PREVALENCE OF TUBERCULOSIS AND ITS ASSOCIATED RISK FACTORS AMONG PATIENTS VISITING BISHOFTU HOSPITAL, OR MIYA REGION, SOUTH EASTERN ETHIOPIA

M.Sc. THESIS

YASCHALEW ANTENEH

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Prevalence of Tuberculosis and its Associated Risk Factors Among Patients Visiting Bishoftu Hospital, Oromiya Region, South Eastern Ethiopia

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Yaschalew Anteneh

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HARAMYA UNIVERSITY

POSTGRADUSTE PROGRAM DIRECTORATE

We hereby certify that we have read and evaluated this Thesis entitled: *The Prevalence of Tuberculosis and its Associated Risk Factors among Patients Visiting Bishoftu Hospital Oromiya Region, South East Ethiopia* prepared under our guidance by *Yaschalew Anteneh*. We recommended that it be submitted as fulfilling the thesis requirement.

Misrak Kebede (PhD)	_____	_____
Major Advisor	Signature	Date
Ameha Kebede (PhD)	_____	_____
Co-Advisor	Signature	Date

As member of the board of examiners of the M.Sc Thesis Open Defense Examination, We certify that we have read and evaluated the Thesis prepared by Yaschalew Anteneh and examined the candidate. We recommended that the thesis be accepted as fulfilling the Thesis requirements for the Degree of Master of Science in General Biology.

_____	_____	_____
Chairperson	Signature	Date
_____	_____	_____
Internal Examiner	Signature	Date
_____	_____	_____
External Examiner	Signature	Date

DEDICATION

I dedicate this thesis manuscript to those who lost their lives due to tuberculosis in Ethiopia

STATEMENT OF THE AUTHOR

By my signature below, I declare and affirm that this thesis is my own work. I have followed all ethical principles of scholarship in the preparation, data collection, data analysis and completion of this thesis. All scholarly matter that is included in the thesis has been given recognition through citation.

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Name: Yaschalew Anteneh Signature: _____

Date: February, 2017

Department: Biology

ACRONYMS AND ABBREVIATIONS

AFB	Acid Fast Bacilli
AIDS	Acquired Immunodeficiency Syndrome
BCG	*Bacillus Calmette-Guerin*
CDC	Center for Disease Control and prevention
CXR	Chest X-ray
DNA	Deoxyribo-Nucleic Acid
DOTS	Direct Observed Treatment Short -course
FMOH	Federal Ministry of Health
HIV	Human Immunodeficiency Virus
LTBI	Latent Tuberculosis Infection
MDR-TB	Multi Drug Resistant Tuberculosis
MTC	*Mycobacterium tuberculosis* Complex
PCR	Polymerase Chain Reaction
PTB	Pulmonary tuberculosis
TB	Tuberculosis
USAID	United States Agency for International Development
WHO	World Health Organization
XMDR- TB	Extremely Multi Drug Resistant Tuberculosis

BIOGRAPHICAL SKETCH

The author was born on October 15, 1965 in Adiet town, West Gojam Zone. The author attended his elementary education in Adiet Primary school and Junior School and his Secondary Education in Tana Haik Comprehensive Secondary School in Bahirdar. He joined Asmera University and graduated with B.Sc. degree in Biology with minor Chemistry in 1986. Then after, he has been teaching Biology in Bale Robe Teachers' Training Institute, Adea Model Secondary and Bishoftu Preparatory School, Bishoftu town. In 2013, he joined the Department of Biology, Haramaya University in Summer Program to pursue his postgraduate study in the field of Biology.

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OPERATIONAL DEFINITIONS

Pulmonary tuberculosis: TB that affects the lungs.

Active Tuberculosis: TB that has been confirmed by clinical and positive sputum smear or chest x-ray result suggestive of TB

Risk Factor: A feature of somebody's habits, socio-economic, environmental, genetic makeup or personal history that increases the probability of disease or harm to health.

Extra pulmonary TB: a form of tuberculosis that occurs in places other than the lungs, including the larynx, the lymph nodes, the pleura, the brain, the kidneys, or the bones and joints.

Pulmonary smear positive (PTB+): at least 2 sputum smear examinations positive for AFB

Pulmonary smear negative (PTB-): at least three sputum examinations negative for AFB, radiographic abnormalities consistent with active pulmonary TB and not responding to a course of general antibiotics, or diagnosis based on positive culture but negative AFB sputum examinations.

Poor diet: a diet without proper amounts and type of nutrients for maximum health.

No income: individuals who are neither engaged in regular work nor entitled for pension but may occasionally work or receive support from others.

Prevalence of Tuberculosis and its Associated Risk Factors Among Patients Visiting Bishoftu Hospital, Oromiya Region, South Eastern Ethiopia

ABSTRACT

Tuberculosis is a deadly infectious disease, affecting millions of people worldwide. Ethiopia ranks seventh among the twenty two high tuberculosis burden countries .The aim of this study was to determine the prevalence of pulmonary tuberculosis and its associated risk factors among patients visiting Bishoftu Hospital in Oromiya Region. A retrospective study based on ten years data of TB patients (from year 2006-2015) and a cross-sectional survey study on the prevalence of smear positive pulmonary TB patients among TB suspect patients visiting Bishoftu Hospital was conducted from June-August 2016. 384 tuberculosis suspects were successively taken from the Out Patient Department of the Hospital. From these suspects, sputum samples were collected and subsequently examined for acid fast bacilli using Ziehl-Neelsen staining technique. Pre-tested questionnaire was also used to determine the associated risk factors of TB infection among the study subjects. The data were entered and analyzed using STAT version 11soft ware. Descriptive statistics and binary logistic regression analyses were employed to identify risk factors associated with pulmonary tuberculosis. The study revealed that the current prevalence of smear positive pulmonary tuberculosis was 8.3 %. The trend of all forms of TB started to decline starting from 2009 onwards in both sexes and all age groups. The study also showed poor diet, HIV/AIDS, previous TB contact history, living in confiding place, alcohol consumption, chat chewing and smoking cigarettes were significantly associated with prevalence of smear positive TB cases. Generally, in this study, the high prevalence of smear positive pulmonary tuberculosis in the area suggested the need for implementing strict pulmonary tuberculosis screening of patients and intensification of health education to prevent the spread of the disease and to create awareness on risk factors contributing to the infection, respectively. In addition, routine checkup of TB among TB suspects is important to minimize the burden of the disease and to control the transmission rate in the area.

***Keywords**: Acid fast bacilli, Smear positive PTB, Sputum samples, Trend, TB suspect*

1. INTRODUCTION

Tuberculosis (TB) is a bacterial disease caused by *Mycobacterium tuberculosis* complex which includes most of the time *Mycobacterium tuberculosis* and occasionally *Mycobacterium bovis*, *Mycobacterium africannum* and *Mycobacterium cannetti* (Demissie *et al.*, 2006). These organisms are also known as tubercle bacilli or Acid-fast-bacilli (AFB). When examining a sputum containing tubercle bacilli processed by Ziehl-Neelson Stain under the microscope, the bacilli are stained red. This is because they retain the primary dye even after washing with acid alcohol due to the waxy component of their cell wall (Cheesbrough, 2002).

Tuberculosis is one of the most challenging communicable diseases and infects one third of the world's population (Demissie *et al.,* 2006). Shockingly, 8.8 million new cases of TB were registered in 96 countries in 2010 (WHO, 2011). Globally South East Asia and Sub-Saharan African countries have the highest TB burden: 35% and 30%, respectively. In addition, 1.1 million deaths were reported and the majority were from Asia (50%) and Africa (26%)(WHO, 2011).The estimated incidence rate was 261 cases per 100,000 individuals and 29,000 deaths in 2010, with an estimated prevalence rate of 394 cases per 100,000 individuals (WHO, 2012). It still remains to be a major public health problem in the underdeveloped world because of poverty, HIV pandemic, movement of displaced people and emergence of multi–drug resistant strains (Bone *et al.,* 2000).

Despite the progress in prevention and treatment of TB, 8.7 million people developed TB in 2012 and 1.3 million died as a result of the disease. Drug-resistant tuberculosis (DR-TB) threatens global TB control and is the major public health concern in several countries. Globally in 2012, an estimated 450,000 people developed multi drug resistant tuberculosis (MDR-TB) and there were an estimated 170,000 deaths from MDR-TB. Internationally, 3.5% of new and 20.5% of previously treated TB cases was estimated to have had MDR-TB in 2013. This translates into an estimated 480,000 people having developed MDR-TB in 2013. On average, an estimated 9.0% of patients with MDR-TB had extensively drug resistant TB (XDR-TB) (WHO, 2014c). There were an estimated 9.6 million new cases of TB, in 2014. Out

of which there were an estimated 480,000 new cases of MDR-TB and an estimated 190,000 people died of MDR-TB (WHO, 2015)

Tuberculosis is one of the ten leading causes of deaths in developing countries (WHO, 2005 & 2007). African countries, south of the Sahara including Ethiopia, are heavily affected by TB. The WHO global reports on TB showed that Ethiopia is among the ten top high burden countries in terms of prevalence or incidence of TB with an estimated incidence of 258/100000 (WHO, 2009 & 2010). In other words, TB is amongst the major causes of morbidity and mortality in the horn of Africa with Ethiopia carrying heavy burden. Ethiopia is the third most populous country in Africa and number seven amongst the countries with highest TB burden in the world (Abdie *et. al.*, 2009).

The prevalence of TB is a useful epidemiological index for measuring the magnitude of the TB problem. It provides useful information for planning a rational program and for monitoring progress. However, in developing countries such information is lacking; the reporting system is poorly developed; diagnostic criteria are usually none standardized and many cases go undetected (Styblo, 1991; Sudre and Kochi, 1992). Ethiopia is no exception; there is neither a reliable disease notification system nor any regular nationwide epidemiological survey of TB (FMOH, 2007). Of course there are studies carried out about the prevalence of tuberculosis and its associated risk factors by different researchers in different parts of Ethiopia (Hussein *et al.*,2012; Yohannes *et al*., 2012; Eyasu *et al*., 2013; Begna *et al.*, 2014). However there is no reliable information on the prevalence of TB and its associated risk factors in the study area, Bishoftu. Therefore, this study was designed to determine the prevalence of TB and its associated risk factors among patients visiting Bishoftu Hospital, Oromiya Region, South Eastern Ethiopia. The study will provide information primarily for public health policy makers, managers and for the wider medical and public health community as support for strategic actions and program planning.

Thus, the general objective of this research was:

- To determine the prevalence and evaluate the associated risk factors of tuberculosis in Bishoftu Hospital, Oromiya Region

The specific objectives were:

- To assess the trend of TB prevalence in the study area
- To determine the current prevalence of tuberculosis in the study area.
- To investigate the association between TB and risk factors in the study area.

2. LITERATURE REVIEW

2.1. Tuberculosis

Tuberculosis (TB) is a potentially fatal contagious disease that can affect almost any part of the body but is mainly an infection of the lungs (Beers *et al.*, 2004). It is caused by a bacterial microorganism, the tubercle bacillus or *Mycobacterium tuberculosis* complex (MTC). Pulmonary tuberculosis is TB that affects the lungs. Although the lungs are the major site of damage caused by tuberculosis, many other organs and tissues in the body may be affected. The usual progression for the disease is to spread from the lungs to locations outside the lungs (extra pulmonary sites). In some cases, however, the first sign of disease appears outside the lungs. The tissues or organs that tuberculosis may affect include: bones, kidneys, female reproductive organs, abdominal cavity, meninges, skin, adrenal glands and blood vessels. All these parts of the body can be infected by *M. tuberculosis*. Infection of the wall of the body's main artery (the aorta), can cause it to rupture with catastrophic results (Beers *et al.,* 2004).

2.2. Causative Agents of Tuberculosis

Tuberculosis is caused by members of the species *Mycobacterium tuberculosis* complex (MTC).The *Mycobacterium tuberculosis* (MTC) comprises seven members which include: *Mycobacterium tuberculosis, M. africanum, M. bovis, M. caprae,M. pinnipedii, M. microti*, and *M. canetti* (Angela *et al.,* 2006). MTB is the etiologic agent of the majority of TB causes in humans; *M. africanuum* and *M. canettii* are primarily pathogenic in humans. *M. bovis and M. microtii* are the causative agents of TB in animals, and can be transmitted to humans (Palomino *et al.*, 2007).

2.3. General Characteristics of *M. tuberculosis*

Mycobacterium tuberculosis is a slow growing mycobacterium with a doubling time of 12–24 hours under optimal conditions. A major feature of MTB is the peculiar cell wall structure, that provides an exceptionally strong impermeable barrier to noxious compounds and drugs and that plays a fundamental role in virulence. Mycobacterium possess an outer membrane,

functionally similar to what is seen in gram negative bacteria, consisting of an asymmetric lipid bi-layer made of long fatty acids in the inner leaflet (mycolic acids) and of glycolipids and waxy components on the outer layer. The outer and inner membrane form a periplasmic space, with the presence of a thin layer of peptidoglycan in the innermost side covalently linked to arabinogalactan and lipoarabinomannan which in turn are bound to mycolic acids. Mycolic acid prevents attack by cationic proteins, Lysozyme, oxygen radicals and nutrient rich reservoir for MTB persistence. The waxy cuticle provides impermeability to dyes, resistance to many antibiotics, resistance to osmotic lyses, resistance to lethal oxidation and survival inside macrophages (Alderwick *et al*., 2007). Isoniazid and ethambutol are two of the most effective anti-TB drugs, target the synthesis of the mycolic acids and arabinogalactan respectively, highlighting the importance of the mycobacterial cell wall in MTB biology (Abdallah *et al.*, 2007).

2.3.1. Taxonomy of *M. tuberculosis*

Taxonomically, mycobacteria belong to the genus *Mycobacterium*, which is the single genus within the family of Mycobacteriaceae, in the order Actinomycetales (Table 1). Actinomycetal es include diverse micro-organisms, but mycobacteria and allied taxa are easily distinguished on the basis of the ability to synthesize mycolic acids. The genus *Mycobacterium* contains a number of strict and opportunistic pathogens that afflict humans and animals alike. Among the strict pathogens, the principal pathogens of humans include *Mycobacterium tuberculosis*, the causative agent of tuberculosis, and *M. leprae*, which causes leprosy. Mycobacterial species are traditionally differentiated on the basis of phenotypic characteristics. However, as the phenotypic characteristics do not allow precise identification of all species of mycobacteria, recent molecular taxonomical approaches for mycobacterial classification and phylogeny are also described (Rastoji *et al.*, 2001).

2.3.2. Pathogenesis of *M. tuberculosis*

Tuberculosis is one of the first and most studied infectious disease, as classically highlighted by the seminal work of R. Koch more than 100 years ago. But we have yet to answer many key questions on the mechanisms of pathogenesis and on the immunological correlates, if any,

associated with protection from developing disease (Collins *et al*., 1998).

Table 1: Taxonomic ranks of Mycobacterium tuberculosis:

Taxonomical ranks	
Domain	Eubacteria or true bacteria
Phylum	Actinobacteria
Class	Actinobacteria
Order	Actinomyetales
Family	Mycobacteriaceae
Genus	*Mycobacterium*
Species	*Tuberculosis*

Source: (George et al., 2004).

Mycobacterium tuberculosis infection occurs when few tubercle bacilli dispersed in the air from a patient with active pulmonary TB reach the alveoli of the host (Fig.1). Here, MTB is quickly phagocytized by professional alveolar macrophages that most often can kill the entering bacteria thanks to the innate immune response (Urdahl *et al.*, 2011).

If the bacilli can survive this first line of defense, it starts actively replicating in macrophages; diffuse to nearby cells including epithelial and endothelial cells, reaching in few weeks of exponential growth a high bacterial burden (Wolf, *et al*., 2008). During these early steps of infection can diffuse to other organs through the lymphatic and by haematogenous dissemination where it can infect other cells (Balasubramanian *et al.,* 1996). Thereafter, once the adaptive immune response kicks in, migration to the site of primary infection of neutrophils, lymphocytes and other immune cells form a cellular infiltrate that later assume the typical structure of a granuloma (Ottenhoff and Kaufmann, 2012). Fibrotic components cover the granuloma that becomes calcified such that bacilli remain encapsulated inside and protected by the host immune response. This primary lesion, classically termed the Ghon complex, was thought to be the "sanctuary" of MTB during latent infection with bacilli persisting in a dormant, non-metabolically active state, for years, decades, or most often for

lifetime. For unknown reasons, latent infection bacilli would start replicating inside this primary lesion, active disease would ensue (Bishai, 2009).

Musing normal lung tissues isolated at necropsy from patients who had died for causes other than TB in a TB endemic country, were able to detect by in situ polymerase chain reaction (PCR) MTB DNA in non-phagocytic cells, fibroblasts and endothelial cells, clearly suggesting that in latent TB subjects MTB bacilli can persists in tissues and cells not associated with the granuloma or the Ghon complex. Using similar experimental settings, MTB was detected in the fat tissue surrounding several organs, residing intracellularly in adipocytes, where it can survive protected from the host immune response. All these evidences suggest that during latent tuberculosis infection, MTB can reside in different organs, tissues and cell types, not associated with the site of primary infection and lacking any sign of the typical granulomatous lesions (Neyrolles *et al.*, 2006).

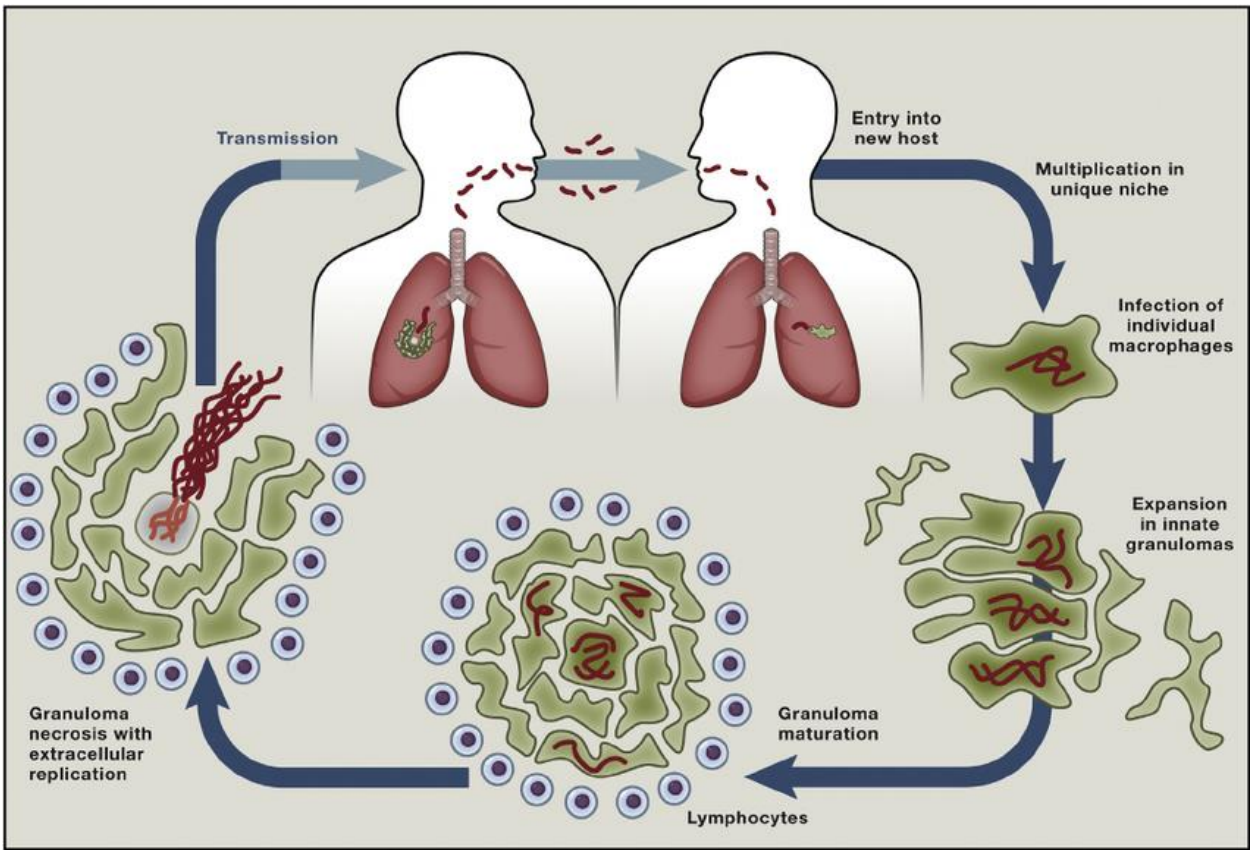

Figure 1: Life cycle of Mycobacterium tuberculosis

Source: (Camber and Stanley, 2014).

Based on the new understanding of biology of MTB, its different metabolic states, the dynamic host immune responses occurring during infection and on the spectrum of conditions are observed during infection. It has been proposed that during latent infection, most bacilli persist in a dormant state with fewer MTB found in an active state. Replicating bacilli, named "scouts" are processed and killed by the host immune defenses and as a result they are responsible for the induction of the larger number of effectors (memory T cells) directed against MTB antigens that are found in the peripheral blood. Latent TB dormant bacteria constantly replenish the bulk of activity replicating bacilli readily killed by the host when for any reason fail to control such as in the case of HIV infection, cancer patients and hematologic condition. These scouts, uncontrolled bacterial replication promotes diseases manifestations and active diagnosis ensues (Gengenbacher, 2012).

2.3.3. Signs and symptoms of tuberculosis

Signs and symptoms of pulmonary TB (PTB) are described into two types. The first types constitutional symptoms such as, fatigue, anorexia, weight loss, low-grade fever, night sweat, acute febrile illness, chills, flu like symptom and the second pulmonary signs and symptoms are cough progressing in frequency and producing mucoid or mucopurulent sputum, hemoptysis, chest pain and dyspnea (Nettina, 2006). Depending on the sort of patient population surveyed, as few as 20%, or as many as 75% of pulmonary tuberculosis cases may be without symptoms. Tuberculosis should be suspected when a pneumonia-like illness has persisted longer than three weeks, or when a respiratory illness in an otherwise healthy individual does not respond to regular antibiotics (Kumar *et al.*, 2007).

2.3.4. Diagnosis of tuberculosis

There are tests that can be used to help detect TB infection: a skin test or TB blood tests. The Mantoux tuberculin skin test is performed by injecting a small amount of fluid (called tuberculin) into the skin in the lower part of the arm. A person given the tuberculin skin test must return within 48 to 72 hours to have a trained health care worker look for a reaction on the arm. The TB blood tests measures how the patient's immune system reacts to the germs that cause TB (CDC, 2011).

The diagnosis of pulmonary tuberculosis in adult is mainly done by collecting a sputum sample. Due to the nature of the waxy coat of *Mycobacterium* cell wall, it retains an aniline dye (e.g.carbolfuchsin) even after decolorization with acid and alcohol; they are thus named Acid Fast Bacilli (AFB). This characteristic enables us to detect them by microscopy. Although this method has low sensitivity; it is widely applied and used globally, because it is simple, rapid and cost-effective. In resource limited settings, culture is used for a definitive diagnosis of TB. However, it is much more costly than microscopy, requiring a long incubation period and facilities for media preparation as well as skilled staff. The other diagnostic method is chest x-ray (CXR). It is less applicable in low resource countries such as inSouth East Asia and Sub-Saharan African countries (Dawit, 2009).

Another method is to detect MTB DNA using PCR for partial amplification of the genetic material present in a specimen. The newly developed Gene–Xpert MTB/rifampicin assay offers rapid automated and real-time detection of the gene and this method requires minimal training to perform and was endorsed by the WHO for fast diagnosis of TB, especially in people living with HIV and patients with suspected MDR-TB (WHO, 2011).The Gene-Xpert MTB/rifampicin test has the advantages of being easy to perform and providing results in less than 2 hours. This technique also furnishes information about resistance to rifampicin, because it detects the most common resistance mutation (Lawn *et al.*, 2011). Although a risk of false-positive reactions has been reported (Van Rie *et al.*, 2012). Furthermore, it should be noted that this assay is expensive, especially the cartridges that are used, and it requires an uninterrupted power supply, ambient temperature of 28^0C, and an environment without extreme humidity or dust. These features make Gene-Xpert MTB/rifampicin less appealing for deployment in peripheral low income settings (Wejise, 2013).

At the time of diagnosis, every TB patient registered under one of the following categories:

1) A patient who has never had treatment for TB or who has taken anti-tuberculosis drug for less than four weeks,

2) Relapsed case: a patient who has been declared cured of any form of TB in the past by a physician, after one full course of chemotherapy and has become sputum smear positive,

3) Failure case: a patient who, while on treatment, remained or became again smear positive five months or later during the course of treatment,

4) Treatment after default: a patient who interrupts treatment for two months or more and returns to treatments with smear positive sputum,

5) Transfer in: a patient who has been transferred from another TB register to continue treatment and,

6) Other: all cases which do not fit the above definitions, for example a patient treated by a private agency, patient diagnosed with TB and relapsed with negative sputum smear (Fujiwara *et al.*, 2005).

2.4. Epidemiology of Tuberculosis

Tuberculosis is one of the major health, social and economic burden at a global level and primarily in low and middle income countries (WHO, 2012).Although TB can be treated, cured, and can be prevented if persons at risk take certain drugs, scientists have never come close to wiping it out (Beers *et al.,* 2004*).*

The lack of an effective vaccine, the long and expensive drug regimens, the few diagnostic tools available in countries where TB is endemic and the dismantlement in several nations of the health systems and control measures that so effectively contributed to control TB throughout most of the 20thcentury, led to the reemergence of TB as a global pandemic. The last twenty years have seen a renewed interest on TB by health authorities and governments which resulted in halving TB deaths. However, it is widely accepted that only a better understanding of the pathogenic processes associated with infection and disease will lead to the development of effective tools capable of conquering this ancient scourge (Delogu *et al*., 2013).

The epidemiology of TB varies substantially around the world. The highest rates (100/100,000 or higher) are observed in sub-Saharan Africa, India, China and the islands of Southeast Asia and Micronesia (Robert, 2012). The TB incidence rate at a country level ranges substantially, with around 1000 or more cases per 100,000 people in South Africa and Swaziland and fewer than 10 per 100,000 population in parts of the Americas, several countries in western Europe,

Japan, Australia and New Zealand (WHO, 2013). An estimated half million cases of multi-drug resistant TB(MDR-TB) also occur annually in Africans; even higher rates of drug resistant disease occur in eastern Europe such as Armenia, Azerbaijan, Belarus, Estonia and Georgia (Robert, 2012).

Most TB cases and deaths occur among men, but TB remains among the top three killers of women worldwide. There were an estimated 410,000 TB deaths among women. Half of the HIV-positive people who died from TB in 2012 were women. Of the estimated 8.7 million new TB cases worldwide in 2012, 2.9 million were women (WHO, 2013). In 2013, an estimated 510,000 women died from TB, 330,000 among HIV negative women and 180,000 HIV negative children from TB (estimates for HIV-positive children are not yet available) (WHO, 2014). There were an estimated 530,000 TB cases among children (under 15 years of age) and 74,000 TB deaths (among HIV-negative children) in 2012 (6% and 8%) of the global totals, respectively. In 2012, an estimated 450,000 cases of multi-drug resistant TB (MDR-TB) emerged globally, which corresponds to around 3.6% of all new cases and 20.2% of all previously treated cases of TB. Over 50% of the estimated MDR-TB cases that emerged in 2012 were in China, India and the Russian Federation. An estimated 170,000 deaths were caused by MDR-TB globally, in 2012 including patients with concomitant HIV infection (WHO, 2014c).

2.4.1. Transmission, prevention and control of tuberculosis

Tuberculosis can develop after inhaling droplets sprayed into the air from a cough or sneeze by someone infected with *Mycobacterium tuberculosis*. All cases of TB are passed to person to person via droplets. When someone with TB infection coughs, sneezes or talks, tiny droplets of saliva or mucus are expelled into the air, which can be inhaled by other person. The disease is characterized by the development of granulomas (granular tumors) in the infected tissues. The usual site of the disease is the lungs, but other organs may be involved. The primary stage of the infection is usually asymptomatic. Primary pulmonary TB develops in the minority of the people whose immune systems do not successfully contain the primary infection. In this case, the disease may occur within weeks after primary infection. TB may

also lie dormant for years and reappear after the initial infection is contained (Ferrara and Meacci, 2005).

The lungs are primarily involved, but the infection can spread to other organs. Close prolonged contacts (people with prolonged, frequent or intense contact) are at the highest risk of becoming infected. Due to this, 22% infection rates are reported, and some reports show even up to 100%. A person with untreated, active tuberculosis can infect estimated twenty other people per year. Others at risk include foreign-born from areas where TB is common, immune compromised patients, residents and employees of high-risk congregate settings, health care workers who serve high-risk clients, medically underserved, low income populations, and children exposed to adults in high-risk categories (Ferrara and Meacci, 2005).

The chance of getting infected by the TB is highest for people that are in close contact with others who are infected. This includes: 1) Family and friends of a person with infectious TB disease, 2) Person who have immigrated from areas of the world with high rates of TB, 3) People in groups with high rates of TB transmission, including the homeless persons, injection drug users, and people living with HIV infection and 4) People who work or reside in facilities or institutions that house people who are at high risk for TB such as hospitals, homeless shelters, nursing homes and residential homes for those with HIV (Alan, 1995).

Once infectious particles reach the alveoli, another cells called the macrophage, engulfs the TB bacteria. Then the bacteria are transmitted to the lymphatic system and bloodstream and spread to other organs occurs. The bacteria further multiply in organs that have high oxygen pressures, such as the upper lobes of the lungs, the kidneys, bone marrow and meninges, the membrane like the coverings of the brain and spinal cord. When the bacteria cause clinically detectable disease, one has TB. People who have inhaled the TB bacteria, but in whom the disease is controlled are referred to as infected. Their immune system has walled off. The organism in an inflammatory focus is known as a granuloma. Those that have no symptoms, frequently have a positive skin test for TB, yet cannot transmit the disease to others. This is referred to as latent tuberculosis infection or LTBI (Beers *et al.,* 2004).Transmission can only occur from people with active TB disease. The probability of transmission depends on infectiousness of the person with TB (quantity expelled), environment of exposure, duration of exposure and virulence of the organism (Nettina, 2006).

General measures such as avoidance of overcrowded and unsanitary conditions are necessary aspects of prevention. Hospital emergency rooms and similar locations can be treated with ultraviolet light, which has an antibacterial effect. Vaccination is one major preventive measure against TB. A vaccine called BCG (Bacillus Calmette-Guérin, named after its French developers) is made from a weakened mycobacterium that infects cattle. BCG is used more widely in many developing countries where TB is more common. Vaccination with BCG does not prevent infection by *M. tuberculosis* but it does strengthen the immune system of first-time TB patients. As a result, serious complications are less likely to develop. The effectiveness of vaccination is still being studied; it is not clear whether the vaccine's effectiveness depends on the population in which it is used or on variations in its formulation. It can also make TB skin test less accurate. Recent, evidences have shown that BCG is effective at reducing the incidence of TB in children by about half in populations with a high prevalence of active TB but it is much less effective in adults (American Lung Association, 2015).

People that have become infected with TB, but do not have active TB disease, may get preventive therapy. The most common preventive therapy is a daily dose of the medicine isoniazid for 6 to 9 months. This treatment kills germs that are not doing any damage during the treatment, but could so do in the future. If the infected person takes his/her medicine as instructed by the healthcare provider, it can keep him/her self from developing active TB disease. Standard anti-TB therapy typically continues for six months. For the first two months, patients receive three to four drug namely rifampin, isoniazed, pyrazinamide and in some cases ethambutol. During the final months, they continue with rifampin and isonized (American Lung Association, 2015).

Damage from TB continues to grow despite effective therapies from drug-susceptible TB that keeps the incidence of TB in western countries at record lows. The reasons for this shocking failure to control TB globally pivot on the difficulty of providing sustained, properly dosed, multi antibiotic therapy in developing countries. Worse this failure has led to development of drug resistant TB, including the recent recognition of extensively drug resistant tuberculosis (XDR-TB) in precisely those regions that are least equipped to deal with it. The result, though predictable, is no less disturbing: high rate of rapidly fatal TB with an estimated 1.7 million

deaths world-wide annually, 9.2 million new cases of TB disease and more than 2 billion people infected with 'latent' TB (Jain *et al*., 2008).

MDR-TB is defined as resistance in vitro to at least isoniazed and rifampicin, while extensively drug resistant tuberculosis (XDR-TB) is resistant to at least one fluoquinolone and one inject able second line anti TB drug in addition to isoniazid and rifampicin (Migliori *et al.,* 2012; and Falzon *et al.,* 2013). A study demonstrated that, in Germany the MDR-TB treatment related costs exceed €50000 and in Europe the average cost to treat a single XDR-TB case is over €160,000 (Diel *et al*., 2012). The largest Meta analytic study presently available revealed that MDR-TB treatment success is only 54% (with 15%death, 8 % failure or relapse and 23% default) (Falzon *et al*., 2013; Migliori *et al.*, 2013).

WHO has recently launched its innovative "End TB strategy" (WHO, 2014c) supporting the TB elimination strategy and the vision of TB free world with zero death, disease and suffering due to TB (Sotgiu *and* Miglori , 2014). The new strategy clearly supports universal access to high quality MDR-TB diagnosis and treatment. However, since the market launch of rifamicin in the early 1960s, no new anti TB drug has been specifically developed until recently, while significant progress has been achieved in the area of diagnosis (Esposito *et al*., 2014; Codesca *et al*., 2015).

2.4.2. Global prevalence of tuberculosis

Tuberculosis prevalence is the number of people in the population who are living with active TB. Prevalence is usually, but not always given as a percentage of the population. The TB incidence is the number of new cases of active TB disease in a population during a certain time period (usually a year) (WHO, 2014a).

Tuberculosis has been on the rise since early 1980s with Sub-Saharan Africa and South East Asia majorly affected with an estimated 1.7 million deaths every year (WHO report 2011 cited in Tadesse, 2008).The highest level of TB infection in the world may be found in eastern Asia, Oceania and in several areas in Africa. In Africa more than 4 million people suffer from active tuberculosis and 650,000 deaths occurred every year (Kaufmann and Parida, 2008)

Tuberculosis is the second leading infectious cause of death in the world, behind only HIV/AIDS, killing approximately 1.7 million people per year. 25% AIDS patients also die of tuberculosis bringing the total deaths each year from this disease to almost 2.5 million people. Eight million new cases of active TB occur every year, and one-third of the world's population is already sub-clinically infected, creating an enormous reservoir of potential future cases of disease. More than 1.5 million new cases of TB occur every year in sub-Saharan Africa, nearly 3 million in South East Asia, and over a quarter million in Eastern Europe. These numbers are rapidly rising, due in large part to the impact of the HIV/AIDS epidemic (NIAID, 2010).

In 2003, 4 million new and relapse TB cases were reported to WHO, of which 1.9 million were sputum smear-positive pulmonary cases. However, it is estimated that nearly 9 million cases may have occurred worldwide. More than 95% of these cases occurred in developing countries (WHO, 2006). The World Health Organization (WHO), estimated that there were 14 million prevalent TB cases (range, 12 million-16 million), 1.3 million deaths among HIV-negative people and 0.38 million deaths among HIV-positive people in 2009 (WHO, 2012). Even though, it is thought that less than two-thirds (63%) of TB cases are notified globally; in 2014, 1.5 million people died of TB. Of these people 0.4 million people were HIV positive. TB now annually causes more deaths worldwide than HIV. In 2014, 1.2 million people died of HIV and this includes the 0.4 million TB deaths among HIV positive people. People, who have both TB and HIV when they die, are internationally classified as having died from HIV(WHO, 2015).

In 2010, about 80% of reported TB cases occurred in 22 countries. Some countries are experiencing a major decline in cases, while cases are dropping very slowly in others. Brazil and China for example, are among the 22 countries that showed a sustained decline in TB cases over the past 20 years. China, in particular, has made dramatic progress in TB control. Between 1990 and 2010, the TB death rate in the country fell by almost 80% and the total number of people ill with TB dropped by half (WHO, 2010).

The largest increase in tuberculosis has occurred in locations and demographic groups with the highest HIV prevalence, which suggests that the epidemic of HIV is at least partially responsible for the increase of tuberculosis. In high HIV prevalence population, tuberculosis is

a leading cause of morbidity and mortality, and the first presenting sign in the majority of acquired immune deficiency syndrome patients (FMOH, 2008).

There are also studies reporting prevalence of childhood tuberculosis. The report indicated that there are very few cases among 0–14 year olds, even in areas of high transmission (10% of all new cases in Africa in 2004 (Dye, 2006).

Table 2: WHO regional TB statistics for 2014

Region	TB Mortality	Prevalence	Incidence	Population
Africa	450,000	3,200,000	2,700,000	963,361,000
Americas	17,000	350,000	280,000	981,613,000
Eastern Mediterranean	88,000	1,000,000	740,000	635,745,000
Europe	33,000	440,000	340,000	907,279,000
South-East Asia	460,000	5,400,000	4,000,000	1,906,087,000
Western Pacific	88,000	2,100,000	1600,000	1,845,184,000
Global Total	1,100,000	13,000,000	9600,000	7,239,269,000

Source: (WHO, 2015)

2.4.3. Prevalence of tuberculosis in Ethiopia

Tuberculosis has been recognized as major public health problem in Ethiopia more than half a century ago. Ethiopia ranked seventh in the world for TB burden and third in Africa in 2008. The estimated epidemiological burden of TB in Ethiopia indicates that TB is in 5^{th} rank of among the ten top causes of deaths (CDC, 2010). The incidence all forms of TB was 261/100,000 per year and the prevalence of all forms of TB was 394/100,000 population per year (WHO, 2011), 163 new smear positive cases per 100,000 persons, and a prevalence of all forms of TB is 579 per 100,000 population (WHO, 2009). In the year 2009/10 Ethiopia registered 146,172 cases of TB. Among these, 139,261(95.3%) were new cases; 46,132 new smear-positive (33.1%); 49,037 new smear-negative (35.2%); 44,092 new extra-pulmonary TB (31.6%) (MOH, 2011). According to the recent national TB drug resistance surveillance

report, 2.3% of new TB cases and 17.8% of previously treated TB cases were estimated to have MDR-TB (WHO, 2014b).

Tuberculosis is affecting all sexes and age groups. Among the total smear positive TB cases reported in 2009/10, 55.5%were males, 7.5% were children <14 years old, and 2% were above the age of 65. The 15 to 34 age group was found to be the one most affected with TB, accounting for 62% of notified new smear positive TB cases (MOH, 2011). It is reported that smear positive PTB is more common among men than women (Deribew *et al.*,2012).The federal ministry of health (FMOH) hospital statistics data showed that TB is the leading cause of morbidity, the third cause of hospital admission and the second cause of death (FMOH, 2008). Over one third of the population has been exposed to TB due to low health services coverage and poorly developed health information system in the country (WHO, 2005).

A study conducted in Metehara Sugar Factory Hospital showed 14.2% prevalence of smear positive pulmonary tuberculosis (Yohannes *et al*., 2012). Another study on smear positive TB conducted in Agaro Health Centre showed a prevalence of 10.9% (Hussein *et al*., 2012).A study conducted in Bale Robe Hospital showed that the prevalence of smear positive tuberculosis was 9.2% (Begna *et al*., 2014) and other study conducted in Nekemte Hospital also showed 9.41% (Eyasu *et al*., 2013).

2.5. Risk factors Associated with prevalence of TB

Risk factors can be divided into those associated with high risk of TB transmission such as poor living and working conditions, and factors that impair the host's defense against TB infection and disease, such as HIV infection, malnutrition, smoking, diabetes, alcohol abuse, and indoor air pollution (Lo¨nnroth *et al*., 2009).

It is reported that human immune deficiency virus (HIV)/AIDS), diabetes, cancer, malnutrition, alcoholism, smoking cigarette, TB contact, extreme poverty, homelessness, injection drug abuse and being in prison were among the commonly identified risk factors associated with tuberculosis in most developing countries including Ethiopia (Muvunyi *et al.*, 2010). Marginalized populations including prisoners have a higher chance of getting infected with TB (Grady *et al*., 2011). A study conducted in Gamogofa, Ethiopia, prison indicated that

the prevalence of PTB was about 8 folds higher than the prevalence in the general community in southern Ethiopia due to overcrowding condition (Zerihun *et al.*, 2014). Reports of other studies also has indicated that, close contacts of infectious TB cases including household contacts and care givers/health care workers are at a higher risk of becoming infected with *Mycobacterium tuberculosis* and development of primary active tuberculosis (Joshi *et al*., 2006). In addition a systemic review performed by Morrison and colleagues in 17 countries (49% in Africa, 29% in Asia, and 22% in central and South America) indicated that household contacts with infectious TB as a risk factor for TB transmission (Morrison *et al*., 2008).

In developing countries incidence of TB occurrence has been associated with factors like socio-economic status (Komati *et al*., 2010), life style/habits (Rehm *et al*., 2009), laboratory (Bonnet *et al*. 2006) and other co-morbidities. Rapid urbanization witnessed in developing countries and socioeconomic status of individuals has also been shown to have influence on a person's susceptibility to infection (Eisenberg *et al*., 2007 and Dye and Williams, 2010).

The association between smoking and TB has been studied in several systematic reviews (Arcavi *et al*., 2004; Yanbaeva *et al.*, 2007; Bates *et al.*, 2007; Shang *et al*., 2011). Biological explanations including impaired clearance of mucosal secretion (Houtmeyers *et al*., 1999), reduced phagocytic ability of alveolar macrophages (Sopori, 2002) and decrease in the immune response and/or CD4 + lymphopenia due to the nicotine in the cigarettes have been given as reasons for increased susceptibility to pulmonary tuberculosis (Arcavi *et al*., 2004).

Alcohol has been recognized as a strong risk factor for TB disease (L¨onnroth *et al.*, 2008). A systematic review of 3 cohort and 18 case control studies concluded that the risk of active tuberculosis is substantially elevated among people who drink more than 40 g alcohol per day and/or have an alcohol use disorder (L¨onnroth *et al.*, 2008). Reasons for increased risk include alteration in the immune system, specifically in altering the signaling molecules responsible for cytokine production (Fok *et al*., 2008).

Not everyone who is infected with the TB develops TB disease. People at highest risk for developing active TB disease are those with a weak immune system including : 1) Babies and young children, whose immune systems have not matured, 2) People with chronic conditions

such as diabetes or kidney disease, 3) Diseases, conditions or drugs that weaken the immune system including cancer, transplantation, malnutrition, diabetes, alcoholism and HIV infection ,4) Organ transplant and recipients,5) Cancer patients undergoing chemotherapy, and People receiving certain specialized treatments for auto immune disorders such as rheumatoid arthritis disease (American Lung Association, 2015).

Recently, there has been an increase in cases of TB. Factors that may contribute to the increase in TB infection are an increase in the appearance of drug resistant strains of TB; and incomplete treatment of TB infectious which can contribute to the emergence of drug resistant strains of bacteria.

3. MATERIALS AND METHODS

3.1. Description of the Study Area

The study was conducted at Bishoftu hospital. Bishoftu special zone is situated between 8° 43′-8° 45′ N latitude and 38° 056′ -39° 01᾽ E longitude. It is located at a distance of 47 km south east of Addis Ababa. The altitude ranges from1900-1995 meters above sea level. Thus, it belongs to *Woina Dega* Zone (Bishoftu City Adm.Office, 2006).

Its average temperature and annual rain fall are 26.08^{o}C and 735 mm, respectively. Based on 1999 census and population projection made for 2006 E.C up to the end of 2005 E.C, the city had a total population of 154,340. Of these, 73,736(48%) were male and 80,574(52%) were female and in terms of age distribution 62% of the population were in the age range of 15-64 (Bishoftu City Administration Office, 2006).

Bishoftu special zone has two hospitals, three health centers, 18 private clinics, one malaria control center and one multi drug resistance TB clinic in Bishoftu Hospital. Based on the national standard of the country the health coverage of Bishoftu was 75% (Bishoftu City Administration Office , 2006).

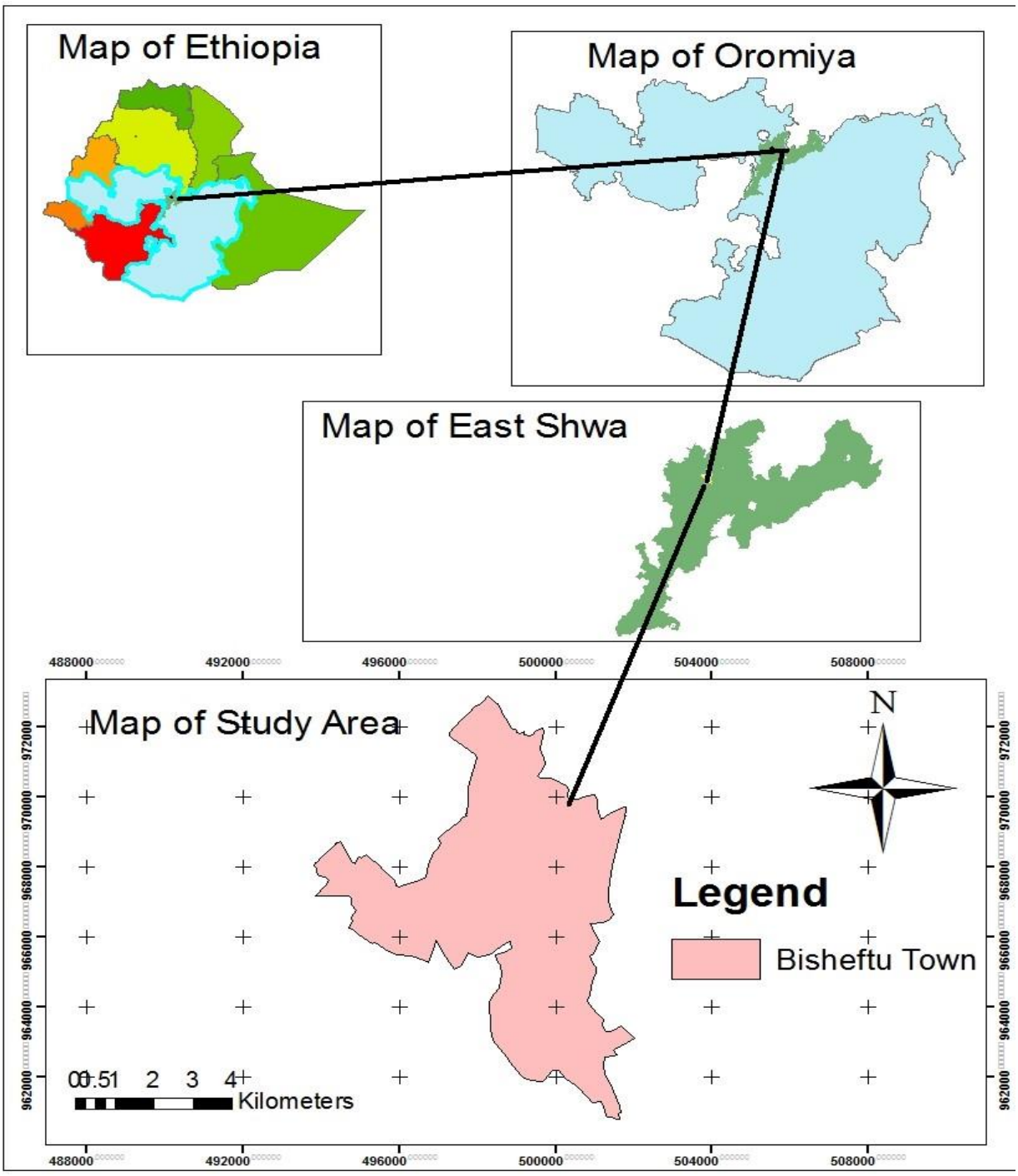

Figure 2: Geographical location of the study area

Source: Bishoftu City Administration Office

3.2. Study Design

The study was conducted from June 2016 - August 2016 at Bishoftu Hospital and has two main parts.

The first part of the study involved a retrospective study to determine the prevalence of tuberculosis and to assess the trend of TB prevalence among all patients who have been admitted at Bishoftu Hospital during the last ten years. This retrospective study comprised the medical records of TB patients by sex and age from the registration book of TB clinic in Bishoftu Hospital in the past ten years (2006-2015).In addition, the total number of all patients who visited Bishoftu Hospital within the last six years (June 2010-August 2015) was taken from the record office of the hospital.

The second part of the study also involved a health institution based cross sectional study to rapidly determine the current prevalence of TB and to find out the associated risk factors of TB. For this, sputum samples from 384 suspected TB patients who visited the hospital within the study period were collected and examined using acid fast test. The national TB control guideline was followed by physicians to diagnose TB patients. Smear positive TB was diagnosed when a patient has at least two initial smear positive sputum examinations for acid fast bacilli (AFB)and when AFB were detected in one of the initial smear examinations by direct microscopy.

Pretested questionnaire was used to collect personal data including socio demographic data of TB suspects who were diagnosed positive by direct microscopy. The willingness of TB patients was asked orally and those who agreed to participate in the study were allowed filling questionnaires. The personal data of TB suspects were classified by gender, marital status, level of education, occupation, average income, residence, number of people living in the house and personal habits such as smoking history, alcohol consumption and diet to find out the risk factors associated with the prevalence of TB. The questionnaire was also used to gather clinical data that were classified as TB history, other critical illnesses such as HIV/AIDS, diabetes mellitus, cancer, etc.

3.3. Sample Size Determination

In order to determine the trend of TB in the study area, the total number of patients who got health services from January 2006 – December 2015 was considered. Regarding the sample size determination for retrospective prevalence investigation, all available TB patients who had been admitted at Bishoftu Hospital from January 2006- December 2015 were included and considered as the sample size of the present study.

The sample size for the cross sectional survey study was estimated by assuming the prevalence as 50% since there was no previously reported study in the area. The sample size was determined using the formula employed by Naing *et al.* (2006).

$n=z^2 P (1-P)/d^2$

Where, n = sample size,

P = Prevalence of tuberculosis,

Z= 95% confidence interval,

d= precision (0.05),

$n= (1.96)^2(.5) (1-0.5)/ (0.05)^2$

n = 384

3.4. Sampling Technique

All patients visiting Bishoftu Hospital with a cough of two weeks or more were considered as TB suspects. 384 TB suspects were successively taken from the Out Patient Department (OPD) of the Hospital.

3.5. Methods of Data Collection

The data for this study were obtained from retrospective TB health record analysis, AFB test, and questionnaire survey.

3.5.1. Retrospective TB health record analysis

The medical record of all notified TB cases over the 10 year's period (2006 to 2015) in Bishoftu Hospital TB clinic was reviewed. The forms of TB, sex and age pattern were assessed to collect necessary information used to determine the trend of TB in the study area. Regarding the total number all types of patients(patients with different cases) in Bishoftu Hospital for the last six years (January 2010- December 2015), data were collected from Bishoftu Hospital patient's data base and the data for the first four years for all types of patients(patients with different cases) (2006-2009) were not available.

3.5.2. Methods of Sputum collection for smear positive PTB

All patients with a cough of two weeks or more were considered as TB suspect and sputum samples were collected from 384 TB suspects. Wide-mouthed translucent cups (containers) were used by trained laboratory technicians in Bishoftu Hospital according to the national tuberculosis and leprosy control program manual standard procedures (FMOH, 2012) on the collection of sputum sample for PTB suspect cases (i.e. spot- early morning - spot).The study participants were visited twice to the Bishoftu Hospital Laboratory Sample Collection Unite to provide sample on two consecutive days. Three sputum samples were collected in the early morning from each person-two spot. They were asked to cough forcibly several times from their lung and expectorate whatever sputum they could produce at the first visit (first spot sample). They were then given a sputum container and asked to repeat the procedure on waking up the next morning (early morning sample). The second spot sample was produced when the early morning sample was brought to the sample collection unit.

3.5.3. Microscopic examination of sputum (AFB test)

The sputum samples were processed and stained using the direct Zeihel –Neelson staining technique and viewed under the microscope for acid fast bacilli (AFB) by an experienced laboratory technician in Bishoftu hospital. The diagnosis of smear positive PTB was based on the national guide line for microscopic examination of tuberculosis (FMOH, 2013). All positive and negative samples were checked and the result was noted on laboratory data collection format. All individuals found to be positive were contacted by health workers in the

TB clinic of Bishoftu hospital and were put on treatment. TB treatment and follow up are provided free of charge at the hospital.

3.5.4. Questionnaire survey

A structured and pre-tested questionnaire was used to find out associated risk factors of TB among TB suspects during their hospital visit from June 2016-Augest 2016. The questionnaire was translated into Amharic and Oromifa and pretested using 15 suspected TB patients and 5 medical staff members. The questionnaire was organized into the following sections:

I. Socio-demographic characters that include age, sex, residence, educational status, occupation, family size, number of children, housing (number of rooms), monthly income and food habit ; II. Other associated risk factors like knowledge about the cause, mode of transmission and prevention, sign and symptoms of TB;

III. Diseases such as HIV/AIDS, Diabetes, cancer, etc

IV. Personal behavior like alcoholism, smoking cigarette and chat chewing.

The questionnaire was filled in either by the participants themselves or by the researcher or laboratory technician for participants with limited education.

3.6. Data Analysis

All data were analyzed by using Stat for windows version 11.0 and Microsoft Excel. Descriptive statistics was used for analysis of retrospective data and data from questionnaire survey. *Chi*-square tests were used to compare differences between groups and $p<0.05$ were considered as statistically significant in this study. A binary logistic regression analysis was used and odds ratio was calculated to determine the strength association between variables and life time exposure to TB infection.

3.7. Data Quality Control

The questionnaire was prepared originally in English and then translated into Afan Oromo and Amharic for the actual data collection and back translated into English. The ten years data of

registered patients (2006-2015) was collected from the medical records of the Bishoftu Hospital and TB clinic by two data collectors (Diploma Nurses) in collaboration with the main investigator of this research. Two nurses from Bishoftu Hospital (BSc Nurses) who were working in the TB section participated in the questionnaire survey.

3.8. Ethical Considerations

The study was carried out after cooperation letter was obtained from the Department of Biology, Haramaya University, to conduct the study. The letter was taken to Bishoftu Hospital, Oromia Health Bureau, and Bishoftu Special Zone Health Bureau. Permission was then obtained from the hospital and each Health bureau. Informed oral consent was obtained from all respondents (attached in the appendices, page68-69). Confidentiality of the participants was kept by the researcher.

4. RESULTS

4.1. Prevalence of TB among Patients in Bishoftu Hospital from 2006-2015

A total of 3976 all forms of TB patients were registered during the last ten years (2006 to 2015) in Bishoftu hospital. Out of 3976 TB cases registered in the last ten years, 2164 (54.4%) were males and 1812(45.6%) were females respectively (Table 3). The data showed that the most commonly affected TB patients reside in age group of 15-34 (50.0%) followed by 35-54 (30.%);however the prevalence was less commonly observed in the age groups 0-14 (7.7%) and ≥55 (12.3%).

Sex wise highest number of TB patients was observed in male (311 and 513) and in female (298 and 411) in the year 2008 and 2009 respectively where as in the year 2014 and 2015 low number of male (114 and 96) and female (81 and 75) TB patients were observed (Table 3). The study revealed that the number of TB patients were increasing among both sex across the years from 2006-2009, being the higher (513 males and 411 females) in 2009. However, currently the distribution of TB among both genders were slightly decreasing across the year from 2010-2015 being the lowest (96 males and 75 females) in the year 2015 (Table 3).

Table 3: Age and sex distribution of all type of TB cases that were registered during 2006-2015

YEAR	SEX	AGE				Number of registered TB cases
		0-14	15-34	35-54	>55	
2006	M	13	70	93	36	212
	F	20	84	80	22	206
	T	33	154	173	58	417
[i]2007	M	18	115	64	26	223
	F	12	121	51	13	197
	T	30	236	115	39	420
2008	M	26	140	93	47	311
	F	44	155	80	24	298
	T	70	295	173	71	609
2009	M	25	2o3	185	100	513
	F	49	181	131	50	411
	T	74	384	316	150	924
2010	M	15	139	81	32	267
	F	20	105	37	26	188
	T	35	244	118	58	455
2011	M	10	93	54	16	173
	F	12	97	35	10	154
	T	22	190	89	26	327
2012	M	7	94	36	15	152
	F	4	61	24	12	101
	T	11	155	60	27	253
2013	M	3	53	31	16	103
	F	8	59	26	6	99
	T	11	112	57	22	202
2014	M	5	70	34	5	114
	F	2	64	11	6	83
	T	7	134	45	11	197
2015	M	4	48	28	16	96
	F	10	37	17	11	75
	T	14	85	45	27	171
Total		307 (7.7%)	1989 (50.0%)	1191 (30.0%)	489 (12.3%)	3976

4.2 Trend of Prevalence of TB Patients in Bishoftu Hospital from year 2006-2015

Based on the type of TB, the most frequent TB was EPTB (42.1%) followed by PTB- (29.9%) and PTB+ (28%) (Figure 1 in the appendices). The trend in the prevalence of all forms of TB showed that there was a considerable difference between years of attendance. The number of PTB (PTB+ and PTB-) and EPTB patients were higher in the year 2009 and later shown a considerable decline between years 2009-2015 (Figure 2).

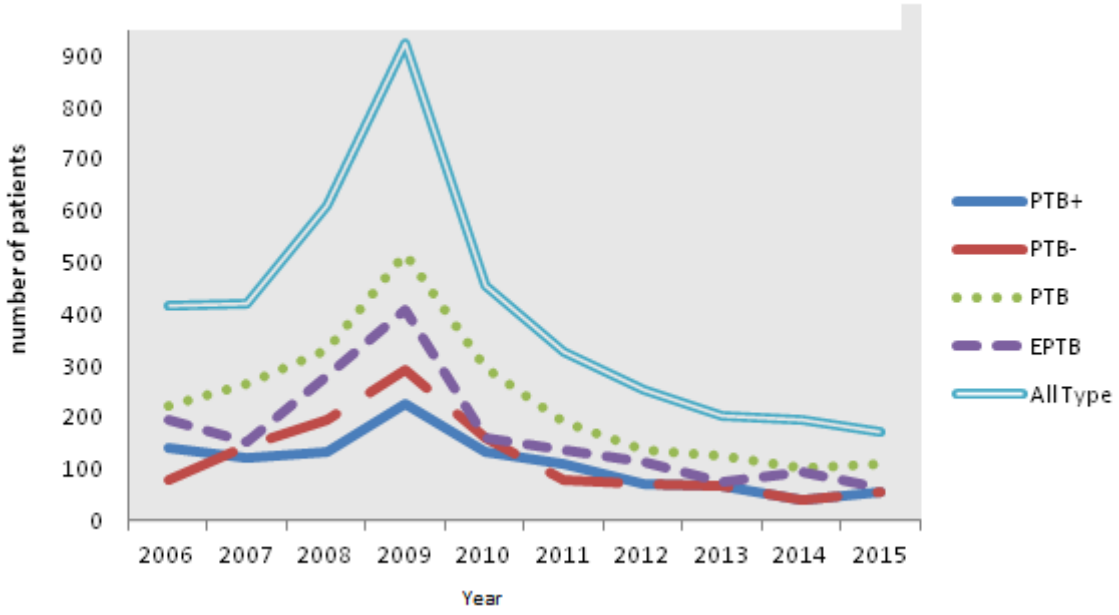

Figure 3: Prevalence of all forms of TB from year 2006-2015 in Bishoftu Hospital

Source: Own Survey result, 2016

The trend of prevalence of all TB type when it is extrapolated out of 100,000 population was highest in the year 2010 (550 per 100,000 population), which then sharply decreased in the year 2011 (249 per 100,000 population) and then gradually declined to189, 185, 175 and112 per 100,000 populations as of 2012 till 2015 respectively (Figure 3).

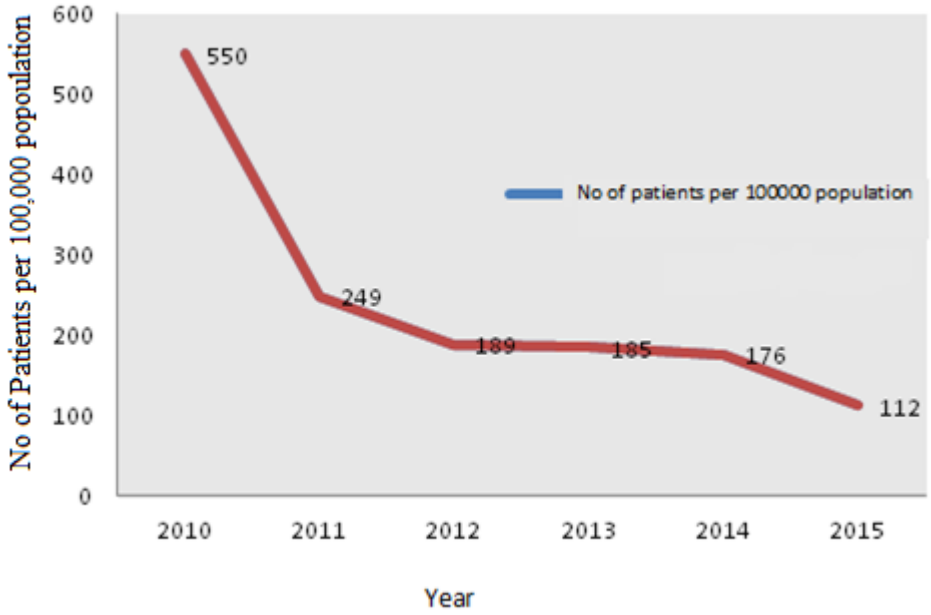

Figure 4: Trend of TB prevalence from the year 2010-2015 in Bishoftu Hospital when it is extrapolated out of 100,000 populations.

Source: Own Survey result, 2016

4.3 Association of Prevalence of Smear Positive PTB and Risk factors (June-August 2016)

4.3.1 Socio-demographic characteristics of respondents

A total of 384 clinically suspected patients were selected to participate in the study. The sex distribution of the respondents showed that, 206 (53.65%) were male and 178 (46.35%) were females. In terms of age category 44 (11.46%) were in 0-14 years, 154 (40.10%) in 15-34 years, 123 (32.03%) in 35-54 and 63 (16.41%) were ≥ 55 years. Regarding their permanent residence, majority of the respondents 210(54.69%) were urban dwellers. Concerning their educational status, 121 (31.51%) of the respondents were illiterate and 146 (38.02%) were primary school completed. With regards to their occupation, 66 (17.19%) were unemployed, 56 (14.58%) were civil servants, 54 (14.06%) who were students, 75 (19.53%) housewives, 132 (34.38%) private workers. Regarding their marital status, 197 (51.3%) of them were married and 101(26.30%) were single (Table 4).

The family size of most respondents range from 3-4 for 161(41.92%) and ≥5 for140 (36.46%) respondents. In regard with their monthly income, the monthly income of respondents, range from no income 109 (28.4%), <600 95(24.7%) 600-1500 were79 (20.5%), 1500-2500, 60 (15.6%) and 41(10.6%) ≥ 2500 Ethiopian birr. Concerning their home, 187(49.1%) of the respondents were living in two rooms and 95 (24.93%) in one room. Regarding their food habit,162 (42.41%) were consuming unbalanced diet and 96 (25.13%) were consuming balanced diet (Table 4).

4.3.2 Disease factors, personal behavior and living conditions of study participants

Most of the respondents 366 (95.3%) were not living in confiding place. As far as the TB contact history is concerned, majority of the respondents 339 (88.3%) had no TB contact history with PTB patients. Majority of the study participants (53.1%) had no disease other than smear positive pulmonary TB. However 55 (14.3%) of them have HIV virus and 72(18.7%) of them had other diseases. With regard to alcohol consumption, majority of them 182 (47.4%) use alcohol sometimes, 171(44.5%) were not taking alcohol and only 31(8.0%) were frequently alcohol consumers. Majority of the respondents 340 (88.5%) were not Chat chewers. Concerning with smoking habit only13.8% of the respondents were smokers and 9.1% of the respondents were living with person smoking in their family. Regarding the environment in which the respondents lived, (4.7%) of the respondents were lived in a confounding environment. However, majority of the respondents (95.3%) were not living in a confounded environment. As far as the TB contact history is concerned, majority of the respondents 339 (88.3%) had no TB contact history with PTB patient (Table 5).

Table 4: Association between socio-demographic characteristics of respondents and prevalence of Smear positive PTB in Bishoftu Hospital from June - August 2016

Variable	Category	P-TB Positive (N %)	Negative (N %)	P-Value
Age	0-14	2 (0.5%)	42(10.9%)	0.094
	15-34	17 (4.4%)	137(35.7%)	
	35-54	12(3.1%0	111 (28.9%)	
	≥55	1 (0.25%)	62 (16.1%)	
Sex	Male	18 (4.7%)	18849.0%)	0.758
	Female	14 (3.6%)	164 (42.7%)	
Residence	Urban	22 (5.7%)	188(49.0%)	0.095
	Rural	10 (2.6%)	164 (42.7%)	
Educational Status	Illiterate	8 (2.1%)	113 (29.4%)	0.814
	Primary ed.	14 (3.6%)	132 (34.3%)	
	Secondary	6 (1.6%)	71 (18.5%)	
	Diploma and above	4 (1.0%)	36 (9.4%)	
Occupation	Unemployed	6 (1.6%)	60 (15.6%)	0.697
	Civil servant	2 (0.5%)	54 (14.1%)	
	Student	6 (1.6%)	48 (12.5%)	
	Housewife	5 (1.3%)	70 (18.2%)	
	Private workers	13 (3.3%)	119 (31.0%)	
	Others	0 (0.0%)	1 (0.25%)	
Marital Status	Single	8(2.1%)	93 (24.2%)	0.428
	Married	19 (4.9%)	178 (46.4%)	
	Divorced	4(1.0%)	37 (9.6%)	
	Widowed	1 (0.25%)	44(11.5%)	
Monthly income in Ethiopian Birr	No income	8(2.1%)	101(26.3%)	0.060
	<600	5(1.3%)	90(23.4%)	
	600-1500	13(3.3%)	66(17.2%)	
	1500-2500	3(0.8%)	57(14.8%)	
	>2500	3(0.8%)	38(9.9%)	
Room	Homeless	1(0.25%)	6(1.6%)	0.210
	1	12(3.1%)	83(21.6%)	
	2	15(3.9%)	172(44.8%)	
	≥3	4(1.0%)	88(22.9%)	
	No response		3(0.8%)	
Family size	0	3(0.8%)	18(4.7%)	0.764
	1-2	5(1.3%)	57(14.8%)	
	3-4	12(3.1%)	149(38.8%)	
	≥5	12(3.1%)	128(33.3%)	
Food habit	**Vegetarian**	**2(0.5%)**	**56(14.6%)**	**0.005***
	Non-Vegetarian	**2(0.5%)**	**64(16.6%)**	
	Balanced	**5(1.3%)**	**91(23.7%)**	
	Unbalanced	**23(5.9%)**	**139(36.2%)**	
	No response		**2(0.5%)**	

Key: *P≤0.05 statistically significant

Table 5: Association between disease factors, personal behavior, disease factors and living conditions of respondents and prevalence of Smear Positive PTB in Bishoftu Hospital from June 2016 - August 2016

Variable	Category	PTB		P value
		Positive (N %)	Negative (N %)	
TB contact history	Yes	9 (2.3%)	36 (9.4%)	0.048*
	No	23 (6.0%)	316 (82.3%)	
Living in confiding place	Yes	4(1.0%)	28(3.6%)	0.004*
	No	28(7.3%)	338(88.0)	
Disease Factors	HIV positive	11 (2.9%)	44 (11.5%)	0.018*
	Diabetes mellitus	4 (1.0%)	28 (7.3%)	
	Lung cancer	0/8 (0.00%)	8 (2.1%)	
	Other	4/72 (1.0%)	68 (17.7%)	
	No other disease	13 3.4%)	204 (53.1%)	
Alcohol consumption	No	17 (4.4%)	154 (40.1%)	0.002*
	Sometimes	8 (2.1%)	174 (45.3%)	
	Frequently	7(1.8%)	24 (6.2%)	
Chat chewing	Yes	6 (1.6%)	27 (7.0%)	0.043*
	Sometimes	2 (0.5%)	9 (2.3%)	
	No	4 (1.0%)	336 (87.5%)	
Smoking Cigarette	Yes	10 (2.6%)	43 (11.2%)	0.003*
	No	22 (5.7%)	309 (80.5%)	
Family Smoking	Yes	6 (1.6%)	29 (7.5%)	0.048*
	No	26 (6.8%)	323 (84.1%)	

Key: *=P<0.005 statistically significant

4.3.3 Socio-demographic characteristics, personal behavior, Disease factors and living conditions of respondents associated with smear positive PTB

The result of this study indicated that Poor diet consumption had statistically significant association with smear positive pulmonary tuberculosis (PTB+) (P<0.05). However there was no statistically significance difference observed among smear positive pulmonary tuberculosis patients in relation to age, sex, residence, educational status, occupation, marital status, family size, housing and monthly income (p > 0.05) (Table 4)

As it is shown in table 5, TB contact history (p=0.04), living in confiding place (p=0.029), being HIV positive (p=0.018), alcohol consumption (p=0.002), chat chewing (p = 0. 043), smoking cigarette (p=0.003), and family smoking (p < 0.048) also have statistical significant association with PTB+ (P < 0.05)

4.3.4. Binary logistic regression analysis of Socio-demographic characteristics and personal behavior, disease factor and living conditions of respondents associated with Smear Positive PTB in Bishoftu Hospital

Binary logistic regression model was used to see the association between the prevalence of Smear positive pulmonary tuberculosis with determinant factors (Table 6)

Poor diet or unbalanced diet consumption had independent association with the distribution of pulmonary tuberculosis among the study respondents (p=0.027). Respondents who were consuming poor diet were five times (OR = 5.29, 95% CI = 1.21 –23.14) more likely to develop smear positive PTB compared to non vegetarian.

HIV infection were associated with the distribution of smear positive PTB among the study respondents (p=0.002). HIV positive respondents were about four times (OR=3.92; 95% CI=1.64-9.33) more likely to develop smear positive PTB than who were HIV negative.

TB contact history were associated with the distribution of smear positive PTB among the study respondents (p=0.004). Those who had contact with active TB patient in their vicinity were about three times (OR = 3.43; 95% CI = 1.43.–7.98) more likely to develop smear positive TB than those who were not.

Living in confiding place were associated with the distribution of smear positive among the study respondents (p=0.0170).Those who lived in confounding place were about four times more likely to develop PTB+ than those who lived in non confounding place(OR= 3.87; 95% CI =1.0-11.62).

The alcohol consuming habits of respondents were associated with the distribution of pulmonary tuberculosis among the study respondents (p=0.001). Frequently alcohol drinkers are six times (OR=6.34; 95% CI=2.11-19.06) more likely to develop PTB+ than those who

consume alcohol sometimes. Alcohol consumption had an independent association with the prevalence of pulmonary tuberculosis.

The smoking status had an independent association with the prevalence of pulmonary tuberculosis (p=0.004).Those who were smoking cigarette are three times (OR = 3.26; 95% CI = 1.44-7.36) more likely to develop smear positive pulmonary TB than those who do not smoke.

The Chat chewing habits of respondents were associated with the distribution of pulmonary tuberculosis among the study respondents (p=0.031). Chat chewers were about three times (OR=2.92; 95%CI=.598-14.31) more likely to develop smear positive PTB than non chat chewers (Table 6).

Table 6: Binary logistic regression analysis of socio demographic characters disease factor and personal behavior of respondents associated with Smear Positive PTB

Variable	Odds ratio	[95%conf.interval]	P-Value
Food habit		.	
Non vegetarian	1		
Vegetarian	1.14	[.155 - 8.33]	0.895
Balanced	1.75	[.330 - 9.34]	0.508
Poor diet	5.29	[1.211 - 23.14]	0.027*
Associated diseases or factor			
No other disease	1		
HIV positive	3.92	[1.649-9.33]	0.002*
Diabetes mellitus.	2.24	[0.683-7.35]	0.183
Lung cancer	Omitted		
Other disease	0.923	[0.291-2.92]	0.892
TB contact history			
No	1		
Yes	3.43	[1.43-7.98]	0.004*
Living in confiding			
No	1		
Yes	3.87	[1.0-11.62]	0.0170*
Alcohol consumption			
Sometimes	1		
No	2.4	[1.00 - 5.7]	0.048
Frequently	6.34	[2.11 - 19.06]	0.001*
Chat chewing			
No	1		
Yes	2.92	[1.10- 7.77]	0.031*
Sometimes	2.92	[.598 -14.31]	0.185
Smoking cigarette			
No	1		
Yes	3.26	[1.44 -7.36]	0.004*
Family smoking			
No	1		
Yes	2.57	[.978 -6.75]	0.055

Key: 1=Reference, $p<0.05$ statistically significant, OD=Odd ratio, 95%CI=95% confidence interval.

4.3.5. Assessments of study respondents level of awareness about the cause of TB, modes of transmission, signs and symptoms and methods of preventing the spread of TB infection

In the current study, 67.4% of the study respondents reported that they had access to health education through Radio/Television and 61.7% of the respondents respond that bacteria/germs as the cause of tuberculosis. Regarding awareness of other risk factors influencing TB, majority of the respondents (73.4%) reported that poor living condition is related to TB. Some of the respondents replied that drug abuse (24.0%), working condition (44.5%) and the presence of other disease (14.8%) are risk factors that influence tuberculosis (Table 7).

Pertaining to the mode of transmission of PTB, 71.3% of respondents replied that droplet infection as a means of transmission, 54.43% through overcrowding, However, minority of respondents answered that 36.9% by sharing the same utensils, 19.0% by living in the same room, and 20.5% by sleeping together and 33.5% open window in public transport or "*Bird simeta"* (Table 8).

The majority of the respondents (70.5%) responded that the spread of PTB (TB transmission) can be prevented (Table 9). In relation to the methods of reducing the spread of TB from infected person, 299 (77.86%) respondents came with an answer that avoiding droplet infection or avoiding coughing or sneezing in front of others, 55.7% of by spiting the sputum in a container with cup, (55.2%) by ventilating living room and only 10.9% replied a wrong answer i.e.by spiting the sputum in the open air everywhere (Table 9). Regarding the symptoms and sign of PTB more than half of the respondents replied that long lasting cough (55.4%) and chest pain (58.8%), as a pertinent symptom and sign of TB. But about other symptoms and signs of PTB less than 50% of respondents replied correctly. i e. their answer for other symptoms and signs of TB were; loss of body weight 44.2%, night sweating 45.5%, persistent fever 29.4%, and loss of appetite 18.5% (Table 9).

Table 7: Awareness of study respondents about the cause of TB and factors influencing TB among study respondents in Bishoftu Hospital (n=384).

Characteristics	Category	Frequency	Percent
Access to Health Education	Yes	259	67.4
	No	125	32.6
Cause of TB	Bacteria/germ	237	61.7
	Aging	15	3.9
	Genetic disorder	6	1.6
	I don't know	96	25.0
	Other	30	7.8
TB is influenced by :			
Drug use	Yes	92	24.0
	No	292	76.0
Poor living	Yes	282	73.4
	No	102	26.6
Presence of other disease	Yes	57	14.8
	No	327	85.1
Working condition	Yes	171	44.5
	No	213	55.5

Table 8: Level of awareness about the mode of TB transmission among study respondents (n=384) in Bishoftu Hospital during June-August 2016

Characteristics	Category	Frequency	Percent
Method of TB transmission	Yes	274	71.35
Through air droplet	No	110	28.65
Overcrowding	Yes	209	54.43
	No	175	45.57
Traveling in a crowded	Yes	172	44.79
Bus	No	212	55.21
Sexual intercourse	Yes	4	1.04
	No	380	98.86
Blood contact	Yes	33	8.59
	No	351	91.41
Sharing the same	Yes	142	36.98
Utensils with TB patient	No	242	63.02
Open window in	Yes	129	33.59
Public transport	No	259	66.41
Insect bite	Yes	3	0.78
	No	381	99.22
Living in the same room	Yes	73	19.01
With the patient	No	311	80.99
Sleeping together	Yes	79	20.57
	No	305	79.43
Hand shaking	Yes	2	0.52
	No	382	99.48
I do not know	Yes	24	6.25
	No	360	93.75

Table 9: Level of awareness among Study respondents (n=384) about Signs, symptoms and methods of preventing the spread of TB infection in Bishoftu Hospital during June-August 2016

Characteristics	Categories	Frequency	Percent
What are signs and symptoms of TB?			
Long last coughing	Yes	213	55.47
	No	171	44.53
Weight loss	Yes	170	44.27
	No	214	55.73
Persistent fever	Yes	113	29.43
	No	271	70.53
Night sweating	Yes	175	45.57
	No	209	54.43
Chest pain	Yes	226	58.85
	No	158	41.15
Loss of appetite	Yes	71	18.49
	No	313	81.51
I don't know	Yes	32	8.33
	No	352	91.67
Is it possible	Yes	271	70.57
To prevent TB?	No	113	29.43
TB patients prevent the spread of TB to others by			
Not coughing in front of	Yes	299	77.86
other people	No	85	22.14
Spit in a container	Yes	214	55.73
with cup	No	170	44.27
Spit out in the open	Yes	42	10.94
everywhere	No	342	89.06
Ventilating the	Yes	212	55.21
living room	No	172	44.79

5. DISCUSSION

The current study showed that TB was predominant in males (54.6%) than female (45.4%) which was in line with the report by Muvunyi *et al.* (2010) and Chandrasekhar *et al*. (2008). Similarly, the sex distribution of TB patients recorded in the present study was also consistent with the report of other studies conducted in different part of the country such as in Southern Ethiopia (Shargie and Lindtjorn, 2005; Nourth West Ethiopia Kassu *et al*., 2007; and report of WHO, 2008 and 2014 b). This reflects sex difference is probably the risk factor of TB in the study area.

Tuberculosis was prevalent in male in all age group except age group below 15, which is consistent with the global pattern of TB where the number of male TB cases exceed that of female in all age groups except in children (WHO, 2008). Age wise, those within 15-34 and 35-54 age had prevalence of 47.10% and 37.10% indicating that these age groups were mainly affected by TB. On the other hand TB was less commonly observed in 0-14 (4.1%) and ≥55 (15.1%) age groups. This result is consistent with the report of the other studies conducted in southern Ethiopia (Shargie and Lindtjorn, 2005), Nepal (Chandrashekhar *et al*., 2008) and national report of federal ministry of health (FMOH, 2013). In addition reports from ministry of health indicated that tuberculosis is an obstacle to the socio-economic development; 75% of people affected by TB are within the economically productive age group of 15-54 years (FDRE MOH , 2008; FDRE MOH, 2010*)*.The higher prevalence of TB in the age groups15-34 and 35-54 is probably due to the fact that these age groups were socially and sexually active which might lead to co-infection with HIV, which is a risk factor for TB (FMOH, 2013).

The finding from retrospective study indicated that the overall annual trends of all forms TB in the last six years (2009-2015) were observed to fall gradually, with a slight fluctuation in the number of cases of PTB+ and PTB- in 2014 and 2015. The decline in prevalence of TB is similar to the national and global TB incidence according to the WHO report of 2008 (WHO, 2008). In addition the result of this study coincide with WHO report that showed fall in the prevalence of all forms of TB in Ethiopia which was 394/100000, 152/100000, and 133/10000

0 population in the year 2011, 2013 and 2014 respectively. This could be due to the effect of DOTS program being implemented in the TB clinic of Bishoftu hospital and improvement of knowledge about TB and advancement of health facilities in the area.

In current retrospective study the number of PTB patients was higher (57.85%) than EPTB (42.15%) from 2006-2015. This finding is consistent with studies in south region of Ethiopia which indicated that, PTB (67%) and EPTB (33%) (Shargie and Lindtjorn, 2005), and in northwestern Ethiopia which also indicated, PTB (64.2%) and EPTB (35.8%), regardless of HIV status (Kassu *et al*., 2007).

This cross sectional study provides insights in to the prevalence of smear positive PTB among TB suspected patients visiting Bishoftu Hospital, as well as outline some possible risk factors. The study showed that out of 384 TB suspects, 32 of them were smear positive PTB patients by direct Zeilhe-Neelsen staining technique and the current prevalence of PTB patients were 8.33%.The result of this finding is coincide with study conducted on prevalence of smear positive TB in hospitals and health centers of Ethiopia; Agaro Teaching Health Center (10.9%) (Hussein *et al*., 2012), Bale Robe hospital 9.2% (Begna *et al.,* 2014), and Nekemte hospital west Ethiopia 9.41% (Eyasu *et al.,* 2013).The study also showed less prevalence of smear positive PTB in the study area compared with other study conducted in Metehara sugar factory Hospital (14.2%) (Yohannes *et al*., 2012). Similar studies conducted in Rwanda also reported (17.3%) (Muvunyi *et al*., 2010), and in Nigeria (14.7%) (Imam, 2008) which were higher compared to the findings in this study.

The finding of this study showed that malnutrition (poor diet consumption) was associated with (p=0.027) smear positive pulmonary TB and this finding is in line with studies that have shown malnutrition and poor living were among the commonly identified risk factors associated with tuberculosis in most developing countries including Ethiopia (Muniyandi *et al*., 2007, Lo¨nnroth *et al*., 2009 and Muvunyi *et al.,* 2010). Malnutrition (both micro- and macro-deficiency) increases the risk of TB because of an impaired immune response (Cegielski and Murray, 2004; Chandra , 1997). TB disease can itself lead to malnourishment because of decreasing appetite and changes in metabolic processes (Abba. *et al*, 2008). Malnutrition results in lowered immunity and immunity is known to play a role in progression of infection to overt pulmonary TB disease. Substantial experimental evidence suggests that

malnutrition can lead to secondary immunodeficiency that increases the host's susceptibility to infection. Increased risk of tuberculosis can result from alteration in the individual protective function or the interaction between T-lymphocytes and macrophages because of nutritional insult (Rook and Hernamndez, 1996; Chan *et al*., 1997).

The prevalence of smear positive PTB was significantly higher (p=0.002) in HIV positive patients (11/55, 20 %) than HIV-negative (21/329, 6.4%) in the present study. Similarly, studies conducted in different parts of the world including some African countries showed the prevalence rate of TB-HIV co-infection ranges from 8% in Congo to 82% in Swaziland (WHO, 2007; Muvunyi *et al.,* 2010). Based on the WHO report in 2012, in Ethiopia the rate of co infection was (41%) (WHO, 2012). As it is well established, the strong association between HIV and TB is attributed to the overlapping of the age group that both infections are affecting and the immunological deprivation that HIV results in. People with HIV are increasingly infected with tuberculosis because HIV weakens their immune system. HIV/AIDS fuels the tuberculosis epidemics in many ways such as promoting progression to active tuberculosis, increasing the risk of reactivation of latent tuberculosis infection, as well as increasing chance of tuberculosis infection once exposed to tubercle bacilli (Sharma *et al.*, 2005).Tuberculosis disease appears when the immune response is unable to stop the growth of *mycobacteria*. IFN-γ or its cellular receptors leads to severe and fatal TB. During HIV infection IFN-γ production is decreased dramatically which leads to an increased risk of developing reactivation or reinfection by M. tuberculosis in these HIV/TB patients (Ottenhoff *et al.,* 1998).

The present study also revealed that contact with TB patient was significantly associated (p=0.004) with pulmonary TB infection i.e. history of previous contact to PTB patients was one of hot related risk factor for PTB, which is consistent with the studies conducted in Ethiopia at Seka Health Center (Gebrie and Mimano, 2010), in Nekemte Hospital (Eyasu *et al.,* 2013) and in other developing countries like India (Rao *et .al*., 2011). In addition A systemic review performed by Morrison and colleagues in 17 countries (49% in Africa, 29% in Asia, and 22% in central and South America) to determine the yield of household contact investigation is in line with the result of this study as well (Morrison *et al*., 2008).

Living in confiding place was found to be associated with PTB+ in the study area (p=0.029). Report from other studies demonstrated that marginalized populations including prisoners have a higher chance of getting infected with TB because of crowded living conditions (Grady *et al*., 2011), prisons of Gamo Goffa Zone, south Ethiopia (Zerihun *et al*., 2014). In line with this finding, studies from Pakistan, Gambia, and Thailand also reported similar findings which point out living in confounding or overcrowding condition as one of the risk factors for TB infection (Khurram *et al*., 2012, Hill *et al*., 2006, and Tornee *et al*., 2004).Transmission of *M.tuberculosis* is more likely if there is poor ventilation. Occupancy density, room volume and air change rate are all directly correlated with the number of new TB infections among persons who share air space. In adequate rates, negative air flow and recirculation of air have been identified as an occupational hazard in hospitals with respect to TB transmission (Menzies *et al*., 2000 and Beggs *et al*., 2003).

Alcohol consumption is one of the significant risk factors associated with TB in the study area (p=0.002). Similarly a study conducted in Kenya (Ndungu *et al*., 2013) that showed alcohol consumption is associated with TB saying that 39.5% of the patients being alcohol consumers. The present finding is also analogous with systematic review of association between alcohol use and tuberculosis found those who consumed more alcohol per day and/or have an alcohol disorder have an elevated risk of active tuberculosis (Lonnorth *et al*., 2008). Moreover, this finding is consistent with the study conducted in Russia which has indicated that 62% of the patients were alcohol abusers and that alcohol abuse/ dependence is associated with an eight fold increase in drug resistance and relapse (Fleming *et al*., 2006). A study in the Greater Vancouver regional district in Canada shows that smear positive patients had a history of alcohol abuse (Hernandez *et al*., 2004). Alcohol consumption leads to higher risk of infection or weakened immune system as a result of direct toxic effects of alcohol on the immune system leading higher risk of break down from infection to TB diseases (Zolnir *et al*., 2001). Reasons for increased risk of developing PTB due to alcohol consumption include alteration in the immune system, specifically in altering the signaling molecules responsible for cytokine production (Szabo, 1997).

Smoking was associated with the distribution of PTB+ (p= 0.003) and consistent with similar studies conducted in different countries (Bates *et al*., 2007; Shang *et al*., 2011 and Ndungu *et al*., 2013). In line with this finding, Bates and colleagues, in their meta-analysis of 24 studies on the effects of smoking on TB, proven that the relative risk of TB disease was high among smokers in comparison to non-smokers and that there was clear evidence that smoking causes remained a risk factor for TB infection and disease TB (Bates *et al*., 2007). Moreover, the association between smoking and TB which supports the present finding has been studied in several systematic reviews (Maurya *et al.,* 2002, Arcavi *et al*., 2004, Yanbaeva *et al.,* 2007).

The reason for the increased risk of infection in smokers is unclear, but may be explained by the effects of smoking on pulmonary host defenses. Smoking has been shown to reduce natural killer cytotoxic activity, to suppress T cell function in both lung and blood, to impair mucociliary clearance of particles. The products of cigarette smoke may favors persistence and/or replication of ingested *Mycobacterium tuberculosis* by impairing the macrophage or dendritic cell function (Shang *et al*., 2011).Smoking damages the lungs and impacts the body's immune system, making smokers more susceptible to TB infection. The occurrence of TB has been shown to be linked to altered immune response and multiple defects in immune cells such as macrophages, monocytes and CD4 lymphocytes (Altet *et al.,* 1996). Other mechanisms, such as mechanical disruption of cilia function and hormonal effects, could also appear secondarily to smoking (Buskin *et al.,* 1994).

The finding of this research also revealed that chat chewing was one of the significantly associated risk factors to smear positive PTB (p=0.031). Similar result was found in study conducted in Nekemte referral hospital, Ethiopia (Eyasu *et al*., 2013).The active ingredient of chat, cathinone is shown to have immunomodulary effect. In principle, this leads to enhanced susceptibility to varies infections including tuberculosis (House *et al*., 1994).

The current study showed that, sex, marital status married, educational level, monthly income, residing in urban areas and family size were not significantly associated risk factors to smear positive PTB. This finding is in contrast with studies conducted in different countries such as a study conducted in Eastern Ethiopia (Abebe *et.al*., 2011) and in Gambia (Philip *et.al*., 2006),

which showed that sex(male), marital status (married), educational level, monthly income, residing in urban areas and family size as identified key risk factors for a smear positive PTB. Lack of association might be explained by different group of study population, study time and methodologies.

The finding of this study showed that 67.4% had access to health education and 61.7% of the study participants were aware of the causative agent of PTB. In contrast to this finding, studies done on Southwest Ethiopia showed that 33.7% of TB suspected patients (Abebe, 2010) and Nigeria50% of patients (Enwuru *et al.,* 2002) had knowledge about the cause of TB. This may be due to relatively better awareness of respondents about the causative agent of TB because many of them had an access to health education.

The majority of the respondents (71.5%) responded that the spread of PTB (TB transmission) can be prevented and this outcome is more or less similar to the study done in Pakistan, which pointed that (89.4%) of patients consider it as a preventable disease (Javaid *et al*., 2004). Majority of the study participants were familiar with the main mode of transmission (71.3%), method of prevention (77.8%), and signs and symptoms of PTB (55.4%). This may be one of the factors for low current prevalence of smear positive PTB (8.3%) compared with other studies cited in this thesis (Eyasu *et al.,* 2013; Yohannes *et al*., 2012; Hussein *et al*., 2012).

Although majority of the respondents were familiar with the main methods of transmission and prevention of PTB transmission, many of them don't know some other possible means of transmission and prevention (e.g. habit of sharing a single cup among several individuals).In relation to this 63.0% of the respondents did not know that sharing the same utensils with TB patients as one of the means of disease transmission and 33.5% of respondents replied that *'Bird'* or open window in public transport as a means of TB transmission. In addition to this only about 20% of respondents answered that TB can be transmitted by living in the same room and sleeping together with TB patients. This finding is in contrast to study conducted in Afar region, Ethiopia which indicated that most of the participants from the study areas suggested that the habit of sharing a single cup among several individuals (87.6%) as a risk factor for exposure to TB (Mengistu *et al,* 2010). In contrast this a study carried out in

Pakistan that (57%) considered separating dishes as an important means of preventing (57%) spread TB disease (Javaid *et al*., 2004)

This shows that, there is misconception to some extent on some of the methods of transmission about TB among the study participants. The findings of this study implied that knowledge about mode of TB transmission and sign and symptoms of tuberculosis is insufficient. Therefore focusing on health education intervention is needed to increase awareness of patients and community.

In regard to awareness of respondents to risk factors influencing TB, particularly about the effect of Poor living condition(73%) the finding is comparable with the study conducted in India which explained that the prevalence of TB was statistically significant higher in population with low standard living (poor living), compared to those with high Standard living (Muvunyi *et al*., 2010).

In relation to other risk factors such as drug abuse, working condition and the presence of other disease some of the respondents believed that they are risk factors associated for TB disease development. Poor awareness regarding etiology of the disease may has a negative impact on patients' attitude towards health-seeking behavior and preventive methods as most people with such believes may not visit health facility or they may consider various traditional alternatives. Based on the results of this study, the respondents had basic knowledge about the common signs/symptoms of TB and its modes of transmission, which agrees with previous studies in a rural community in southwest Ethiopia (Abebe *et al*., 2010), Eastern Ethiopia (Daniel *et al*., 2014), in north east Ethiopia (Mengistu *et al*., 2010 and also in Iran (Yousif *et al*., 2009) and Philippines (Christina *et al*., 2009). In this regard, it was reported that persistence cough for 2 or more weeks, chest pain and weight loss were the common sign and symptom of TB. Through the air when a person with TB sneezes or coughs, and sharing cups with the patient were the common perceived modes of transmission in different studies (Mengistu *et al*., 2010, Daniel *et al*., 2014). The reported basic communities' knowledge about the symptoms and transmission methods of TB has an important implication for the TB control program in the current study area in particular and also in the country in general in that it could reduce diagnosis and treatment delay, as well as spread of the disease.

6. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

Tuberculosis is one of the most challenging communicable diseases and infects one third of the world's population. It is caused by members of the species *Mycobacterium tuberculosis* complex. The overall objective of this study was to estimate the prevalence of TB and the associated risk factors for tuberculosis. The data for this study was obtained from TB health record of Bishoftu Hospital for retrospective study (Jan 2006 to December 2015) and AFB and questioner survey for cross sectional study (June 2015 to August 2015).

The finding from ten years recorded data (2010-2015) shows that the prevalence and the trend of all forms of TB are gradually decreasing (550/100000 to 112/100000) in the study area. The finding of the cross sectional study carried on from June, 2016-August, 2016 also reveals that the current prevalence rate of smear positive PTB among TB suspects in Bishoftu hospital is 8.33% by direct Ziehle-Nelson staining technique. The associated risk factors to smear positive pulmonary tuberculosis were found to be poor diet, HIV/AIDS, TB contact history, living in confounding place, alcohol consumption, chat chewing, smoking cigarette and being passive smoker.

6.2 Conclusions

TB was predominant in males than females and the prevalence of all forms of TB were dominant within the age groups from 15-34(47.1%) and 35-54(37.1%) in both sexes. The overall annual trends of all forms TB in the last six years (2010-2015) were observed to fall gradually, with a slight fluctuation in the number of cases of PTB+ and PTB- in 2014 and 2015.

Among suspect patients visiting Bishoftu Hospital during the study period August-June, 2016, the overall prevalence of smear positive TB cases were 8.3%. poor diet, TB contact history, living in confiding place, HIV, alcohol consumption, chat chewing and smoking cigarettes were significantly associated with smear positive PTB.

Peoples having poor diet, TB contact history, living in confiding place, HIV positive, smoking cigarette, frequently, alcohol consumers and chat chewers were 2-6 times more likely to

develop TB. Although majority of the respondents were familiar with the main methods of transmission and prevention of PTB transmission, many of them didn't know other possible means of transmission and prevention such as drug abuse, working condition and the presence of other disease were not considered as risk factors for TB disease development.

This shows that, there is misconception to some extent on some of the methods of transmission of TB among people. The findings of this study also implied that knowledge about mode of TB transmission and sign and symptoms of tuberculosis is insufficient. Therefore focusing on health education intervention is needed to increase awareness of patients and community.

6.3 Recommendations

Based on the findings of this study and limitations of the research, the following recommendations were given.

- Intervention is required on the identified associated risk factors of TB.
- The concerned health bureaus should make intervention through awareness creation (advancement of knowledge about TB) and improving service of health facilities in the study area.
- Routine checkup of TB among TB suspects is important to minimize the burden of diseases and society awareness is very important to control TB infection and TB disease.
- Health service providers should give continuous health information regarding TB for patients and their care takers at TB clinic not only at the start of treatment.
- The DOTS program being implemented in the TB clinic of Bishoftu hospital should be equipped with additional man power to increase the service facilities
- Governmental Health institutions such as hospitals and health centers should use patients being treated in DOTS program as TB advocate groups to create community awareness and avoid risk factors and misconception.
- Physicians should assign patients with prolonged coughing to AFB test to prevent the effect of delayed diagnosis.
- Encourage use of standardized symptom and sign-based screening strategy to accelerat ing implementation of intensified TB case finding in resource-limited settings.

7. REFERENCES

Abba, K, Sudarsanam.D, Grobler.L, and Volmink.J.2008. Nutritional supplements for people being treated for active tuberculosis. *Cochrane Database of Systematic Reviews* no. 4.

Abdallah, AM, Gey van Pittius NC, Champion PA, Cox J, Luirink J, Vandenbroucke-Grauls CM, Appelmelk BJ, Bitter.2007. W. Type VII secretion-mycobacteria show the way. *Nat. Rev. Microbiol.* 5(11):883-891.

Abebe, G. Deribew A, Apers L, Woldemichael K, Shiffa J, Tesfaye M, Abdissa A, Deribie F, Jira C, Bezabih M, Aseffa A, Duchateau L, Colebunders R.2010. Knowledge, health seeking behaviour and perceived stigma towards tuberculosis among tuberculosis suspects in a rural community in southwest Ethiopia. *PLoS ONE* 5:10.

Abebe, D.S., Bjune, G., Ameni, G., Biffa, D., Abebe, F.2011. Prevalence of pulmonary tuberculosis and associated risk factors in Eastern Ethiopian Prison. *The International Journal of Tuberculosis and LungDisease* 15(5):668-73.

Abdie A, Gunnar B, and Fekadu A. 2009. Pastorialism and delay in diagnosis of TB in Ethiopia. From http; /WWW Biomed central.com. *East Afr j Public Health* 6(1):156-9.

Alan, B, Bloch. 1995. Screening for Tuberculosis and Tuberculosis Infection in High-Risk Populations Recommendations of the Advisory Council for the Elimination of Tuberculosis MMWR recommendations and reports 44(11): 18-34.

Alderwick, L.J., H.L. Birch, A.K. Mishra, L. Eggeling and G.S. Besra. 2007. Structure, function and biosynthesis of the *Mycobacterium tuberculosis* cell wall: Arabinogalactan and lipoarabinomannan assembly with a view to discovering new drug targets. *Bio chem.Soc. Transact.* 35: 1325-1328.

Altet, MN,Alcaide J,Plans P,Taberner JL,Salto E, Fouguera LI. 1996. Passive smoking and risk of pulmonary tuberculosis in children immediately following infection. A case-control study. *Tuber Lung Dis* 77(6): 537-44.

American Lung Association. 2015. Tuberculosis Causes, Symptoms and the Associated Risk factors.http://www.lungusa.org Accessed on October15, 2015.

Angela, D.P., Giuseppina, C.,Tony, F.V.,Bijo,Fatmira S. & Giuse, T.2006. Detection of *Mycobacterium tuberculosis complex in milk using polymerase chain reaction (PCR).Food Control* 17:776-780.

Arcavi, L andN. L. Benowitz. 2004. Cigarette smoking and infection. *Archives of Internal Medicine* 164(20): 2206–2216.

Balasubramanian, V, Pavelka MS, Jr, Bardarov SS, Martin J, Weisbrod TR, McAdam RA, Bloom BR, Jacobs WR., Jr.1996. Allelic exchange in *Mycobacterium tuberculosis* with long linearrecombination substrates.*J.Bacteriology* 178:273–279.

Bates, A., Khalakdina, M. Pai, L. Chang, F. Lessa. and K. R. Smith. 2007. Risk of tuberculosis from exposure to tobacco smoke: a systematic review and meta-analysis. *Archives of Internal Medicine* 167(4): 335–342.

Beers, Mark H., MD, and Robert Berkow, MD., 2004. Infectious Diseases Caused by Mycobacteria. In *The Merck Manual of Diagnosis and Therapy*. White house Station, NJ: Merck Sharp & Dohme Corp., a subsidiary of Merck & Co., Inc., Kenilworth, NJ, USA.

Beggs CB, Noakes CJ, Sleigh PA. 2003. The transmission in confined spaces: *An analytical review of alternative epidemiological models*. *Int J Tuberc Lung Dis* 7:1015-1026.

Begna, Tulu, Nagasa Dida, Yibeltal Kassa and Biruhalem Taye. 2014. Smear positive pulmonary tuberculosis and its risk factors among tuberculosis suspect in South East Ethiopia; a hospital based cross-sectional study *BMC Research Notes* 7:285.

Bishai, WR . 2009. Rekindling old controversy on elusive lair of latent tuberculosis. *Lancet.* 356:2113– 2114.

Bishoftu City Administration Finance and Economic Development Office. 2006. Bishoftu City Profile, Bishoftu, Ethiopia.

Bone, A, Aerts and Grzemska M. 2000. Tuberculosis control in prisons: a manual for program managers, Geneva Switzerland WHO /CDS/TB.281. http://apps.who.int/iris/bitstream/ 10665/66823/1/

Bonnet, MMB., Loretexu , LPP., Francis, FVV., Barbara, BOO and, DOO'B. 2006. Tuberculosis after HAART initiation in HIV-positive patients from five countries with a high tuberculosis burden. *Journal of Acquired Immune Deficiency Syndrome* 20 (9): 1275–1279.

Buskin, SE, Gale JL,Weiss NS,Nolan CM. 1994. Tuberculosis risk factors in adults in King Country, Washington, 1998 through 1990. *Am J Public Health* 84 (11):1750-6.

Cambier, J and Stanely F. 2014. Host evasion and exploitation scheme of *mycobacterium tuberculosis. Leading age review* 159: 1499-1500.

CDC (Centers for Disease Control and Prevention). 2010. Tuberculosis Elimination www.cdc.gov/globalhealth,2010: CDC-Ethiopia: Tuberculosis Elimination accessed on 10, September, 2015.

CDC (Center for Disease Control and Prevention). 2011. TB Basic facts: CDC/TB/Basic TB Facts. Available on line at, http://www.cdc.gov/tb/topic/basics/default.htm accessed on September 10, 2015.

Cegielski, J.P and Murray. 2004. The relationship between malnutrition and tuberculosis: evidence from studies in humans and experimental animals. *International Journal of Tuberculosis and Lung Disease*, 8(3): 286–298.

Chan J, Tanaka KE, Mannion C, Carroll D, Tsang MS, Xing. 1997. Effects of protein calorie malnutrition on mice infected with BCG. *I Nutr Immunol* 5: 11-9.

Chandra, R. 1997. Nutrition and the immune system: an introduction. *The American Journal of Clinical Nutrition* 66(2): 460S–463S.

Chandrashekhar, T. S., Kishore, V. P., Sharat, C. V., Hari, S. Joshi., Michael, N. B. 2008. Comparison of pulmonary and extra-pulmonary tuberculosis in Nepal-a hospital-based retrospective study. *BioMed Center Infectious Disease* 8: 8-25.

Cheesbrough M. 2002. Medical laboratory manual *for tropical countries* Cambridge university press part two 2nd edition 3: 289-291.

Christina, M, Domingo B, Lisa A. 2009. A descriptive study of the knowledge, attitude and practices on tuberculosis among treatment partners of pediatric patients in Tarlac city. PIDSP 10:1.

Codesca, LR, Ciconali G, Mazzola E. 2015. Managing an XDR-TB outbreak. *The public health countenance of the medal. EurRespir* 45: 25-29.

Collins, HL, Schaible UE, Kaufmann SH. 1998. Early IL-4 induction in bone marrow lymphoid precursor cells by mycobacterial lipoarabinomannan. Immunol 161:5546–5554.

Daniel Tolossa, Girmay Medhin and Mengistu Legesse. 2014. Community knowledge, attitude, and practices towards tuberculosis in Shinile town, Somali regional state, Ethiopia. *BioMed Central Ltd* 14:804.

Dawit Abebe. 2009. Prevalence and associated risk factors of pulmonary Tuberculosis among prisoners in Eastern Ethiopia. MPH Thesis, University of Oslo, Oslo, Norway.

Demissie, M, Omer OA, Lindjorn B, Hombergh J. BerhaneY, Hailemariam D and Kloos (Eds). 2006. *The Epidemiology and Ecology of Health and Disease in Ethiopia* pp. 409-434.Shama books, Addis Ababa, Ethiopia.

Delogu G., Sali M., Fadda G. 2013.Biology of *Mycobacterium tuberculosis* TB infection. *Mediterranean journal of Hematology and Infectious Diseases* 25(1): 070

Deribew, A, Abebe G, Apers L, Abdissa A, Deribew F, Woldemichael K,Jira C, Tesfaye M, Shiffa J, Aseffa A, Bezabih M, Abeje T, Colebundrs R. 2012. Prevalence of pulmonary TB and spoligo type pattern of Mycobacterium tuberculosis among TB suspects in a rural community in South west Ethiopia. *BMC Infect Dis* 12:54

Diel, R, Rutz S, Castell S. 2012. Tuberculosis: *Cost of illness in Germany*. Eur Respir, 40: 143–151.

Dye, C. 2006. *Global epidemiology of tuberculosis*. *Lancet* 18: 367(9514): 938-40.

Dye, C and Williams, G. 2010. The population dynamics and control of tuberculosis *Sci Transl. Med* 328 (5980): 856–861.

Eisenberg, J, M. A. Desai, K. Levy.2007. Environmental determinants of infectious disease: a framework for tracking causal links and guiding public health research. *Environmental Health Perspectives* 115 (8): 1216–1223.

Enwuru, CA., Idigbe, EO., Ezeobi ,NV., Otegbeye, AF. 2002. Care-seeking behavioral patterns, awareness and diagnostic processes in patients with smear- and culture-positive pulmonary tuberculosis in Lagos, Nigeria. *Trans. R .Soc. Trop. Med .Hyg.* 96(6): 614-6.

Esposito S, D'Ambrosio L, TadoliniM. 2014. ERS/WHO Tuberculosis Consilium assistance with extensively drug-resistant tuberculosis management in a child: *case study of compassionate delamanid use. Eur Respir* 44: 811-815.

Eyasu Ejet, Mengistu Legesse, Gobena Ameni .2012. A Preliminary Study on the Epidemiology of Tuberculosis in Nekemte and Its Surroundings -Western Ethiopia. *Star Journal* 1(1): 18-25

Eyasu Ejeta, Adil Ibrahim, Amsalu Tefera, Abdulkerim Mohammed and Abdurrahman Said. 2013. Prevalence of smear positive pulmonary tuberculosis and its associated risk factors among patients attending Nekemte Referral Hospital. *Star Journal* 2(3): 85-92.

Falzon, D, Gandhi N, Migliori GB. 2013. Resistance to fluoroquinolones and second-line injectable drugs: impact on multidrug-resistant TB outcomes. *Eur Respir* 42: 156- 168.

Federal Ministry of Health. 2007. TB**,** leprosy and TB/HIV prevention and control program manual, fourth edition. FMOH, Addis Ababa, Ethiopia. http://www.moh.gov.et accessed on 10, June 2016.

Federal Ministry of Health. 2008. *Manual of Tuberculosis and Leprosy and TB/HIV Prevention and Control*. 4th edition. Ethio Tikur Printing Press, Addis Ababa, Ethiopia.

Federal Ministry of Health. 2011. First Ethiopian National Population Based Tuberculosis Prevalence Survey. National Health and Nutrition Research Institute. Addis Ababa, Ethiopia.

Federal Ministry of Health. 2013. Guidelines for Clinical and Programmatic of Management of TB /HIV and Leprosy, 5th ed.FMOH, Addis Ababa, Ethiopia.

Ferrara, G and Meccai. 2005. Transmission and pathogenesis of tuberculosis. *Literature review. Lancet* 367 (9519): 1328-1334.

.

Fok, A, Y. Numata, M. Schulzer, and M. J. FitzGerald. 2008. Risk factors for clustering of tuberculosis cases: a systematic review of population-based molecular epidemiology studies, *International Journal of Tuberculosis and Lung Disease* 12(5): 480-492.

Fleming, M, E. Krupitsky, M. Tsoy, E. Zoartau, N. Brazhenko, W. Jakubowiak and M. E. McCaul. 2006. Alcohol and Drug Use Disorders, HIV Status and Drug Resistance in a Sample of Russian Patients, *International Journal of Tuberculosis and Lung Disease* 10(5): 65-70.

Fujiwara, P, Frieden TR, Sherman LF, Crawford JT, Nivin B. 2005. Exclusively drug resistant tuberculosis in the human body. *The international journal of tuberculosis* 49(22): 234-245.

Gagneux, S. 2012. Host-pathogen co evolution in human tuberculosis. Philos Trans R Soc Lond B Biol Sci 367: 850–859.

Grady, O J, M. Maeurer, R. Atun, I. Abubakar, P. Mwaba, M. Bates. 2011. Tuberculosis in prisons: anatomy of global neglect. *European Respiratory Journal* 38(4): 752–754.

Grange, J, Zumla A. 2002. The global emergency of tuberculosis: what is the cause? *Journal of the Royal society for the promotion of Reproductive of Health* 122: 78–81.

Gebrie, D., Mimano, L.N. 2010. Prevalence of PTB among patients attending Seka Health Center, Jimma,Oromia, Region, Ethiopia. *East African Journal of Public Health* 7(3): 268-273.

Gengenbacher, M, Kaufmann, SH. 2012. SH. *Mycobacterium tuberculosis*: Success through dormancy. *FEMS Microbiol Review* 36: 514–532.

George, M., Julia A and Timothy G. 2004. *Taxonomic out Line of the Prokayrotes. Bergey's Manual of Systematic Bacteriology* 2nd edition Michigan state university Bergeys manual trust: 3-232.

Hernandez, E, V. Cook, D. Kunimoto, R. K. Elwood, W. A. Black and J. M. Fitz Gerrald. 2004. Transmission of TB from Smear Positive Patients: A Molecular Epidemiology Study. *Thorax* 59(4): 286-290.

Hill, P, D. Jackson-Sillah, S. A. Donkor, J. Out, R. A. Adegbola, C. Lienhardt. 2006. Risk Factors for Pulmonary Tuberculosis: A Clinical Based Case Study in the Gambia. *BMC Public Health* 6(289): 156.

Hussien Ali, Zeyudin Ahmed, Mekonnen Abiyu, Abera Solomon and Ali Solomon. 2012. Smear Positive Pulmonary Tuberculosis (PTB) Prevalence amongst Patients at Agaro Teaching Health Center, South West Ethiopia**.** *Ethiopian Journal of Health Science* 22:71–76.

House, RV, Thomas PT, Bharagava HN. 1994. Comparison of immune functional parameters following in vitro exposure to natural and synthetic amphetamines: *Imunopharmacol Immunotoxicol* 16:1-21.

Houtmeyers, E, R. Gosselink, G. Gayan-Ramirez, and M.Decramer. 1999. Regulation of mucociliary clearance in health and disease. *European Respiratory Journal* 13(5): 1177-1188.

Imam, T, Oyeyi T. 2008. Retrospective study of PTB prevalence among patients attending in infectious disease hospital. *Bayero J pure applaid sci* 1:10–15.

Jain, S., Lamichhane, G., Nimmagadda, S., Pomper, M., Bishai, W. 2008. Antibiotic treatment of tuberculosis. *Old Problems, New Solutions Microbes* 3(6): 285-292.

Javaid, Ahmed Khan, Muhammad Irfan, Amna Zaki, Madiha Beg, Syed Fayyaz Hussain, Rizvi , N. 2004. Knowledge, Attitude and Misconceptions regarding Tuberculosis in Pakistani patients. *journal of Pakistan Medical association* 56(5): 211-214.

Joshi, R, L. Reingold, D. Menzies, and M Pai. 2006. Tuberculosis among health-care workers in low and middle income countries: a systematic review *PLoS Medicine* 3(12): article e494.

.

Kassu, A., Mengistu, G., Ayele, B., Diro, E., Mekonnen, F., Ketema, D., Moges, F., Mesfine, T., Getachew, A., Ergicho, B., Elis, D., Aseffa, A, Wondmikun, Y., Ota, F. 2007. Co-infection and clinical manifestation of tuberculosis in human immunodeficiency virus infected and uninfected adults at teaching hospital, North West Ethiopia. *Journal of Microbiology, immunology and Infectious* 40: 116-122.

Kaufmann, SH. and Parida, SK. 2008.Tuberculosis in Africa: learning from pathogenesis for biomarker identification. *Cell Host Microbe* 4(3): 219-28.

Khurram, H. T. B. Khaar and M. Fahim. 2012. Multi-Drug Resistant Tuberculosis in Rawalpindi Pakistan. *Journal of Infection in Developing Countries* 6(1): 29-32.

Komati , S., Shaw, PA., Stubbs , N., Mathibedi , MJ. and Malan, L. 2010. Tuberculosis Risk Factors and Mortality for HIV Infected Persons Receiving Antiretroviral Therapy in South Africa. *Journal of Acquired Immune Deficiency Syndrome* 24(12): 1849–1855.

Kumar, Vinay, Abbas, Abul K. Fausto, Nelson, and Mitchell, Richard N. 2007. Robbins Basic Pathology (8th ed.). Saunders Elsevier 516-522 ISBN 978-1-4160-2973-1.

Lawn, SD, Brooks S V, Kranzer K, Nicol Mp, Whitelaw A, Vogt M, Bekker L-G,Wood R. 2011. Screening or HIV-associated tuberculosis and riampicin resistance before antiretroviral therapy using the Xpert MTB/RIF assay: a prospective study. *PLoS Med* 8(7):e 1001067.

L¨onnroth, K, B. G. Williams, S. Stadlin, E. Jaramillo, and C.Dye. 2008. Alcohol use as a risk factor for tuberculosis-a systematic review. *BMC Public Health* 8(289): 112-124

L¨onnroth, K, E. Jaramillo, B. G. Williams, C. Dye, and M. Raviglione. 2009. Drivers of tuberculosis epidemics: the role of risk factors and social determinants. *Social Science and Medicine* 68(12): 2240–2246.

Maurya, V, V. K. Vijayan, and A. Shah. 2002. Smoking and tuberculosis: an association over looked. *International Journal of Tuberculosis and Lung Disease* 6(11): 942–951.

Mengistu Legesse, Gobena Ameni, Gezahegne Mamo, Girmay Medhin, Dawit Shawel, Gunnar Bjune and Fekadu Abebe. 2010. Knowledge and perception of pulmonary tuberculosis in pastoral communities in the middle and Lower Awash Valley of Afar region, Ethiopia. *BMC Public Health* 10: 187-194.

Menzies, D, Fanning A, Yuan L et al. 2000. Hospital ventilation and risk for tuberculosis infection in Canadian health care workers. *Ann Intern Med* 133: 779-789.

Migliori, GB, Dara M, de Colombani. 2012. Multidrug-resistant tuberculosis in Eastern Europe: Still on the increase? *Eur Respir* 39: 1290-1291.

Migliori, GB, Sotgiu G, Gandhi NR. 2013. Drug resistance beyond extensively drug-resistance tuberculosis: individual patient data meta-analysis. *Eur Respir* 42: 169-179.

Muniyandi, M, R. Ramachandran, P. G. Gopi. 2007. The prevalence of tuberculosis in different economic strata: a community survey from South India. *International Journal of Tuberculosis and Lung Disease* 11(9): 1042–1045.

Morrison, J, M. Pai, and P.C.Hopewell. 2008. Tuberculosis and latent tuberculosis infection in close contacts of people with pulmonary tuberculosis in low-income and middle-income countries: a systematic review and meta-analysis. *The Lancet Infectious Diseases* 8(6): 359–368.

Muvunyi, CM, Masaisa, F., Bayingana ,C., Musemakweri, A., Mutesa, L. and Hernandez , TC. 2010. Prevalence and diagnostic aspects of sputum smear positive tuberculosis cases at a tertiary care institution in Rwanda**.** *African Journal of Microbiology Research* 4: 88 916.

Naing, S,Winn T, Rusli,B. 2006. Practical issues in calculating sample size for prevalence studies. University Sains, Kelantan. Malasiya.

Ndungu, P, Gunturu Revathi, Samuel Kariuki, Zipporah Ng'ang'. 2013 A Risk Factors in the Transmission of Tuberculosis in Nairobi: A Descriptive Epidemiological Study
Kenya Medical Research Institute Aga Khan University Hospital (AKUH), Nairobi, Kenya.

Nettina, S. 2006. Treatment for pulmonary tuberculosis. Indonesia health care system and management of pulmonary TB- patient. kb,psu,ac.th /psukb/bitsstream/2553/1417/7/29 2543

Neyrolles, O, Hernandez-Pando R, Pietri-Rouxel F, Fornes P, Tailleux L, Barrios Payan JA, Pivert E, Bordat Y, Aguilar D, Prevost MC, Petit C, Gicquel B. 2006. Is adipose tissue a place for *Mycobacterium tuberculosis* persistence? PLoS ONE. 1:e43. doi:10.1371/journal.pone.0000043

NIAID. 2010. National Institution of Allergy and Infectious Diseases. Global Health Research plan for HIV/AIDS, Malaria, and Tuberculosis: National Institution of Allergy and Infectious Diseases. *Journal of Nepal medical college* 12 (1): 1−4.

Ottenhoff, Tom H.M; Kumararante, Dinakantha; Casanova, Jean-Laurent. 1998. Novel human immunodeficiencies reveal the essential role of type-1 cytokines in immunity to intracellular bacteria. *Immunology Today19* (11):491-494

.

Ottenhoff, TH, Kaufmann SH. 2012. Vaccines against tuberculosis: where are we and where do we need to go? PLoS. Pathog. 8(5):e1002607.http://dx.doi.org/10.1371/journal.ppat.1002607

Palomino., C.,Leao, C., Ritacco, V. 2007. *Tuberculosis.* From basic science to patient care: Tuberculosis Text book. com. Mycobacteriology Unit Institute of Tropical Medicine. BELGIUM 1st ed. 93-94

Philip C. Hill, Dolly Jackson-Sillah., Simon A. Donkor, Jacob Out., Richard A. Adegbola and Christian Lienhardt. 2006. Risk factors for pulmonary tuberculosis: a clinic based case control study in the Gambia. *BMC Public Health* 6:156-162.. .

Rao V, Gopi P, Bhat J, Yadav R, Selvakumar N, Wares D. 2011 Selected risk factors associated with pulmonary tuberculosis among Saharia tribe of Madhya Pradesh central India. *European Journal of Public Health* 1-3.

Rastoji N, E.Legrand, C. Sola. 2001. The mycobacterium; an introduction to nomenclature and pathogenesis. *Rev. sci. tech. Off. int. Epiz* 20(1): 21-54.

Rehm. J, Samokhvalov , AV., Neuman , MG. and Room, R. 2009. The association between alcohol use, alcohol use disorders and tuberculosis (TB). A systematic review. *Journal of British Medical College of Public Healt* 9: 450-455.

Robert L. Serafino. 2012. Epidemiology of *Mycobacterium tuberculosis*. *South Sudan Medical Journal* 5(2).

Rook GA, Hernandez-Pando R.1996. The pathogenesis of tuberculosis. *Annual Review Microbol* 50: 258-284.

Shang. S ,D.Ordway, M.Henao-Tamayo. 2011. Cigarette smoke increases susceptibility to tuberculosis-evidence from in vivo and in vitro models. *Journal of Infectious Diseases* 203(9): 1240–1248.

Shargie, B. E., Lindtjorn, B. 2005. DOTS improve treatment out comes and service coverage for tuberculosis in Ethiopia: retrospective trend analysis. *Bio Med Center Public Health* 5: 62-73.

Sharma, S.K, Mohan, A. and Kadhiravan , T. 2005 . HIV-TB co-infection: Epidemiology, diagnosis & management. *Indian Journal of Medical Researh* 121 (4): 550–567.

Sopori M. 2002. Effects of cigarette smoke on the immune system. *Nature Reviews Immunology* 2(5): 372–377.

,

Sotgiu G, Migliori GB. 2014. *Is tuberculosis elimination a reality? Lancet Infect Dis* 364-365.

Styblo, K,1991. The Impact of HIV Infection on the Global Epidemiology of Tuberculosis. *Bulletin of international union-Tubercle Lung Diseases* 66: 27-32.

Sudre, P., Kochi, A. 1992. Tuberculosis: a global overview of the situation today. *Bulletin of World Health Organization* 70: 149-159.

Szabo, G. 1997. Alcohol's contribution to compromised immunity. *Alcohol Research and Health* 21(1): 30–38.

Tadesse Ligidi. 2008. Prevalence of human immunodeficiency virus infection and immune status in newly diagnosed adult tuberculosis patients in Adama Hospital, Adama, MSc Thesis, school of public health, Addis Ababa University, Ethiopia.

Tornee, S, J. Kaewkungwal, W. Fungladda, U. Silachm- roon, P. Akarasewi and P. Sunakorn. 2004. Risk factors for Tuberculosis infection among household contacts in Bangkok Thailand. *The Southeast Asian Journal of Tropical Medicine and Public Health* 35(2): 375-383.

Urdahl, KB, Shafiani S, Ernst JD. 2011. Initiation and regulation of T-cell responses in tuberculosis. *Mucosal Immunol* 4:288–293

.

USAID (United States Agency for International Development). 2011. Ethiopian demographic health Survey: doi:usaid.gov/ethiopia/ accessed on 10, September 2015.

Van Rie, A Meller K, John M-A, Scott L, Page-Shipp L, Dansey H, Victor T, Warren R. 2012. False- positive rifampicin resistance on Xpert MTB/RIF:case report and clinical implications. *Int. J. Tuberc. Lung Dis* 16(2): 206-8.

Wang, H, M. Yu, M. Ochani. 2003. Nicotinic acetylcholine receptor $\alpha 7$ subunit is an essential regulator of inflammation. *Nature* 421(6921): 384–388.

Wejise, C. 2013. Point-of-care diagnosis or tuberculosis elimination? *Lancet* 6736(13): 10-1.

WHO. 2005. Global tuberculosis control report.World Health Organization, Geneva, Switzerland.

WHO. 2006. Global tuberculosis control report.World Health Organization, Geneva, Switzerland.

WHO. 2007. Global tuberculosis control report.World Health Organization, Geneva, Switzerland.

WHO. 2008. Global tuberculosis control report.World Health Organization, Geneva, Switzerland.

WHO. 2009. Global tuberculosis control report.World Health Organization, Geneva, Switzerland.

WHO. 2010. Tuberculosis control report. Doi. Who.int/tb/publication/global report.

WHO. 2011. Global tuberculosis control ISBN 9789241564380 WHO press, World health organization, 20 avenues Appia 1211 Geneva 27 Switzerland. http://www.who.int/tb/publications/globalreport/

WHO. 2012. Global tuberculosis control: surveillance and planning doi: who.int/tb/publications/global report/en/, Geneva, Switzerland.

WHO. 2013. Global tuberculosis report. WHO/HTM/TB2014.08. World Health Organization, Geneva Switzerland

.

WHO. 2014a. Global tuberculosis report. WHO/HTM/TB2014.08. Geneva,World Health Organization, Geneva, Switzerland.

WHO. 2014 b. Tuberculosis progress in Ethiopia: WHO country office for Ethiopia, Addis Ababa, Ethiopia.

WHO. 2014c. Anti-microbial resistance global report on surveillance, doi: who.int/drugresistance/en/.

WHO, Geneva, 2015 Global tuberculosis report

Wolf, AJ, Desvignes L, Linas B, Banaiee N, Tamura T, Takatsu K, Ernst JD. 2008. Initiation of the adaptive immune response to *Mycobacterium tuberculosis* depends on antigen production in the local lymph node, not the lungs. *J. Exp. Med* 205:105–115.

Yanbaeva, D, M. A.Dentener, E.C.Creutzberg, G.Wesseling, and E. F. M. Wouters. 2007. Systemic effects of smoking: *Chest* 131 (5): 1557–1566.

Yohannes, Ali, Abera Solomon, Ali Solomon. 2012. Smear positive pulmonary tuberculosis among suspected patients attending Metehara sugar factory hospital; eastern Ethiopia. *Journal o f African Health Science* 12 (3): 325 − 330.

Yousif, KT, Khayat MI, Salman HD.2009. Survey of knowledge, attitude and practices: enhanced response to TB ACSM, Iraq. *MEJFM* 7:1.

Zerihun, Zerdo, Girmay Medhin, Adane Worku, Gobena Ameni.2014. Prevalence of pulmonary tuberculosis and associated risk factors in prisons of Gamo Goffa Zone, south Ethiopia: A cross-sectional study, A Cross-Sectional Study. *American Journal of Health Researc* 2(5): 291-297.

Zolnir-Dove M. Poljak M, Erzen D,Sorli J. 2003. Molecular epidemiology of tuberculosis in Slovenia results of a one-year (2001) nation –wide study .*Scand J Infect Dis* 35: 863-868.

8. APPENDICES

Table- 1: The prevalence of all forms of TB patients that attended in Bishoftu Hospital during the study period (2006-2015)

Year	PTB+	PTB-	PTB	EPTB	ALL TB TYPES
2006	142	80	222	196	418
2007	121	146	267	153	420
2008	134	196	330	279	609
2009	225	292	517	407	924
2010	133	162	295	160	455
2011	111	80	191	136	327
2012	72	72	139	114	253
2013	67	67	127	75	202
2014	39	39	103	94	197
2015	55	54	109	62	171
TOTAL	1112	1188	2300	1676	3976
Percentage	28.0%	29.9%	57.9%	42.1%	100%

Table 2: Total number of Patients between (2010-2015) years and ten year TB patient's record (2006-2015) in Bishoftu General Hospital, South East Ethiopia

Variables	Label	Average patients population Per year	TB patients per year	Percentage
Year	2006	NA	418	
	2007	NA	420	
	2008	NA	609	
	2009	NA	924	
	2010	82,668	455	0.55
	2011	131,194	327	0.24
	2012	133,333	253	0.189
	2013	109,099	202	0.185
	2014	111,829	197	0.176
	2015	153,229	171	0.112
Age	0-14		307	7.7%
	15-34		1989	50.0%
	35-54		1191	30.0%
	≥55		489	12.3%
Sex	Male		2164	54.6%
	Female		1812	45.4%
TB type	PTB+		1112	28%
	PTB-		1188	29.9%
	PTB		2230	57.9%
	EPTB		1676	42.1%
	All TB type		3976	100%

Key: NA=Not Available

CONSENT FORM

VOLUNTEER AGREEMENT FORM

Title Prevalence of Tuberculosis and its Associated Risk Factors Among Patients Visiting Bishoftu Hospital Oromiya Reagen,South East Ethiopia

Princpal Investigator: (Yaschalew Anteneh)

Address: Haramya University, Tel: 0911568991

Email: yaschalew.anteneh@yahoo.com

General information about Research

This study will estimate the prevalence and evaluate the associated risk factors of tuberculosis in the study area.

Possible Benefits, Risks and Discomforts

There are no direct benefits to be gained from this study immediately, neither are there any risks associated with it. The only inconvenience might come from the time you will spend completing the questionnaire. The data from this study will be used only for the purpose of the study (Master Thesis)

Confidentiality

Your identity and participation in this study will be treated strictly confidential. The information that we obtain from you will not be shared with anybody, except the study investigators. Your identity remains secret since your personal information will only be designated by a unique participant number. Your name will not appear in any reports or publications resulting from this study. After the study is completed, you may request information about the study results.

Voluntary Participation and Right to Leave the Research

You participate entirely voluntarily in this study. You have the right to refuse to participate in the study. You also have the right to your participation in the study at any time, even after you

have signed this informed consent form. The withdrawal of your consent will not cause any disadvantage or loss of advantages /privileges.

Contacts for Additional Information

Any questions or any further clarifications concerning the study can be directed to:

Contact of the promoter

Misrak Kebede (Dr.)/Ameha Kebede (Dr.)

College of Natural and Computational Sciences, Department of Biology

Tel: 00 32 9 264 9902, Fax: 00 32 9 225 5510

Email: drmisrak2015@gmail.com or amehakebede@yahoo.com

Contact of the local researcher

Yaschalew Anteneh

Tel: 0911 568991

Email: yaschalew.anteneh@yahoo.com

VOLUNTEER AGREEMENT

The above document describing the benefits, risks and procedures for the research title (name of the research) has been read and explained to me .I have been given an opportunity to have any questions about the research answered to my satisfaction. I agree to participate as a volunteer.

Date: _____

Name of the volunteer_____

- If volunteers cannot read the form themselves, a witness must sign here

Ahaadii Wal-galtee

Gaaffillee qo'annoo warraa deebisan wajjin Ahaadii Wal-galtee

Qorannoo f iqo'Tamsa'ina dhukkuba Sombaa (TB) fi wantoota dhukkuba kana wajjin qunnamtii qaban dhukkubsattoota Hospitala Bishooftu Naannoo Oromiyaa Keessatti Wal'ansa argatan kessaa

Maqaa nama qorannoo gaggeessu:Yaschaalaw Antanah

Tessoo: Haroomayyaa Yunivarstii

Bilbilaa 0911568991 E.mail: yaschalew.anteneh@yahoo.com

Qaranno kun kan xiyyeeate

-Tamsa'ina Dhukkuba Sambaa (TB) naannoo Qo'onna Keessatti

Wantoofa (dhimmifa)dukkuba kana wajjin walitti dhufenya jiru qo'achuuf

Dabalaa deeme moo yku hir'achaa deem. .

Faayyidaa qoranno fi qo'annoo,rakkoolee fi mijaawinaan kan hinqabnee Faayyidaa bu'aa kaallattidha irraa argachuuf miti ,qo annichaa wajjinnis walqabatee yaaddoo fi balaa rakkoon dhufuu danda'uu homa hinjjru ragaaleewwan gaaffilee kan sassabamu sagantaa digrii lammaffa ittin guutuu fi kaayyoo karoorfamee qofaaf kan oluudha.

Amanammumaan isaa

-Hirmaanan gaafatamaa ,maalummaa fi hirmaanan isa iccitiin isa kan eegameedha,ragaaleeww an gaaffiidhan argamaan abboo qo'annoo gaggeessuun alaa hin ibsamu.

- Gaaffiilee irratti kan hirmaatuu koodii lakkoofsaan qofa ni qabama. Akkasumaas gabaasa qo,annoo irratti maqaa hirmaataa hin ibsamu.

- namaaa gaaffii irratti hirmaatu mirgaa inni qabu gaaffii dhaaf deebii kennu fi kennu dhisuu

- qaamni gaaffii deebisuu amantuma deebii kennuuf hirmachu qaba

- akkasumaas deebbi kennu dhisun mirgaa issaatii

-waligaltee ahaadii irratti ergaa mallatteesse booda gidduun dhisuu ni danda'a

-ragaa dabalataaf teessoo arman gadiifii gaaachuun ni danda'ama

- Waa'ee gaaffii dhiyaateef gaaffii yoo qabataan gorsistoota qo'anno fi qoranno namoota armaan gadii gaafachuu ni dandeessuu

1. Dr. Misrak Kebede
2. Dr. Ameha Kebede

Lakk.Bilbilaa:00 32 9 264 9902 Email: drmisrak2015@gmail.com / amehakebede@yahoo.com

Maqaa nama qoranno gaggeessu: Yaschaalaw Antanah

Bilbilaa: 0911 56 89 91

E-mail: yaschalew.anteneh@yahoo.com

Raggaalee armaan olitti ibsammaanii sirrumaan qo'annichaa, rakkoolee fi mata duree qo'annichaa haalaa sirrii ta'een naf dubbisamee, akkasumaas naf ibsamee, dabalataanis waa'ee qo'annichaa aka gaafadhu carraan nakemame hundumtu naf ibsamee feedhidhan deebbi kennuuf walii galeera.Guyyaa_____

Kooda namaa deebii kennu_____

Gaaffii gaafatamaa dubisuu kan hin dandeenyee yoo ta'ee bakka bu'aan isaa mallatteessu danda'a

Adeemsi gaaffiii deebii yeroo adeemsisamu fi gaaffilee feedhiin hirmachu isaa ilaaluu koo mallattoo kootiin mirkaneessa

Guyyaa_____
Mallattoo_____Yunivarsitii Haroomayaa

Questionnaire

A. Socio demographic characters of the study respondents

1. Age of respondent's 0-14 □ 15-34 □ 35-54 □ 55 and Above_____

2. Sex of respondent's Male □ Female □

3. Residence Urban □ Rural □

4. The highest level of school completed. Illiterate (no formal education) □ Primary □ secondary □ diploma and above □

5. Occupation, unemployed □ civil servant □ student □ housewife □

Private worker □ other specify_____

6. Marital statuses, single □ currently married □ divorced/separated □ widowed □

7. Family size 1-2 □ 3-4 □ 5 &above □ No family □

8. Total monthly income in Ethiopian birr. Less than 600 □ 600-1500 □

1500-2500 □ Above 2500 □

9. Housing (number of rooms) 1 □ 2 □ 3 & above □ homeless □

10. Food habit, Vegetarian □ non vegetarian □ balanced □ poor diet □

B. Behavior of respondents

11. Do you consume or drink alcohol? No □ Sometimes □ Yes □

12. Do you chew chat? Yes □ Sometimes □ No □

13. Do you smoke cigarettes? Yes □ No □

14. If your answer is 'no' for question number 13, is there a family member at home that smoke Cigarettes?

Yes □ No

C Other associated diseases and TB history of respondents

15. Other associated diseases of the respondents

HIV Sero-status □ diabetes- mellitus □ lung cancer □ other □ No □

. 16. Have you ever had long contact with TB patients?

Yes □ No □

17. Have you ever lived in confinding environment such as military camp, prison or college dormitory?

Yes □ No □

D. Awareness of respondents to Tuberculosis.

18. Do you listen to health educations about TB through Radio or Television? Yes □ Sometimes □ No □

19. What is the cause of Tuberculosis? Bacteria or germ □ Aging □

Genetic disorder □ other, specify _____.

20. How is Tuberculosis transmitted? Through air droplet □ through overcrowding □

Through sexual intercourse □ through blood contact □ traveling in a crowded bus □

Sharing the same utensils such as cups in the house □ open window in public transports □

Through insect bites □ living in the same room □ sleeping together □

I don't know □ others, specify _____

21. What are the signs & symptoms of Tuberculosis? Long -lasting cough (2 weeks or greater)

Persistent fever □ loss of weight □ night sweating □ chest pain □

Loss of appetite □ I don't know □ other specify _____.

22. Is it possible to prevent TB infections?

Yes □ No □ I don't know □

23. How could a person with Tuberculosis prevent the spread of TB to others?

Not coughing/sneezing in front of other people □ spit in a container with cup or not □

Spitting out in the open everywhere □ ventilating the living room/open windows □

Avoiding shaking hands and blood contact □ Other specify _____ .

24. Tuberculosis is influenced by the factors such as drug use □ poor living □

Working condition □ the presence of other disease □
I don't know

Mootummaa Naannoo Oromiyaati
Bulchiinsa Naannoo Magaala
Bushoftuu Waajira Eegumsa
Fayyaa Bushooftuu
በኦሮሚያ ክልላዊ መንግሥት
በቢሾፍቱ ከተማ አስተዳደር
የቢሾፍቱ ጤና አጠባበቅ ጽ/ቤት

Lakk. 1486/92/6

Guyyaa 30/09/08

Hoospitaala Bishooftuutiif

Bishooftuu

Dhimmi : deeggarsa gaafachuu ilaala

Akkuma matadureen irratti ibsamuuf yaalametti **obbo Yaschalew Anteneh** qorannoo (research) matadureen "prevalence of Tuberculosis and its associated factors among patients visiting Bishoftu Hospital ,oromia regional state , Ethiopia " jedhamu irratti qorannoo gaggeessuf koree "Health research Ethical Review Committee" BEFO irraa eeyyama argachuu isaanii xalayaa lakk.BEFO/AHBTFH/1-8/2089 guyyaa 29/9/2008 waajira keenyaaf barreessaniin nu beeksisanii jiru.

Waan kana ta'eef hojii qorannoo kanaa irratti deeggarsa barbaachisaa ta'e akka gootaniif isin beeksifna.

Mootummaa Naannoo Oromiyaati Bulchiinsa Naannoo Magaala Bushooftuu Waajira Eegumsa Fayyaa Bushooftuu
በኦሮሚያ ክልላዊ መንግሥት በቢሾፍቱ ከተማ አስተዳደር የቢሾፍቱ ጤና አጠባበቅ ጽ/ቤት

Nagaa wajjin!

Abbabaa Baqqalaa Hurnsaa
አበበ በቀለ ሁሪሣ
Itti Gaafatamaa Wajjira Eegumsa
Fayyaa Magaalaa Bishooftuu
የቢሾፍቱ ከተማ
ጤና ጥበቃ ጽ/ቤት ኃላፊ