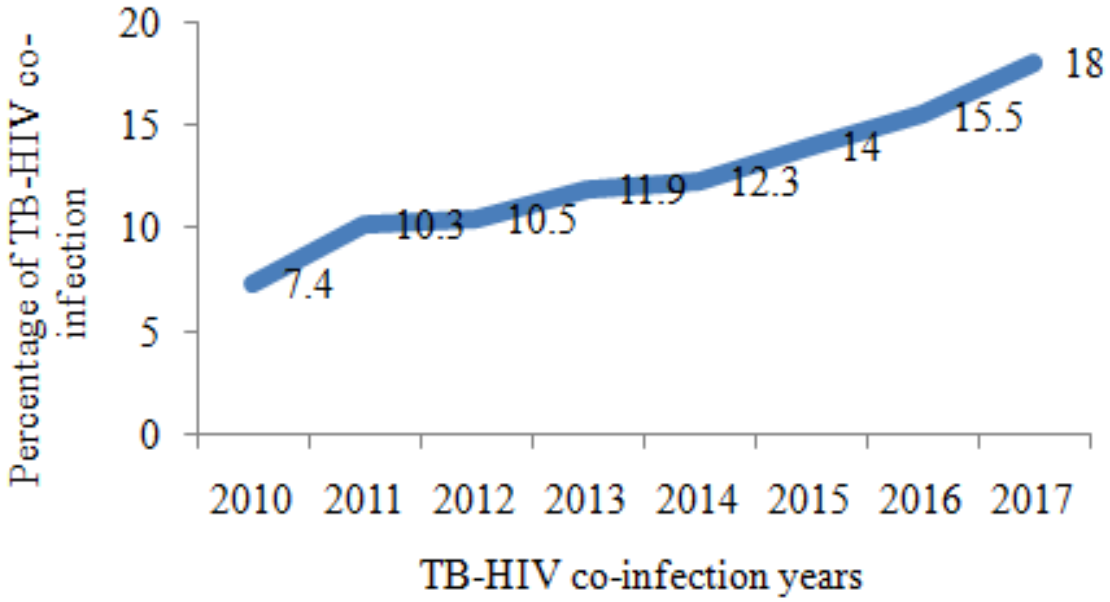

Figure 5: Percentage distribution of TB-HIV co-infected patients attended Debre Elias Health Center from September 1**,** 2010-January 30, 2017 (n=620).

The percentage prevalence of 620 TB-HIV co-infected patients attended Debre Elias Health Center from September 1, 2010-January 30, 2017 increased. In these subsequent years from September 1 2010-January 30, 2017 the annual prevalence of TB-HIV co-infection in each year respectively were, 7.4%, 10.3%, 10.5%, 11.9%, 12.3%, 14%, 15.5%, and 18% respectively (figure 5). In this study, the incidence was 10.6% which was smaller than that of 27% TB-HIV co-infected incidence obtained by another study conducted in Vietnam from 2001-2007 (UNAIDS, 2008). Even though it is so, mortality related to TB and HIV/AIDS diseases decreased, because, of improvements in the availability of anti TB and anti HIV drugs, Directly Observed Therapy Short course and good behavioral change related to the two diseases. Antiretroviral (ARV) therapy reduces the incidence of TB in HIV infected patients by more than 80% (Badri *et al.,* 2002). Both anti TB treatment and ARVs are indispensable in the management of patients with TB-HIV co-infection (Sharma *et al.,* 2005). The key therapeutic principles underlying the treatment of TB-HIV are treatment of TB always takes precedence over treatment of HIV infection. In patients who are already on ARVs, the same has continued with appropriate modifications both in ARVs and in anti-TB treatment. In patients not receiving ARVs, the need

for and timing of initiation of ARVs have to decided after assessing the short term risk of disease progression and death, based on $CD4^+$ cell count and type of TB, on individual basis (Sharma *et al.,* 2005). The convergence of HIV and TB pandemics continue to be collectively the leading cause of morbidity and mortality worldwide. Highly active antiretroviral therapy (HAART) has been critical effect in combating the morbidity and mortality by TB-HIV co-infection worldwide. A retrospective cohort study conducted among HIV infected patients with TB between January 2000 and December 2004 in Thailand. The objective of the study was to establish the impact of antiretroviral therapy (ART) on survival of patients co-infected with HIV and TB. Patients were categorized in to ART+ group (received ART) and ART – group (did not receive ART) and were follow until April 2005, 1003 patients were identified; 411 in ART+ group and 592 in ART – group. The result indicated that based on the log –rank test the survival rates at 1, 2 and 3 years after TB diagnosis were 96.1%, 94.0%, and 87.7% for ART+ group and 44.4%, 19.2% and 9.3% for ART-group ($p<0.001$). From the study, it concluded that antiretroviral therapy substantially reduce mortality rate among TB-HIV co-infected patients (Weerawat *et al*., 2006**).**

Table 3: Tuberculosis Status on the Bases of $CD4^+$ Cells at the Study Area (n=620)

$CD4^+$T-cells count	TB-HIV co-positive patients (n=620)	Total study subjects
<200 cells/mm^3	228 (36.8%)	228
200-349 cells/mm^3	154 (24.8%)	154
350-500 cells/mm^3	123 (19.8%)	123
>500 cells/mm^3	115 (18.5%)	115

There were 228 (36.8%), 154 (24.8%), 123 (19.8%), and 115 (18.5%) prevalence of TB in HIV patients who had $CD4^+$ cells count <200 cells/mm^3, 200-349 cells/mm^3, 300-500 cells/mm^3, and >500 cells/mm^3 respectively. Therefore the prevalence of TB-HIV co-infection were more on HIV/AIDS patients who had a $CD4^+$ cells count<200 cells/mm^3 (36.8%) and $CD4^+$ cells count between 200-349 cells/mm^3 (24.8%) as it registered on the Standard National Medical Registry in Debre Elias Health Center. There was similar study done in Northern Tanzania by (Ngowi *et al*., 2008) the prevalence of TB among HIV/AIDS patients were 30% had a $CD4^+$ cells count <200 cells/mm^3, 35% between 200-349 cells/mm^3, 20% between 350-500 cells/mm^3 and 15% in >500 cells/mm^3. Co-infection is associated with lower $CD4^+$ T-cells count than those with HIV alone, which could translate in to an increased progression of HIV to AIDS, morbidity and mortality (Giri *et al.,* 2013).

Table 4: The Status of Tuberculosis on HIV/AIDS Patients at Different Sites and Time

Country	Site	Prevalence in %	Reference
Ethiopia	Debre Markos	44%	(Esmael *et al.*, 2013)
Africa	Africa	43%	(USAID, 2015)
Kenya	Kenya	41.8%	(Nyamogoba et al., 2012)
Centeral Nigeria	Dalhat Araf Specialist Hospital of Lafia	34.5%	(Gyar *et al.*, 2014)
Ethiopia	Gondar-Dabate	34%	(Tadesse T. and Tadesse S ., 2013)
India	South India tertiary hospital	27%	(Padyana *et al*., 2012)
Ethiopia	South west Ethiopia	8.1%	(Kebede and Wabe, 2012)
Ethiopia	Butajira Hospital	20.3%	(Seada and Tewelde, 2015)
Ethiopia	Mizan Amman General Hospital	18.5%	(Fiseha *et al*., 2015)
India	Teaching Hospital of Maharasha	17%	(Giri *et al*., 2013)
Ethiopia	Ethiopia	7.8%	(EHNRI, 2013)
Ethiopia	Debre Elias(current)	26.4%	(Walelign, 2017)
Ethiopia	Amhara	4.9%	(EHNRI, 2013)

Risk factors such as age, sex, marital status, educational status, occupational status, residence, $CD4^+$ cells count and WHO clinical stages recognized as factors remarkably influenced health outcomes of humans. This study showed that the association between the above risk factors and TB-HIV/AIDS co-infected patients at Debre Elias Health Center. TB-HIV/AIDS co-infection among TB patients well recognized as main problem of people, especially in resource poor settings (Fiseha *et al*., 2015). In this study, out of 980 TB patients who attended at Debre Elias Health Center from September 1, 2010-January 30, 2017 and received treatment 620 (26.4%)

were TB-HIV/AIDS co-infection as the data obtained from the Standard National Medical Registry directly based on purposive sampling technique. These 620 (26.4%) TB-HIV/AIDS co-infected patients' prevalence relatively was medium than the prevalence showed in similar study done at different area in different time. Forinctance at tertiary care hospital of south India among 200 HIV positive patients 54 (27%) had TB-HIV/AIDS co-infection and the remaining 146 (73%) were HIV positive alone (Padyana *et al.*, 2012). Study done in Debre Markos showed 44% were TB-HIV co-infected (Esmael *et al.*, 2013). Like to these Dabat Gondar 34% (Tadesse and Tadesse, 2013), Kenya 41.8% (Nyamogoba *et al*., 2012) and in 2012, 43% in Africa (USAID, 2015) as high as 50-80% in parts of sub-Sahara Africa (Luetkemeyer and Daley, 2013). As study conducted in Nigeria 30.0% were TB-HIV co-infected (FMH, 2000), and 43.2% in Gambia (Van der Sande *et al*., 2004). These might be due to differences in the study site, time, sample size, methodological variation. It might be also due to current strategic plan of the Ministry of health in Ethiopia that expands health facilities across the country and increased awareness of the community through health education formally in health education institution or via mass media about the prevention and control of TB and HIV/AIDS diseases. In contrast 26.4% TB-HIV/AIDS co-infection prevalence in Debre Elias Health Center currently was higher than the TB-HIV/AIDS co-infection prevalence showed by similar study done in South West Ethiopia, among 296 TB and HIV patients at hospital treatment center 24 (8.1%) of patients were co-infected with TB and HIV (Kebede and Wabe, 2012). As a study done at a tertiary teaching hospital of western Maharasha, India showed that out of the total 1012 HIV positive patients, who attended the ART clinic and received treatment, 172 (17%) had TB-HIV/AIDS co-infection and the remaining 480 (83%) were HIV positive alone (Purushottam *et al*., 2013). The prevalence of TB among HIV positive clients in Ethiopia was 7.8% and in Amhara region 4.9% (EHNRI, 2013). This might be due to multi TB and HIV related risk factors or it might be due to the difference in sample size and methodological variation. In addition, the difference between the prevalence in this study and other studies may be due to differences in inclusion and exclusion criteria. Which means as patients already diagnosed to have tuberculosis and started tuberculosis treatments were included in this study, this may makes high rates than the other studies on the above study sites.

5. CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

In general, this study assessed the prevalence of TB-HIV/AIDS co-infection on individuals who attended at Debre Elias Health Center from September 1, 2010-January 30, 2017. HIV/AIDS and TB diseases are the first and the second leading cause of morbidity and mortality respectively. So TB and HIV/AIDS diseases concomitantly were the major health problem of human beings in this study area, because since HIV/AIDS infection mainly targeted on our immunity system which keeps our body from the infection of other opportunistic diseases, our immunity system weekend and create good opportunity for the infection of our body by opportunistic disease like TB. TB-HIV/AIDS co-infection aggravated by many risk factors such as; sex, age, marital status, educational status, occupational status, residence, $CD4^+$ cell counts, body weight <18.5 kg, low monthly income, alcohol use, history of asthma, diabetes mellitus and WHO HIV/AIDS clinical stage independently. TB-HIV/AIDS co-infection had significantly co-relation with sex (p=0.003), age (p=0.000), marital status (p=0.000), educational status (p=0.011), residence (p=0.000). Due to females are more vulnerable to the two diseases, and as these diseases mostly affected the reproductive age groups (16-30 years old). With perspective of those diseases individuals with many sexual partners infected more, and because of literate individuals have more know how to check themselves, in addition urban dwellers were also more affected by TB and HIV/AIDS diseases as the result of their more attention on how to get money to lead their life than their health respectively. Currently the prevalence of TB-HIV/AIDS co-infection who received treatment at Debre Elias Health Center from September 1, 2010-January 30, 2017 was 620 (26.4%). These 620 (26.4%) total TB-HIV/AIDS co-infected patients data distributed in each year from 2010-2017 as, 46 (7.4%) in 2010, 64 (10.3%) in 2011, 65 (10.5%) in 2012, 74 (11.9%) in 2013, 76 (12.3%) in 2014, 87 (14%) in 2015, 96 (15.5%) in 2016, and 112 (18%) in 2017. With regarding to these, the prevalence of TB-HIV/AIDS co-infection at this study area slightly increase from 2010-2017 and mortality decrease as the community awareness about the transmission and control of TB and HIV/AIDS diseases was improved with the expansion of integrated and strategic preventive measures enhance body immunity implemented as early as possible before active TB developed. Public awareness how to use anti TB and anti HIV drugs

and health education bring behavioral change to control the progression of the diseases and use of condoms to control transmission of HIV/AIDS disease leads to TB later.

The prevalence of TB-HIV/AIDS co-infection in this study area was more prevalent on females than males. Because of ,over load work in the households, with their biological make up high rate of transient and permanent immunosuppression with pregnancy, lactation, low fitness, cultural and social factors they used their body as sources of income generation and using females condom is not easy. These related with WHO report showed more females infected with TB-HIV/AIDS co-infection than males in Africa **(**WHO, 2003). In age group of 16-30 years old TB-HIV co infection, also more due to males and females are sexually active in this age group. According to marital status, single individuals mostly infected due to high chance of getting many opposite sexual partners. In regard to educational status and occupational status literate individuals and other workers were more co-infected due to they have high awareness to know themselves by check up and because of males and females most of the time focus on how to get money without seeing their health respectively (Table 1). $CD4^+$ cell count <200 cells/mm^3 with WHO clinical stage IV were highly vulnerable to the two diseases because of low cell count and/ low immunity is good for TB and HIV/AIDS infection (Table 3) and due to high severity of the HIV/AIDS virus and disease load (Table 4). Although there is sample size, place, time, inclusion and exclusion criteria, and methodological variation the prevalence of TB-HIV/AIDS co-infection in the study area was medium relative to some study carried out at different study area in different time. Totally, as the result of this study, prevalence of TB-HIV/AIDS co-infection in the study area increase gradually from 2010-2017 and mortality decrease due to formal and informal community awareness and good health education about TB and HIV/AIDS diseases improved.

5.2 RECOMMENDATIONS

As these research findings, the following recommendation suggested:

- Concerned stakeholders about TB and HIV/AIDS diseases should be focus on education and awareness to Debre Elias Woreda community about TB and HIV/AIDS diseases characteristics; causes, mechanism of transmission, mechanism of prevention and control, and their side effects on the infected individuals as well as on the growth and development of the country as a whole.
- Additional studies should be carried out at Debre Elias Health Center on TB and HIV/AIDS diseases to find out more new characteristics and new risk factors which induces the incidence, prevalence and distribution of TB and HIV/AIDS diseases in Debre Elias Health Center tributary areas and/ Debre Elias Woreda administration.
- More attention should be given for those patients have $CD4^+$ cell counts <200 cells/mm^3 and who are found on WHO HIV/AIDS clinical stage III and IV because infected individuals in these two conditions were more affected and severely ill as their immunity systems weekend.
- Laboratory technicians capacity in knowledge, skills and experiences about TB and HIV/AIDS diseases should be advanced with formal and informal training for long or short term duration to give qualified TB and HIV/AIDS diseases diagnosis and treatment services.
- To get proper and efficient TB and HIV/AIDS diseases diagnosis and treatment peoples should be encouraged to involve in DOTS or directly observed treatment for short course approach.

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Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented to any other University and all sources of information used for the thesis have been fully acknowledged.

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