PREVALENCE AND ASSOCIATED RISK FACTORS OF TUBERCULOSIS (TB) AMONG PATIENTS IN WARDER HOSPITAL, WARDER TOWN, ETHIOPIAN SOMALI REGIONAL STATE

M.Sc. THESIS

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Prevalence and Associated Risk Factors of Tuberculosis (TB) Among Patients in Warder Hospital, Warder Town, Ethiopia Somali Regional State

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As thesis Research advisors, we hereby certify that we have read and evaluated this thesis prepared, under our guidance, by Haftamu Kiros entitled "Prevalence and Associated Risk Factors of Tuberculosis (TB) Among Patients in Warder Hospital, Warder Town, Ethiopian Somali Regional State". We recommend that it be submitted as fulfilling the thesis requirements.

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D E D I C A T I O N

I dedicate this thesis for all people who lost their lives because of Tuberculosis (TB)

STATEMENT OF THE AUTHOR

First, I declare that this thesis is my own work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for M.Sc. degree in Biology at Haramaya University and is deposited at the University Library to be made available to borrowers under the rules of the library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

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BIOGRAPHICAL SKETCH

The author, Haftamu Kiros Hagos was born on June 1984 in Emba Alage Wereda, Southern Zone of Tigray Regional State from his father Kiros Hagos and his mother Tadelech Asmerom. He attended his Elementary, Secondary education and Preparatory classes from1995-2006 at Adishiho Elementary, Adishiho Junior School Adishiho Secondary school and Adishiho Senior Secondary School. After completion of preparatory education; he joined Bahir-Dar University, Department of Biology in 2007 and graduated with B.Ed. Degree in Biology in July 2009. After graduation, he was employed by the Federal Ministry of Education (MoE) for the Ethiopian Somali Regional State Education Bureau as a Biology teacher and later on he joined Haramaya University in July 2013 to pursue his study for the degree of Master of Science in Biology.

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LIST OF ABBREVATIONS AND ACRONYMS

AFB	Acid Fast Bacilli
AIDS	Acquired immunodeficiency syndrome
BCG	Bacillus Calmette Guerin
CFP-10	Culture filtrate protein 10
CPT	Cotrimoxazole Prophylaxis Therapy
CSA	Central Stastical Authority
DNA	Deoxy Ribo nucleic Acid
DOTS	Directly Observed Treatment-Short Course
ELISPOT	Enzyme Linked ImmunoSpot
EPTB	Extra Pulmonary Tuberculosis
ESAT	Early Secretory Antigen Target
HIV	Human Immunodeficiency Virus
INF ϒ	Interferon gamma
L-J	Löwenstein-Jensen media
LTBI	Latent tuberculosis infection
MDR-TB	Multidrug -resistant tuberculosis
MGIT	Mycobacteria Growth Indicator Tube
MOE	Ministry of Education
MSF-H	Medecins Sans Frontieres Holand
MTB	Mycobacterium Tuberculosis
MTC	*Mycobacterium tuberculosis* Complex
NAA	Nucleic Acid Amplification
NALC- NaOH	N-acetyl-L-cyteine sodium hydrooxide
NMAJB	National Metrology Agency Jijiga Branch
PLHIV	People Living with Human Immunodeficiency Virus
PPD	Purified Protein Derivative
PTB	Pulmonary Tuberculosis
QFT	QuantiFERON
RNA	Ribo Nucleic Acid

RD	Region of Difference
SPSS	Statistical Package for Social Science
TCH	Thiophen-2-Carboxylic Acid Hydrazide
TST	Tuberculin Skin Test
WHO	World Health Organization
ZN	Ziehl-Neelsen stain

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Prevalence and Associated Risk Factors of Tuberculosis (TB) Among Patients in Warder Hospital, Warder Town, Ethiopia Somali Regional State

ABSTRACT

Tuberculosis is one of the widely occurring infectious diseases and it is the leading cause of death in the Ethiopian Somali regional state including Dollo zone, Warder town. The objective of this study was to determine the prevalence of pulmonary TB and its associated risk factors among TB patients in Warder Hospital, Warder Town, Ethiopian Somali Regional State, A retrospective study based on five years data of TB patients (2012-2016) was employed. Purposeful sampling technique was used to select the study participants. A cross sectional study was conducted among 422 TB suspected patients visiting Warder Hospital from October - December 2016. Sputum sample were collected and examined following standard national guideline for diagnosis of TB using direct Ziehl – Nelson staining techniques. Pretested structured questionnaire was employed to collect data on associated risk factors for PTB. The collected data were analyzed using SPSS version 20 and descriptive statistics and logistic regression analysis were employed to identify risk factors associated with pulmonary tuberculosis. A total of 1482 all forms of TB patients were registered during the last five years (2012 to 2016) in Warder Hospital. Based on retrospective study, the number in PTB patients were higher (74.1%) than that of EPTB (25.9%). Males and the productive age group were highly affected in the study area. The prevalence of smear-positive PTB of the current study by cross sectional was 9.7%. Factors significantly associated with smear-positive PTB were age, marital status, having close contact history with TB patients chat chewing and smoking cigarette. Overall, in this study, the high prevalence of smear positive pulmonary tuberculosis in the area suggested the need for strict intervention and intensification of health education to prevent the spread of the disease and to create awareness on risk factors contributing to the infection. Hence proper implementation of DOTS and a regular 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: *Sputumtest, Somali, Warder, Ziehl-Nelson,*

1 .INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by the bacillus *Mycobacterium tuberculosis*. *Mycobacterium tuberculosis* (*M. tuberculosis*) is the primary human pathogen that causes tuberculosis. Tuberculosis cases are categorized as having pulmonary TB (PTB) if the lung is the only organ that is involved and as extra pulmonary TB, if any other organ is involved. This disease damages the lungs, central nervous system, lymphatic system and circulatory system. Rate of infection with *M. tuberculosis* is associated with host's inherited susceptibility, environmental risk factors and genetic variations (Cubillos-Ruiz *et al.,* 2010).

The most common method for diagnosing TB worldwide remains sputum smear microscopy which was developed more than 100 years ago, in which bacteria are observed in sputum samples examined under a microscope. However, developments in TB diagnostics in the last few years mean that the use of rapid molecular tests to diagnose TB and drug-resistant TB is increasing, and some countries are phasing out use of smear microscopy for diagnostic purposes. In countries with more developed laboratory capacity, cases of TB are also diagnosed via culture methods (WHO, 2013).

Early symptoms of active TB may present in weight loss, fever, night sweats, and loss of appetite. For some people, the symptoms may be more subtle, and may go unnoticed, while in others the disease either goes into remission or become more chronic and debilitating with cough, chest pain, and bloody sputum (WHO, 2012).

Transmission of TB can occur through different ways such as: Human-to-human and human-to-animal, poor hygienic conditions, blood and fecal contamination and inhalation of contaminated droplets that are released from the lungs of infected individuals (WHO, 2011).

In general relatively few of the people infected with *Mycobacterium tuberculosis* will go on to develop TB disease. Symptoms from primary infection are generally insignificant and the infection is healed in at least 90% of the cases. The bacteria remain latent in the body and can

be reactivated at any time during the remaining life span. The reactivation is generally caused by an immunosuppressive disease or treatment, or high age. The probability of developing TB is much higher among people infected with HIV (human immune deficiency virus). Without proper treatment, the mortality rate is high. In studies of the natural history of the disease among sputum smear-positive and HIV-negative cases of pulmonary TB, around 70% died within 10 years (Tiemersma *et al*., 2011).

TB remains a major cause of morbidity and mortality in many countries and a significant public health problem worldwide (WHO, 2012). The global incidence of TB was estimated to be 139 cases per 100,000 in 2006. Ninety-five percent of these cases and 98 percent of TB deaths occur in developing countries, affecting mostly (75 percent) persons in the economically productive age group (15–50 years) (Dara *et al*,. 2009).

In 2008, there were an estimated 9.4 (range, 8.9-9.9 million) million incident cases (equivalent to 139 cases per 100,000 population) of TB globally. This is an increase from the 9.3 million TB cases estimated to have occurred in 2007, as slow reductions in incidence rates per capita continue to be outweighed by increases in population. Most of the estimated number of cases in 2008 occurred in Asia (55%) and Africa (30%), with small proportions of cases in the Eastern Mediterranean Region (7%), the European Region (5%) and the Region of the Americas (3%). The 22 high-Burden Countries, defined as the countries that rank first to 22nd in terms of absolute numbers of cases and which have received particular attention at the global level since 2000 account for 80% of all estimated cases worldwide (Nigatu and Abraha, 2010).

According to WHO, (2011) the number of people who fell ill with TB dropped to 8.8 million in 2010, including 1.1 million cases among people with HIV. The number has been falling since 2005. The estimated global incidence rate fell to 128 cases per 100,000 populations in 2010, after an increase in 2012 at 141 cases per 100,000. The rate is falling but very slowly. The number of people who died from TB fell to 1.4 million in 2010.

The burden of TB in Africa is far greater today. Continuing poverty and political instability in parts of the continent has inhibited the progress in implementing effective TB control measures. Southeast Asia has the highest number of new TB infection annually; Africa has a TB incidence rate double that of Southeast Asia and the highest number of TB related deaths in the world as well as the highest per capita TB mortality. South Africa and Nigeria have the fourth and fifth largest numbers of new TB cases annually; however, South Africa, has the highest prevalence, incidence, and death rate per capita worldwide (Jennifer, 2009).

Ethiopia has a total population of above 80 million with 86.2% living in the agrarian regions [Oromiya, Amhara, Southern Nations Nationalities and Peoples Region and Tigray regions]. The rest 9.2% and 4.6% live in the pastoral areas of Gambella, Somali, Benshangul-Gumuz and Afar regions, and urban areas such as Addis Ababa, Diredawa and Hareri (Central statistical authority, 2007) respectively. Ethiopia ranks seventh among the world's 22 high burden TB countries. The country had an estimated 306,330 TB cases in 2006, with an estimated incidence rate of 379 cases per 100,000 populations. The Stop TB Strategy is the approach recommended by WHO to reduce the burden of TB in line with global targets set for 2015 (WHO, 2012).

The Somali Regional State of Ethiopia including Dollo Zone, Warder Town is an area suffering from a long running conflict. The conflict has severely undermined the ability of the public sector to deliver basic social services to most of its population. As a result, people in the region are not only exceedingly poor but also bear a disproportionately high incidence of TB. In the year 2000, the incidence of pulmonary positive TB in the Somali Regional State of Ethiopia was noted at 175-250/100,000, which is much higher than the national level of 165/100,000 (Dualeh , 2000).

Therefore, this study was designed to determine the prevalence of TB and its associated risk factors in Dollo zone, Warder town, Somali Regional State, Ethiopia.

The present study was aimed at meeting the following objectives

General objective

- To determine the prevalence of TB and associated risk factors among patients living in Warder Town and visiting Warder Hospital, Somali Regional state.

Specific objectives

- To determine the prevalence of TB among patients visiting Warder Hospital.
- To determine the trends of TB for the past five years retrospectively in the study area.
- To identify the major socio-demographic risk factors of TB in the study area.

2. LITRETURE REVIEW

2.1. Historical Background of TB

A familiarity with the history of tuberculosis alerts one to put in perspective means of struggle against the white plague, which has caused and is still causing a mighty burden of illness and deaths of human beings and animals (WHO, 2003). Tuberculosis has afflicted humans and animals since ancient times. The disease was described in Italian writing 2000 years or more before Christ was born and was also found to be evident in Neolithic man from various skulls and other bones recovered from different parts of the world (Salo, 1994).

Tuberculosis in cattle, which was also called 'Pearl-disease', attracted attention thousands of years ago and the early meat inspection regulations in various countries were concerned with this form of disease .The danger of eating meat from tuberculosis-infected cattle existed in Mosaic laws and the German regulations banning the sale of tuberculosis meant (Salo, 1994).

Generally, the turning point in the history of *Mycobacterium* and tuberculosis in particular, occurred in 1852 when a German Scientist, Robert Koch, publicly announced that he had observed and cultured the bacillus responsible for tuberculosis The theory of infectiousness of tuberculosis was placed upon firm foundation and research work since then has been directed towards understanding the epidemiology of the disease and the means by which it can be controlled and ultimately eradicated (Groschel, 1982).

2.2. Causative Agent of TB

Tuberculosis is one of the most devastating diseases of mankind and remains a major health threat in Africa with much higher rates in the Sub-Saharan part of the continent. The *Mycobacterium tuberculosis* complex (MTBC) is the cause of TB and encompasses *M. tuberculosis*, *M. bovis*, *M. africanum*, *M. canettii*, *M. pinnipedii, M. caprae*, and *M. microti*,which have 99% genetic similarity and identical 16S sRNA (Sreevatsan *et al*., 1997).
M. tuberculosis is the predominant cause of TB in humans. *M. tuberculosis* is an acid fast, facultative intracellular aerobic pathogen that has straight or curved rod morphology and exists

either singly or in clusters. *M. tuberculosis* is a slow growing bacterium and divides once every 18-24 hours requiring 18-21 days before visible colonies develop on solid medium (Salyers and Whitt, 1994).

The cellular envelope *of M. tuberculosis* consists of a plasma membrane and a highly unusual cell wall. The plasma membrane consists of a classical bilayer structure. The elaborate distinctive features of the mycobacterial cell walls include the lipoarabinomannan lipomannan, mycolylar abinogalactan, phosphatidyl myoinositol mannoside, sulfatide, cord factor, and other acylated trehaloses, phenolic glycolipids, lipoligosaccharides, and other attenuated lipids. Many of these have been shown to be involved in the virulence and pathogenesis of this bacillus. Lipoarabinomannam, a predominant component of the cell wall, is a virulence factor for *M. tuberculosis*, which activates macrophages and scavenges reactive oxygen intermediates (Nigou *et al*., 2003)

M. tuberculosis is large, thin, slow growing bacilli, with a cell wall made of a waxy substance called *mycolic acid* which makes the cell less permeable this permeability barrier makes the cell repel stains, causing Gram stains to show a weak positive, or to show up white; so typically an alternative acid-fast stain is used instead (AFB) (Ellis and Zabrowarny, 1997).

2.4. Taxonomy and Characteristics of Tuberculosis (TB)

The *Mycobacterium tuberculosis* complex constitutes a genetically closely related group, and its members, *M. tuberculosis*, *Mycobacterium africanum*, *Mycobacteriurn bovis*, and *Mycobacterium microti*, may be considered as subspecies of *M. tuberculosis* (Wayne and Kubica, 1986). The close relatedness between *M. tuberculosis* complex bacteria has been established by DNA-DNA hybrization (>95%) (Baess, 1979), multiplelocus enzyme electrophoresis (Feizabadi *et al.,* 1996), and Sequencing of 16s ribosomal RNA and housekeeping genes (Feizabadi *et al* 1996). Furthermore, repetitive DNA elements, such as the insertion sequence IS6110 and the direct repeat (Hermans, 1995), have been found restricted to the *M. tuberculosis* complex, Nevertheless, the host range and pathogenicity of the M. *tuberculosis* complex species vary enormously. The natural reservoir of *M. tuberculosis* and

M. africanum is limited to humans (Wayne and Kubica, 1986) and that of *M. microti* is limited to voles (Wells, 1945). In contrast, the host range of *M. bovis* is very broad, and this species causes disease among a wide range of wild and domestic mammals as well as in humans (Thoen *et al.,* 1984). Colonies of primary *M. tuberculosis* cultures almost invariably have a characteristic patterned texture, due to tight cording of the bacterial cells (Runyon *et al.,* 1970).

2.5. Pathogenesis of Tuberculosis (TB)

The inhalation of small size respiratory droplet nuclei through the respiratory tract is the commonest route of entry of the tubercle bacillus. The respiratory droplet nuclei are small enough in size to pass into the lower respiratory tract escaping the anatomical barriers of naso pharynx and upper respiratory tract (Schluger and Rom, 1998). *M. tuberculosis* does not infect the respiratory bronchial epithelium and studies indicated that the bronchial epithelium can produce antimicrobial peptides with a wide spectrum of activity (Diamond *et al*., 1991).

The knowledge of bacterial metabolism is still developing, but it is known that *M. tuberculosis* can adapt their metabolism to the available sources within the host's tissues; causing the bacteria to become firmly planted within the host. The metabolism of fatty acids as a source of carbohydrates is necessary for the growth of *M. tuberculosis* while most of the bacteria prefer to have access to oxygen, they can adapt to anaerobic conditions by using nitrate to replace oxygen in the production of adenine tri phosphate (Fritz *et al*., 2002).

Phagocytic cells mainly macrophages take up the bacteria once inhaled droplets pass into the lower respiratory tract and are deposited in the alveolar spaces, which assist in the induction of a rapid inflammatory response and accumulation of cells. Although alveolar macrophages are the first cells to engulf, dendritic cells and monocyte-derived macrophages also take part in the phagocytic process. The subsequent intracellular fate of mycobacteria is considered as predetermined by the mode of entry into macrophages, however, experiments have shown that intracellular trafficking of *M. tuberculosis* was not significantly altered by blocking individual receptors (Kleinnijenhuis *et al*., 2011).

Two to three weeks after infection the immune system forms tubercles (lesions) that contains the mycobacterium. Ninety percent of the infections stop here and lay dormant for an indefinite period of time possibly never going on to be a detectable active disease. If the bacteria do not lay dormant, the bacteria continue to grow until the tubercles invade other portions of the lung and active tuberculosis begins once, in the active stage, cell death (necrosis) occurs and cavities are formed in the lungs. The necrosis is believed to be caused as a result of the response of the immune system by releasing cytokine (a protein that acts as a mediator in the immune response system) at toxic levels and the release of photolytic enzymes (enzyme that catalyzes the splitting of proteins (Ernst, 1998).In addition the growth of *M. tuberculosis* is accelerated if the bacteria have increased access to oxygen which is why the infection normally occurs in the lungs although tuberculosis normally affects the lungs it can spread to other parts of the body like the brain, blood, bones, glands, etc. Symptoms include a cough that lasts longer than two weeks, pain in the chest, coughing up blood or sputum, weakness, weight loss, no appetite, chills, fever, and night sweats (Kaplan *et al*., 2003).

2.6. Transmission of Tuberculosis (TB)

Tuberculosis is primarily a respiratory disease but it can also spread to other parts of the body. The primary route of transmission of infection within and between species is by the airborne route and is facilitated by close and prolonged contact between infected and healthy humans or animals through the exchange of respiratory secretions. However, other routes of transmission such as congenital and vertical transmission have been recorded. Transmission of tuberculosis can be animal-to-animal, animal-to-human, human-to-animal as well as human-to-human (Kempf *et al*., 2005). In man, human TB is spread from person to person through TB bacilli (bacteria), which are found in the mucus of infected individuals. Tuberculosis in humans has been associated with poor environmental conditions, age, nutrition, cigarette smoking, alcoholism and overcrowding (Derek, 1999).

In industrialized countries, the incidence of TB due to *M. bovis* in humans is almost at zero level as a result of pasteurization of milk and milk products and good control measures of bovine tuberculosis in cattle populations, although the potential risk remains However, in developing countries the story is analogous to conditions in the 1930s and 1940s in Europe,

where more than 50% of cervical lymphadenitis cases in children were caused by *M. bovis* infection. Various routes of infection from animals to humans infection, such as from drinking or handling contaminated milk and milk products, and also infected carcass, has been documented .Ethiopia is one of these countries where many epidemiologic and public health aspects of the infection remain largely unknown (Ayele *et al.,* 2004).

Agricultural workers and rural dwellers have been reported to have developed pulmonary TB due to *M. bovis* as result of inhalation of cough spray from infected cattle and dust particles, or aerosols, shed by infected animals, while urban dwellers can acquire the infection via the gastrointestinal route and develop extra-pulmonary TB (Daborn *et al*., 1996).

2.7. Prevalence and Distribution of Humans Tuberculosis (TB)

In humans, tuberculosis continues to be a leading cause of morbidity and mortality worldwide, killing more than 2 million people per year, making it the single leading microbial killer of adults (WHO, 2004). According to WHO, if this trend continues one third of the world's population might be infected and mostly from the developing world, particularly Asia. It has also been estimated that approximately 40% of people living in the Indian subcontinent, China and the Pacific are infected with TB (Chakraborty, 2004).

Out of all TB cases notified to the WHO in 2000, 10% were from Europe, with an average incidence of 42/l 00 000 which is an increase from that reported in 1991 Fifteen countries (Australia, Canada, Greece, Iceland, Israel, Italy, Malta, Monaco, The Netherlands, New Zealand, Norway, San Marino, Sweden, Switzerland, and the USA) were said to have fulfilled the low-incidence country of WHO with crude case notification rate of below 10/l 00 000 (WHO, 2002).

According to the WHO Global TB Report 2009, Ethiopia ranked seventh in the world for TB burden and third in Africa in 2008, with an estimated TB incidence all forms of 378 new cases per 100,000 persons, 163 new smear positive cases per 100,000 persons, and a prevalence all forms of 579 per 100,000 populations (WHO, 2009).

2.8. Prevalence and Distribution of Bovine Tuberculosis (TB)

Large numbers of cattle and other animals, including wildlife populations, have been known to harbour *M. bovis* which contributes to the transmission of the disease and also causes difficulty in its control. In industrialized countries, bovine tuberculosis is controlled in fanned animals, as a result of which the disease is rare. These countries are conscious of local and international implications of the disease for trading in animal and animal products (Pfeiffer, 1995). In Africa and Asia, where animals constantly live in the open, bovine TB had been rare but, the introduction of European breeds of cattle and the subsequent development of intensive agriculture rapidly changed the distribution of the disease in these areas (Shirima, 2003).

The disease is now present in almost all African countries affecting domestic and wildlife as well as humans. The disease was reported to be prevalent in 33 (80%) of 43 African member countries. In tuberculin testing of cattle in Burkina Faso, reported a 13% positive reactions and isolation of *Mycobacterium* in 26% of 60 retailed milk samples collected in markets, reported a 0.2% prevalence of bovine tuberculosis in the Lake Victoria area of Tanzania, while also isolated mycobacterium species from raw milk of pastoral cattle in the Southern highlands of Tanzania (Kazwala *et al.*, 1998).

Seventeen percent prevalence has also been reported in another study in Chad using purified protein derivative (PPD) tuberculin testing while 6% isolation of *M. bovis* from apparently healthy milk cows was reported in another study in Nigeria. Prevalence rates of bovine tuberculosis ranging from 0.89-25% have also been reported from several studies in Nigeria and other parts of Africa (Awah-Ndukum *et al*., 2005).

Of the 36 Asian nations, 16 reported sporadic/low occurrence of bovine TB, and one (Bahrain) described the disease as enzootic; ten did not report bovine TB; and the remaining nine did not have data (Cosivi *et al*., 1998). In Latin America and the Caribbean on the other hand, the regional prevalence of bovine TB has been estimated at 1% (de Kantor and Rittaco, 1994).

2.9. Categories of TB patients

The immune system reacts to TB in two different ways depending on whether TB is in the active or latent phase. When the TB germs are latent in the body they are considered infections. After they have entered the body the immune system reacts by building a wall around them in the way a scab forms over a cut. TB can stay alive inside these walls for years, or even for a life time, in a latent state. While the bacteria live inside these walls they cannot be spread from one person to another and they do not create any harm to the host (WHO, 2012).

When TB bacteria are in an active state they cause disease. People who have a very weak immune system, such as those with a serious illness, aging, or drug and alcohol abuse are very good candidates to contracting the disease. Shortly after TB bacteria enter the body of someone with a weak immune system the disease begins damaging tissues and organs. When latent TB becomes active TB, usually due to a weakened immune system, the bacteria break out of the walls and begin to rapidly multiply. People with active TB are able to treat the disease by taking several different medications either on their own or with the help from others and also by surgical treatment if antibiotics are ineffective (WHO, 2012).

2.10. Common Risk Factor Associated With TB

2.10.1 Geographic factors

As tuberculosis is spread by respiratory droplets, concentration of airborne bacilli and duration of exposure to active TB cases are considered as two key factors in transmission of tuberculosis. Many studies have established that the TB infection prevalence is higher in household contacts compare to the general population. The prevalence is highest for those who are sharing activities and room air with sputum smear positive cases therefore; proximity and persistence of contacts are major determinants of risk of *Mycobacterium tuberculosis* transmission. Moreover, investigation on TB prevalence among household contacts also indicated that children especially infants are at both increase risk of latent infection and active tuberculosis (Singh *et al.*, 2005).

2.10.2. Socio-economic factors

Some studies have shown that the socio-economic factors, such as poor housing, crowded conditions, poorly ventilated spaces, low income, lack of access to medical care, lack of knowledge of TB prevention are associated with tuberculosis infection. In one way, poverty can be understood as roof cause of tuberculosis. Reported from WHO, 2002 cited that "While TB is not exclusively a disease of the poor, the association between poverty and TB is well established and widespread" (WHO, 2002).

2.10.3. Malnutrition

Malnutrition impacts on cell-mediated immunity which is the principal host defense against tuberculosis. Thus it is an important risk factor for the infection and development of tuberculosis. In addition, some observations on risk factors for tuberculosis infection show that there is no significant difference in prevalence of positive tuberculin skin test among malnourished compared to normal children (Dannenberg, 1982).

2.10.4. Immunodeficiency

Some studies indicated that in HIV-infected persons tuberculosis most often results from the reactivation of latent TB infection but there is no strong evidence that HIV sero-positive persons are more likely to acquire tuberculosis infection than HIV sero-negative individuals, given the same degree of exposure ,However, once infection does occur, the risk of developing disease is much greater among persons with HIV infection, because HIV impairs the host's ability to contain new tuberculosis infection. Thus immunodeficiency is not only direct risk for TB infection but also a risk factor for progression to active tuberculosis (van Asten *et al*., 2003).

2.10.5. Pathogen related factors

People with high bacterial density in sputum, untreated TB, including multi drug resistance Tuberculosis (MDR-TB) are highly contagious and can transmit this serious type of TB to others. (Abebe *et al*., 2006).

2.10.6. Genetic factors

The hyper-susceptibility to *Mycobacterium* infection related to genetic factors has been described in many studies. It was demonstrated that the mutation at locus 395 of interferon gamma receptor 1 gene leading to dysfunction of the protein in the cell membrane. This makes the individual more susceptible to *Mycobacterium* infection (Mirsaeidi *et al*., 2006)

2.11. Diagnosis of Tuberculosis (TB)

Active pulmonary tuberculosis is difficult to diagnose, especially in children and people living with Human Immunodeficiency Virus (PLHIV) who have weakened immune systems (Truffot-Pernot *et al*., 2006). To determine if a patient has active TB disease, the following tests may be used:

2.11.1 Smear Microscopy

Acid-Fast Staining remains the initial step for evaluation of TB using direct microscopic examination of the acid-fast bacillus (AFB) in a smear. Because it is cheap and fairly rapid, it is the only diagnostic test for TB, particularly in developing countries. Two methods are available for the direct examination: conventional staining with carbolfuschin Ziehl–Neelsen (ZN) or Kinyoun stain using light microscopy and auraminebased stains (auramine- or auraminerhodamine) based on fluorescent microscopy. Both methods rely on the retention of stain following the application of acid, resulting from tight binding of the stain to mycolic lipids in the cell wall of the bacillus. The bright fluorescence of stained bacteria under UV microscopy increases the sensitivity of detection at relatively low microscopic power by fluorochrome dye rhodamine (or rhodamine-auramine) staining and is useful for screening Various methods of concentrating sputum based on centrifugation have been shown to

increase diagnostic yield when used prior to microscopy. Whether the increase in sensitivity holds for HIV patients remains to be defined, particularly in those who are smear negative (Swaminathan *et al*., 2010).

2.11.2 Culture

Traditional solid-phase culture techniques such as L-J culture remain the gold standard diagnostic test for TB in most resource-poor countries. Six weeks or longer on solid media and 7-21days with liquid culture media will take the organism to grow. The development of early, manual broth based culture systems such as BACTEC 460 (BBL; Becton Dickenson Microbiology Systems) which measured growth radio metrically have now been largely superseded by newer, fully automated non-radiometric systems. They include systems based on fluorescence such as BACTEC 9000 (Becton Dickinson) and MGIT (Mycobacterial Growth Indicator Tube Becton Dickinson), those that use a colorimetric CO sensor such as MBT and the ESPII system (TREK Diagnostic Systems, Inc) that measures the pressure changes in vial head space. The BACTEC 9000 system has the added advantage of using a compatible medium for mycobacterial blood culture which is of particular use in detecting dissemination of mycobacteria in blood of HIV patients, who have an increased rate of bacteraemia (Mendelson, 2007).

2.11.3 Biochemical test

The differentiation of mycobacterium tuberculosis complex (MTC) by biochemical analyses includes colony morphology, niacin accumulation test, growth in the presence of thiophen-2-carboxylic acid hydrazide (TCH; 2μg/ml), nitrate reduction on modified Dubos broth, and growth characteristics on Lebek medium and on bromocresol purple medium (induction of a pH-dependent change of color from blue to yellow). Oxygen preference in *Mycobacterium* isolates on Lebek (a semisolid medium) can be described as aerophilic (growth on the surface) and microaerophilic (growth below the surface) (Normung, 1986).

2.11.4. Tuberculin Skin Test (TST)

The tuberculin skin test (TST) has been in existence for over 100 years. The test works by injecting a small amount of liquid containing dead TB cells into the lower part of the arm. The injection site must then be evaluated by a trained healthcare professional 48-72 hours later. The TST measures the delayed type hypersensitivity response to a purified mix of mycobacterial antigens, purified protein derivative (PPD). Purified protein derivative comprises antigens that are found not only in *M. tuberculosis*, but also in *M. bovis*-BCG and other mycobacteria. As such, the response to TST lacks specificity in defining both latent TB infection (LTBI) and active disease. In addition, the TST is compromised in HIV infection, where immune suppression commonly leads to anergy, thereby reducing sensitivity. However, the TST remains a useful determinant of which patients should receive *isoniazid prophylaxis* to reduce progression of LTBI to active disease (60% reduction in progression to active TB in people who are TST positive (Pai *et al*., 2004).

2.11.5. Interferon Gamma Release Assays

Recent developments of immune based assays to detect *M. tuberculosis* infection are a significant advance (Pai *et al*., 2004).The 6-kDa early-secreted antigenic target (ESAT-6) and culture filtrate protein 10 (CFP-10) are two proteins encoded by the RD1 genomic segment of *M. tuberculosis*, which is absent from all BCG strains and the vast majority of environmental mycobacteria. It has been shown that ESAT-6 and CFP-10 can stimulate peripheral blood mononuclear cells from patients with tuberculosis to secrete specific interferon-gamma (IFN-γ). As a result, Quantiferon (QFT) and Enzyme Linked Immuno spot (ELISPOT) assays that detect IFN-γ release in response to these antigens differentiate between *M. tuberculosis* infection and immune sensitization by BCG vaccination or exposure to environmental mycobacteria (Sorensen *et al*., 1995).

2.11.6 Nucleic acid amplification tests

Nucleic acid amplification (NAA) is a rapidly evolving improvement in the detection of targeted regions of the *M. tuberculosis* genome by amplifying specific regions of

mycobacterial DNA and identification of MTB which requires strong laboratory capacity and good quality control procedures and is relatively expensive (Robin, 2007).

2.12. Control and prevention of Tuberculosis (TB)

Today's intimate and rapid global interconnections mean that an uncontrolled infectious disease in one part of the world could result in a global threat to animal and public health. In the 1940s, the advent of antibiotics capable of defeating the disease created optimism that TB could soon be controlled and eradicated. In the mid-1980s, that optimism proved to be premature, as a progressive worldwide increase of TB incidence dashed hopes of eradication in the near future (WHO, 2004).

Many authors have thrown some light on factors that could militate against the total eradication of tuberculosis. The ubiquitous nature of mycobacterium their ease of interchange between man and animals and the wide range of reservoir hosts are just a few examples of such factors Other factors are mycobacterium's ability to withstand fermentation, pasteurization, and resistance to pH changes the slow-growing, thick wall of Mycobacterium and its ability to develop resistance to TB drugs (Girrifin *et al*., 2005). The World Health Organization's Directly Observed Therapy-Short course (DOTS) strategy to support control of tuberculosis arose from the work of Styblo and others initially in Africa in the 1970s, emerging as a 'brand' in 1995 and has since been promoted to national and local governments (Ogden *et al*., 2003).

DOTS is a systematic strategy for TB control and declared by the Director General of WHO in 1997 as the most important public health breakthrough of the decade, in tens of lives that will be saved .The strategy comprises of five components which include; government involvement, constant supply of good drugs, microscopy, observed therapy, and monitoring of patients (Atun *et al*., 2005).

By 2004, the programme had been applied in 183 countries with an increase in cure rates of up to 90% in some countries. Population coverage was reported to be complete in 9 of the 22 high-burden countries and almost complete in 5. BCG vaccination at birth is currently

employed in most countries of the world to control tuberculosis. Areas of particular weakness in the control of TB are laboratory services, human resource development and the monitoring control programme (WHO, 2006). In humans, in addition to the factors affecting control caused by the organism itself, three main factors have threatened the control of tuberculosis. These are increased global migrations, the rise and spread of HIV/AIDS, and poorly managed TB control programs, which result in multi-drug resistant strains especially in sub-Saharan Africa, the Indian sub-continent, south East Asia, Russia and to a lesser extent other countries of the world (Anon, 2005).

Trials to evaluate the effectiveness of Bacillus Calmette Guerin (BCG) vaccination for the control of tuberculosis in cattle have been undertaken since 1920 but it has been reported that vaccination can induce reactivity to tuberculin, hence causing a major problem. The possibility of using a vaccine against bovine tuberculosis warrants serious consideration (Buddle *et al*., 1995).

2.13. Treatment of Tuberculosis (TB)

People who have active TB are treated with several types of antibiotics due to the fact that there are a plethora of bacteria to be killed, and also to prevent the bacteria from becoming resistant to the medications. The most common medications used to cure TB are, *isoniazid*, *rifampin*, *ethambutol*, *pyrazinamide*. TB bacteria die very slowly and it takes at least six months for the medicine to kill all of the TB bacteria. Many people start feeling better after only a few weeks of treatment even though the TB bacteria are still alive in their bodies. Since many people start to feel better after only a few weeks of antibiotic therapy they tend to skip doses of medications or quit taking them all together. When this happens the TB bacteria will grow again and may keep the individual sick for a longer period of time (WHO, 2005).

The bacteria may also become resistant to the medications they were taking, and in that case new and different medications will be prescribed. Patients with drug resistant TB should be treated with a minimum of two to three drugs to which their organisms are susceptible. It is very important that the medications are taken exactly as directed by a nurse or physician, and

local health departments offer DOT therapy which can also help increase the chances of TB to be cured from an individual (WHO,2013).

DOT therapy, or directly observed therapy, involves meeting with a health care worker every day or several times a week. DOT helps in several ways. The health care worker can help remind those with TB to take their medication and complete treatment. Also with DOT, medication may only need to be taken two to three times a week rather than every day (WHO, 2010). Surgical treatment of tuberculosis may be used if medications are ineffective all together. There are three surgical procedures for respiratory TB*: pneumothorax*, in which air is introduced into the chest to collapse the lung; *thoracoplasty*, in which one or more ribs are removed; and removal of a diseased lung, in whole or in part. According to health-cares.net it is possible for patients to survive with one healthy lung. Spinal tuberculosis may result in a severe deformity that can be corrected surgically (WHO, 2012).

3. MATERIALS AND METHODS

3.1. Description of the Study Area

The study was conducted at Warder town,Warder Hospital which is found in Dollo zone of Somali Regional State. Warder is bordered on the southwest by the Korahy zone, on the north by Danot, and on the east by Gelladen. It is located in 6^0 5'N latitude and $45^0$21'E longitude (2005). (Figure 1)

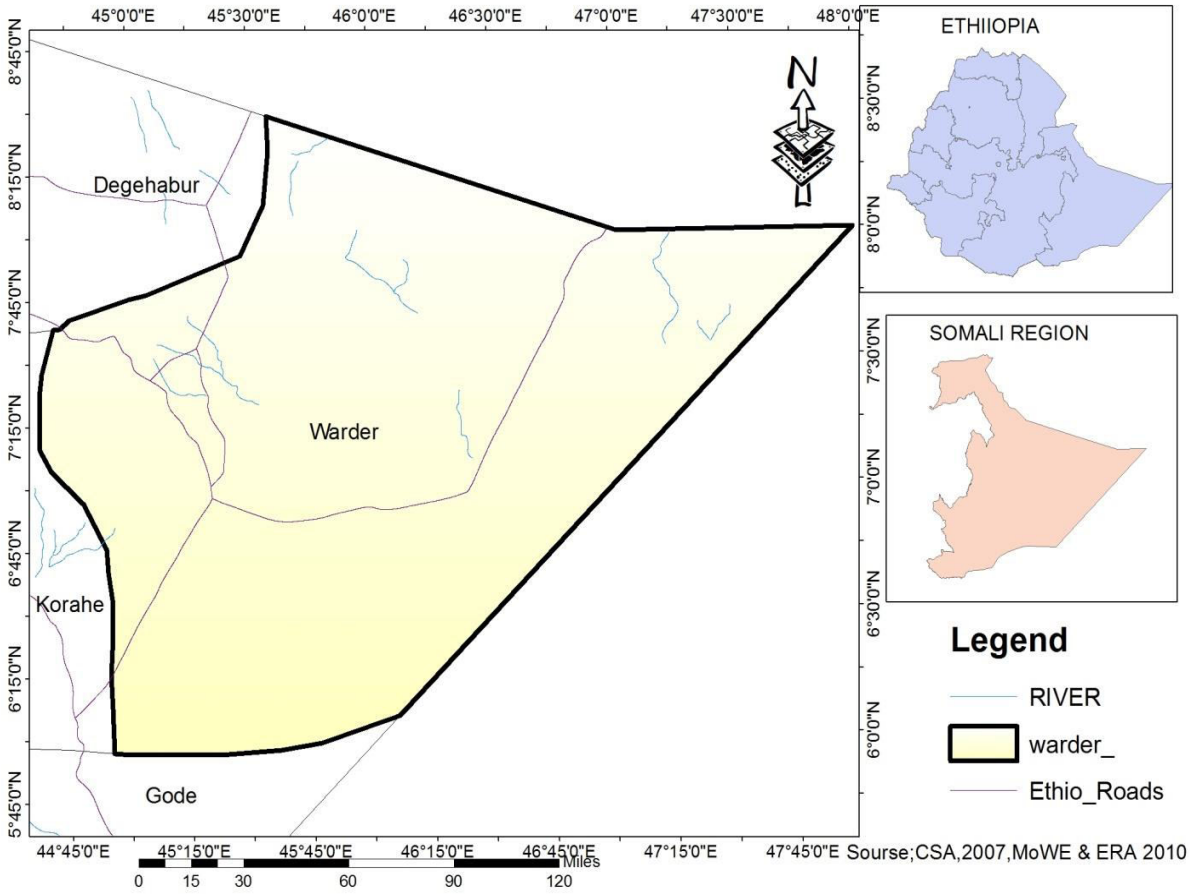


Figure -1Map of the Study Area

The average annual rainfall of Warder town is 400mm. The low annual rainfall and its uneven distribution together with the frequent recurrence of drought have made water the single most

important element that determines the living style of the population. The climate of Warder town is semi desert. The rainfall receives twice per year i.e. - spring and autumn and dry winter and summer. Its annual temperature is 27^0c (NMAJB, 2009).

According to CSA (2007), Warder town had a total population of 18,357, of whom 9,737 were men and 8,620 were women. The constantly mobile nature of the population, which is mainly due to lack of dependable year-round water sources, is a major constraint to the development of basic infrastructure.

3.2. The Study Design

The design of the study was hospital based cross sectional study of TB by collecting and analyzing of the hospital records and preparation of structured questionnaires. Prevalence and trends of TB and its associated risk factors in the study area were assessed from October – December 2016. Laboratory tests of sputum samples for TB was also carried out in Warder Hospital during the study period.

3.3. Study Population

The study site, Warder town has a total of four kebeles .The total residents who live in Warder town and who volunteer to participate in this study were considered as the study population of the research.

3.4. Sample Size Determination

Since there was no previous published report of TB among the population of Warder town, the sample size was calculated based on the assumption that at least 50% of the population has TB. Accordingly, the following formula (WHO, 2000) was used to calculate the sample size:

$n=Z^2p\,(1-p)/d^{2,}$ Where:

n=number of study subjects enrolled in the study

Z= 95% confidence interval=1.96

d = marginal error between the samples and the population =0.05

P = prevalence of TB =50%

The sample size obtained using the above formula was 384.When non response rate (10%) was added to this number; the overall size sample become 422.

3.5. Sampling Techniques

Out of the total population visiting the Warder TB center, 422 patients were selected by purposive sampling technique.

3.6. Method of Data Collection

The following methods of data collection were employed to collect all necessary data for the study. These were analysis of recorded health documents, structured questionnaire and sputum test for TB.

3.6.1. Collection of health records

TB related health records such as reports prepared by the Hospital and MSFH for the last five years were collected to determine the trend and pattern of TB in Warder town through document analysis. In addition, each patient's health record (patient's registration book) was inspected and relevant information was gathered using patients health record format, which has been developed by Warder Hospital and MSFH.

3.6.2. Questionnaire Survey

Structured questionnaire was first developed in English and then translated into local language (Somali) and then changed back to English for accuracy. The questionnaire was pre-tested using 10 %(42) of study participants before the actual study began. Finally the questionnaire was administered to all 422 participants in order to obtain information about their age, sex, occupation, level of education, and marital status. Their knowledge, attitude, and practice related to TB and risk factors such as, smoking, alcoholism, drinking of raw milk and eating of raw meat and others.

3.6.3. Sputum sample collection

Each patient was instructed to provide morning sputum for AFB test. Three consecutive morning sputum specimens were included in this study. Participants were oriented to bring 10ml of sputum and the specimens were collected at Warder Hospital for laboratory test by the laboratory technicians. Sputum specimens were digested and decontaminated by the N-acetyl L-cyteine sodium hydrooxide (NALC- NaOH) method and centrifuged at 3000 rpm for 15 min. Two drops of phenol red indicator were added to the sediment after the supernatant was discarded and hydrochloric acid (2N HCl) was added to neutralize the content. Neutralization was achieved when the color of the solution changes from purple to yellow. Then the sediment was prepared for microscopic observation. All the laboratory materials that were needed for the study were obtained from Warder Hospital.

3.6. Method of Data Analysis

The prevalence of TB was analyzed using descriptive statistics such as frequencies and percentage. Logistic regression analysis was employed to identify risk factors associated with pulmonary tuberculosis. All analyses were done using SPSS version 20 software. *Chi*-square tests were used to compare differences between groups and $p<0.05$ were considered as statistically significant in this study.

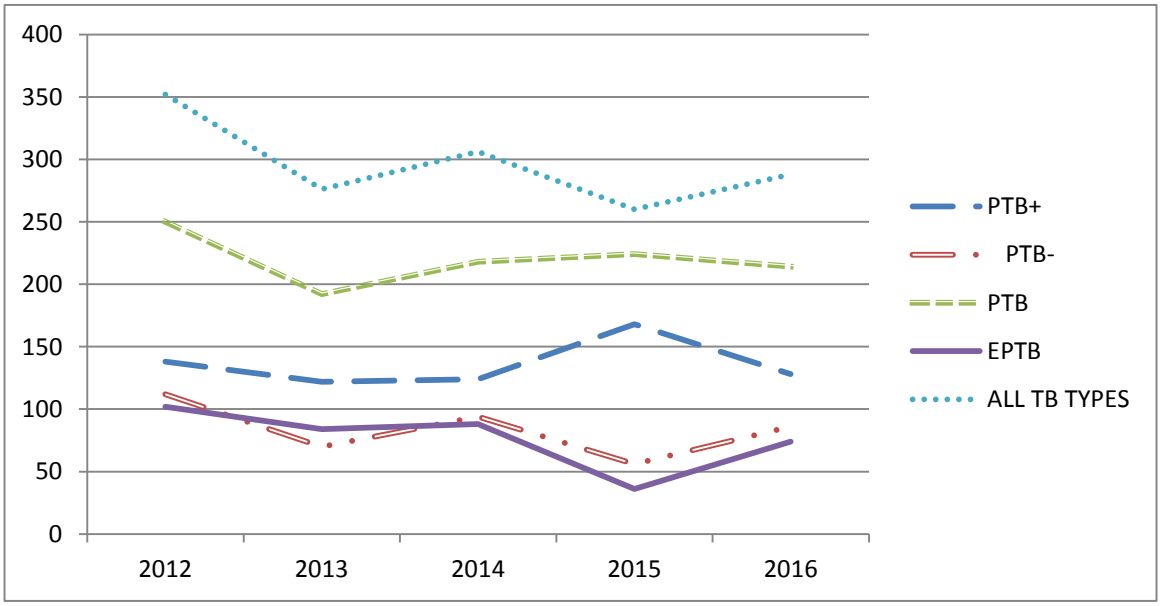
3.6. Ethical Considerations

An authorization to carry out the study was obtained from the Hospital Board ethical committee using a support letter prepared by the University of Haramaya. Oral informed consent of the participants was obtained after explaining the purpose, objectives and the methodology of the study in detail. Information about patients who participated in the study was kept confident.

4. RESSULT AND DISCUSSION

4.1. The Prevalence of TB among patients in Warder Hospital from 2012-2016

A total of 1482 TB patients of all forms were registered during the last five years (2012 - 2016) in Warder Hospital. Based on the type of TB, the most frequent TB was PTB+ (45.88%) followed by PTB- (28.20%) and EPTB (25.91%) as shown in the figure below (fig.2). The trend in the prevalence of all forms of TB showed that there was a slight difference over the years of attendance. The number of PTB+ patients were considerably higher in the year 2015(168) and were of relatively constant in number the rest years with the little different in the year of 2012 (138).The finding from retrospective study indicated that the overall annual trends of all forms TB in the last five years (2012-2016) were vary continued from year to year, with a small variation in all years. In current retrospective study the number of PTB patients was higher (74.1%) than EPTB (25.9%) from 2012-2016. This finding is consistent with studies carried out in southern region of Ethiopia which indicated that, PTB (67%) and EPTB (33%) (Shargie and Lindtjorn, 2005) and in northwestern Ethiopia which has also shown PTB (64.2%) and EPTB (35.8%) regardless of HIV status (Kassu *et al*., 2007).



4.2. Prevalence of TB by age and sex of all types TB cases that were Registered in Warder Hospital from 2012-2016

Out of 1482 TB cases registered in the last five years, 1006 (67.9%) were males and 476 (33.1%) were females respectively (Table 2). Highest numbers of TB patients were observed among males 240 and 208 in the year 2012 and 2013. In females high number of TB patients were registered in the year 2014 (120) and least number in the year of 2013 (68). Where as in the year 2014 and 2016 low number of males (186 and 182) TB patients were observed (Table 2). The study revealed that the number of TB patients were decreasing among males across the years from 2012-2016. From the total TB patient numbers of males TB patients were higher than the number of females TB patients. This finding was in line with the report made by Muvunyi *et al*, (2010) the highest TB infection was showing in males than females (Table 2).

The data showed that the most commonly affected TB patients reside in the age group of 15-38 (62.4%) followed by >38 (34.6%); however the prevalence was less commonly observed in the age groups 0-14 (3%).There are studies reporting prevalence of childhood tuberculosis, estimates indicate that there are very few cases among 0–14 year olds (Dye,2006). According to Dye (2006), TB cases occurred predominantly among young adults.

Table1.Age and sex distribution of all types TB cases that were Registered from 2012-2016

Year	Sex	Age			Number of Registered TB
		0-14	15-38	> 38	
2012	M	4	180	56	240
	F	8	71	33	112
	T	12	251	89	352
2013	M	5	169	34	208
	F	3	41	24	68
	T	8	210	58	276
2014	M	3	70	76	186
	F	6	43	71	120
	T	9	150	147	306
2015	M	4	103	83	190
	F	1	50	19	70
	T	5	153	102	260
2016	M	9	83	90	182
	F	2	78	26	106
	T	11	161	116	288
Total		45 (3%)	925(62.4%)	512(34.6%)	1482(100%

4.3. Trend of TB prevalence from the year 2012-2016 in Warder Hospital when it was extrapolated out of 100,000 populations

The trend of prevalence of all TB types when it was extrapolated out of 100,000 populations was highest in the year 2016, 750 per 100,000 populations, and was least 495 in the year 2013. Generally the number of patients was increases from year to year when extrapolated out of 100,000 even though the total number of patients was decreases from year to year. This indicates that the prevalence of TB in the study area was very high (Table3). The variation in prevalence of TB was in contrast to the national and global TB incidence according to the WHO report of 2008 (WHO, 2008). In addition the result of this study was in contrast with WHO report that showed fall in the prevalence of all forms of TB in Ethiopia which was 394/100000, 152/100000, and133/100000 population in the year 2011, 2013 and 2014 respectively. The finding also in line with a report in the year 2000, the incidence of pulmonary positive TB in the Somali Regional State of Ethiopia was noted at 175-

250/100,000, which was much higher than the national level of 165/100,000 (Dualeh, 2000).This could be due to the effect of DOTS program not well being implemented in the TB clinic of Warder Hospital and lack of knowledge about TB and lack of health facilities in the area.

Table 2.Total patients record of five years and TB patient's record (2012-2016) in Warder Hospital, Somali Region, East Ethiopia

Variables	Label	Average patients population	TB patients per year (%)
Year	2012	65097	352 (0.54)
	2013	55679	276 (0.495)
	2014	50505	306 (0.605)
	2015	45330	260 (0.573)
	2016	38397	288 (0.750)

4.4. Prevalence of Tuberculosis (PTB) in the Study Area by Cross Sectional Study from October-December, 2016

The cross sectional study has provided feedback in to the prevalence of smear positive PTB among TB suspected patients visiting Warder Hospital, as well as outlined some possible risk factors. The study showed that out of 422 TB suspects, 41 of them were smear positive PTB patients by direct Ziehl-Neelsen staining technique and the current prevalence of PTB patients were 9.7% (Table4).The result of this finding is much closer with study conducted elsewhere in Ethiopia on prevalence of smear positive TB in hospitals and health centers of 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 of the present study.

4.5. Association of Prevalence of Smear Positive PTB and Risk factors On the Study Area

4.5.1 Socio-Demographic characteristics of respondents

A total of 422 clinically suspected TB patients were selected to participate in the study. The sex distribution of the respondents showed that, 320 (75.82%) were male and 102 (24.17%) were females. In terms of age category, 39 (9.24%) were in 0-14 years, 199 (47.15%) in 15-34 years, and 184 (43.60%) were ≥ 38 years. Regarding their permanent residence, majority of the respondents 318 (75.35%) were rural dwellers. Concerning their educational status, 209 (49.5%) of the respondents were illiterate, 92 (21.18%) were primary school completed, 65 (15.40%) were secondary school completed and 56 (13.27%) completed higher education. With regards to their occupation, 30 (7.10%) were government employed, 35 (8.29%) were daily labor, 102 (24.17%) were merchants, 56 (13.27%) students, and majority 199 (47.2%) were farmers. In case of their marital status, 52 (12.32%) of them were single, more than half 276 (65.40%) were married and 94 (22.27%) were divorced.

The family size of most respondents that ranges >5 were 230 (54.50%) and 1-5 were 192 (45.50%).Regarding the monthly income of respondents, ranges from <100 38 (9.00%), to 50 (11.84%) > 2000 Ethiopian birr. Concerning their room number, 23(5.45%) of the respondents were homeless, 251 (59.47%) living in one room, 103 (24.40%) in two rooms and 45 (10.66%) were living in three rooms. Regarding their life style, 274 (64.92%) were pastoralist and 148 (35.07%) were non-pastoralist (Table 5).

The study showed that TB was predominant in males 320 (75.82%) than females 102(24.17%) this finding was also 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; North West Ethiopia Kassu *et al*., 2007; and report of WHO, 2008 and 2014). A similar distribution of TB patients was reported in Nigeria in which the number and proportion of male TB patients (55%) were higher that of female TB patients (Makpa et al., 2011). In addition the higher number male of TB patients than female ones might be due to the fact that men are usually chew chat, share cigarette and cups for drinking water while chewing, moving from place to place for various purposes, sharing utensils, and exposure to dust (Mengistu Legesse *et al*., 2010). 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 was 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 15-38 and >38 age had prevalence of 6.2% and 2.8% indicating that these age groups were mainly affected by TB. On the other hand TB was less commonly observed in 0-14 (0.71%) 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, 2008; FDRE, 2010*).*The higher prevalence of TB in the age groups15-38 and >38 was probably due to the fact that these age groups were socially and sexually active which might lead other diseases, which are a risk factor for TB (FMOH, 2013).

In this study, age (p=0.036) and marital status, (p=0.03) were identified as key risk factors for PTB from socio demography perspective. This finding was similar to reports of several authors' indifferent countries (Philip *et al*., 2006, TAOI, 1981, Alvi *et al*., 2000, Abebe *et al*., 2011 and Chakraborry *et al*., 1995) but it was contrary to the one which was conducted in Addis Ababa, where there was no association of PTB and socio-demography (Demissie *et al.,* 2002).

Table 3.Association between socio-demographic characteristics of respondents and prevalence of TB patients who visited warder hospital from October-December 2016

Variable	Category	+VE PTB	-VE	Total	P-value
Age	0-14	3(0.7)	36(8.5%)	39(9.2)	0.036*
	15-38	26(6.2)	173(41%)	199(47.2)	
	>38	12(2.8)	172(40.8)	184(42.8)	
Sex	Male	30(7.1)	290(68.7)	320(75.8)	0.676
	Female	12(2.8)	91(21.6)	102(24.2)	
Residence	Urban	10(2.4)	94(22.3)	104(24.7)	0.998
	Rural	31(7.3)	287(68)	318(75.3)	
Occupation	Government employ	3(0.7)	27(6.4)	30(7.1)	0.844
	Daily labor	5(1.2)	30(7.2)	35(8.4)	
	Merchant	9(2.1)	93(22)	102(24.1)	
	Student	11(2.6)	45(10.7)	56(13.3)	
	Farmer	13(3.1)	186(44)	199(47.1)	
Marital Status	Single	10(2.4)	42(10)	52(12.4)	0.03*
	Married	17(4)	259(61.4)	276(65.4)	
	Divorced	14(3.3)	80(19)	94(22.3)	
Family Size	1-5	19(4.5)	211(50)	230(54.5)	0.271
	>5	22(5.2)	170(40.3)	192(45.5)	
Monthly income in Ethiopian Birr	<100	6(1.4)	32(7.6%)	38(9)	0.262
	100-500	5(1.2)	55(13. %)	60(14.2)	
	600-1000	19(4.5)	226(53.6%)	235(58)	
	1100-2000	4 (0.9)	35(5.92%)	39(6.8)	
	>2000	7(1.7)	43(10.2%)	50(11.9)	
Class Room for living	Homeless	1(0.23)	22(5.21)	23(5.44)	0.419
	One	24(5.7)	227(53.8)	251(59.5)	
	Two	9(2.1)	94(22.3)	103(24.4)	
	>=three	7 (1.7)	38(9)	45(10.7)	
Lifestyle	Pastoralist	25(5.9)	249(59)	274(64.8)	0.56
	Non-pastoralist	16(3.8)	132(31.3)	148(35.2)	

Regarding TB contact history majority of the respondents 258 (61.13%) had no TB contact history with PTB patients. Majority of the study participants 335 (79.39%) had no disease other than smear positive pulmonary TB and 87 (20.61%) of them had other diseases. With

regarding to alcohol consumption, majority of them 417 (98.81%) never use alcohol, 5 (1.18%) were taking alcohol sometimes (table 6). Majority of the respondents 310 (73.45%) were Chat chewers. Regarding with smoking habit most of 300 (71.09%) of the respondents were smokers, 64 (15.16%) of the respondents were smoking cigarette sometimes and only 58 (13.74%) were non smokers. Regarding to their family smoking habit majority 330 (78.19%) were smokers. Concerning the use of milk majority 372 (88.15%) of the respondents never boiled milk but in case of meat it was in contrast to milk in which most 391 (92.65%) of the respondent cooked meat (Table 6).

As it is shown in table 6, TB contact history (p=0.023), chat chewing (p = 0. 033) and smoking cigarette (p=0.041) have statistical significant association with PTB+ ($P \leq .05$).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 and Muvunyl *et al.,* 2010). 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).

Smoking was associated with the distribution of PTB+ (p= 0.041) 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 dendrites 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 consistent with that of chat chewing which was one of the significantly associated risk factors to smear positive PTB (p=0.033). 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).

Table 4.Association Risk Factors (Disease Factor and Personal Behavior) and Prevalence of TB among Patients Who Visited Warder Hospital from October –December 2016

Variable	Category	+VE PTB	-VE	Total	P-value
TB contact history	Yes	9(2.13)	155(36.72)	264(38.9)	0.023*
	No	32(7.58)	226(53.55)	258(61.1)	
Do you have other disease before	Yes	7 (1.65%)	80(18.9%)	87(19.7)	0.581
	No	34(8.05%)	301(71.3%)	335(79.3)	
Family Smoking	Yes	33 (7.81%)	297(70.4%)	330(78.2)	0.709
	No	8 (1.89%)	84(19.9%)	92(21.8)	
Alcohol consumption	Never	39(9.2%)	378(89.6%)	417(98.8)	0.74
	Sometimes	2(0.5%)	3(0.71%)	5(1.2)	
	Always	0(0.00)	0(0.00%)	0(0)	
Chat chewing	Never	14(3.31%)	90(21.3%)	104(24.6)	0.033*
	Sometimes	1(0.23%)	7(1.7%)	8(1.93)	
	Always	26(6.2%)	284(67.3%)	310(73.5)	
Smoking Cigarette	Never	10(2.36%)	48(11.4%)	58(13.8)	0.041*
	Sometimes	6(1.42%)	58(13.7%)	649(15.1)	
	Always	25(5.92)	275(65.2%)	290(71.1)	
Do you boil milk before use it?	Never	36(8.53%)	336(80%)	372(88.5)	0.825
	Sometimes	4(0.94%)	33(7.8%)	37(8.7)	
	Always	1 (0.23%)	12(2.84%)	13(3)	
Do you cook meat before use it?	Never	(0.00%)	9(2.13%)	9(2.13)	0.999
	Sometimes	2(0.5%)	20(4.73%)	22(5.23)	
	Always	39(9.2 %)	352(83.41%)	391(92.6)	

4.5.2 Logistic regression analysis of Socio-demographic characteristics and personal behavior of respondents associated with TB in Warder Hospital

Logistic regression model was used to see the association between, the prevalence of pulmonary tuberculosis with determinant factors (socio demographic and personal behavior) variables (Table 7)

The adult age had independent association with the distribution of pulmonary tuberculosis among the study respondents (p=0.044). Respondents who were ranged in the age of 15-38 were two times (AOR = 2.346, 95% CI = 1.21 –2.75) more likely to develop smear positive PTB than the other age groups.

TB contact history were associated with the distribution of smear positive PTB among the study respondents (p=0.001). Those who had contact with active TB patient in their vicinity were almost about five times (AOR = 5.373; 95% CI = 1.978–14.596) more likely to develop smear positive TB than those who had no contact.

Chat chewing were associated with the distribution of smear positive among the study respondents (p=0.023).Those who chew chat were about three times more likely to develop PTB+ than with those who were non chewers (AOR= 3.44; 95% CI =1.598-14.31).

The smoking status had an independent association with the prevalence of pulmonary tuberculosis (p=0.009).Those who were smoking cigarette are five times (AOR = 4.886; 95% CI = 1.417-3.509) more likely to develop smear positive pulmonary TB than those who do not smoke.

Table 5.Logistic regression analysis of socio demographic characters and personal behavior of respondents associated with TB patients.

Variable	Adjusted Odds ratio	[95%conf.interval]	P-Value
Age			
0-14	1		
15-38	2.346	[1.21 – 2.75]	0.044*
>=38	0.344	[0.122 -279]	0.653
Marital status			
single	1		
married	3.21	[0.152-0.418]	0.398
divorced	1.42	[0.458-1.012]	0.078
TB contact history			
No	1		
Yes	5.373	[1.978-14.596]	0.001*
Chat chewing			
Never	1		
Sometimes	1.32	[0.122- 0.972]	0.166
Always	3.44	[1.598 -14.31]	0.023*
Smoking cigarette			
Never	1		
Sometimes	3.11	[0.365 -2.656]	0.550
Always	4.886	[1.417 -3.509]	0.009*

Key*statistically significant (P<0.05), 1=Reference group, AOR=Adjust Odd Ratio, 95%C.I=95% Confidence Interval

4.5.3. Awareness of respondents on cause, transmission and symptom of PTB in Warder Hospital

More than half the respondents 254 (60.2%) responded that the spread of PTB can be prevented.

In this study the majority, 380 (90%) of the study respondents reported that they had no access to health education through Radio/Television and 102 (24.2%) of the respondents respond that bacteria/germs as the cause of tuberculosis. About 203 (48.10) responded that sexual intercourse as cause of TB. Regarding awareness of payment to TB treatment, more than half of the respondents 262 (62.1%) reported that have this information. Majority of the respondent 305 (72.3%) did not know the effect of TB and 299 (70%) of didn't know correctly the curability of TB. Most of the respondents 313 (74.2%0 replied that TB drug can be purchased from drug shop. The finding of this study showed that 90% had no access to health education and 48.10% of the study participants were not aware of the causative agent of PTB the this finding is in consistent to studies done on Southwest Ethiopia showed that 33.7% of TB suspected patients (Abebe, 2010) and Nigeria50% of patients (Enwuru *et al.,* 2002) had no knowledge about the cause of TB. This may be due to relatively less awareness of respondents about the causative agent of TB because many of them had no an access to health education and this finding is contrast to a study done in north Ethiopia where 86% of the study participants were aware of TB (Mesfin *et al*.,2005).

Regarding to the mode of transmission of PTB, majority 328 (77.7%) of them respondents replied that sexual intercourse as a means of transmission, 314 (74.4%) by blood contact, 289 (68.48%) by traveling on a crowded bus, 264 (62.55%) through air droplet, 117 (27.7 %) through overcrowding, However, few of the respondents answered that 63 (14.9%) by sharing the same eating and drinking materials, 45 (10.7%) by mosquito bite, and 289 (6.6%) hand shaking.

In relation to the methods of reducing the spread of TB from infected person to healthy person, 288 (68.24%) respondents came with correct answer that is ventilating the living room, 224

(53.1%) of by spiting the sputum in a container with cup, 214 (50.71%) by not coughing in front of other peoples and 300 (71.1%) replied a wrong answer with not sharing of utensils and spitting out in the open air 316 (74.9%).

Regarding the symptoms and sign of PTB more than half of the respondents replied that loss of appetite 335 (79.4%) and weight loss 301 (71.3%), coughing 291 (69) and chest pain 290 (68.7%) as a pertinent symptom and sign of TB. Less than half on the respondents recognized symptoms and signs of PTB correctly. i e. their answer for other symptoms and signs of TB were; fever 159 (37.7%), skin rash 116 (27.5%) and cough with blood 125 (29.6%) according the tables below.

The finding of this study also showed that respondents had lack of knowledge concerning bacteria as a causative agent of TB. Instead, most of them perceived mainly either sexual intercourse or aging and genetic disorders the cause of TB, which is more or less similar with other studies in Afar region (Legesse *et al*,.2010) .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 facilities 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, 2010)in northeast Ethiopia (Legesse *et al*,.2010) and also in Iran (Yousif *et al* 2009) and Philippines (Christina *et al*,. 2009).

Another important aspect noted in this study was that most of the participants were aware of the prevention and treatment methods of TB, which is more or less similar to a study performed Shinille area of Ethiopia by (Melaku et al, .2013).

Table 6. Awareness of study participants about TB at warder hospital warder town

Characteristics	Category	Frequency	Percent
Access to health Education	Yes	42	10
	No	380	90
Cause of TB	Bacteria	102	24.2
	Aging	83	19.7
	Genetic disorder	28	6.6
	Sexual intercourse	203	48.1
	Insect bit	6	1.4
Do you know that TB treatment Is free of charge	Yes	262	62.1
	No	160	37.9
Is it possible for TB to be completely cured?	Yes	123	29.1
	No	299	70.9
Do you know any danger if a TB patient is not treated	Yes	305	72.3
	No	117	27.7
Is it possible to purchase TB drug from drug shop	Yes	313	74.2
	No	109	25.8

Table 7.**Awareness of study participants on mode of transmission TB**

Characteristics	Category	Frequency	Percent
Method of TB transmission:-			
	Yes	264	62.6
Through air droplet	No	158	37.4
Overcrowding	Yes	117	27.7
	No	305	72.3
Traveling in a crowded	Yes	289	68.5
Bus	No	133	31.5
Sexual intercourse	Yes	328	77.7
	No	94	22.3
Blood contact	Yes	314	74.40
	No	108	26.60
Sharing Materials with TB patient	Yes	63	14.9
	No	35	85.1
mosquito bite	Yes	45	10.7
	No	377	89.3
Hand shaking	Yes	28	6.6
	No	394	93.4

Table 8.Awareness of study participants to sign and symptoms of TB

Characteristics	Categories	Frequency	Percent
Cough with blood	Yes	145	34.4
	No	277	65.6
Weight loss			
	Yes	301	71.3
	No	121	28.7
Fever			
	Yes	159	37.7
	No	263	62.3
Night sweating			
	Yes	213	50.5
	No	209	49.5
Chest pain			
	Yes	290	68.7
	No	132	31.3
Loss of appetite			
	Yes	335	79.4
	No	87	20.6
Skin rash			
	Yes	116	27.5
	No	306	72.5
Fatigue			
	Yes	274	64.9
	No	148	35.1
Is it possible			
To prevent TB?	Yes	254	60.2
	No	168	39.8
TB prevent by:-			
Not coughing in front of others	Yes	214	50.7
	No	208	49.3
Spit in a container with cup	Yes	224	53.1
	No	198	46.9
Spit out in the open Everywhere	Yes	106	25.11
	No	316	74.88
Ventilating the living room	Yes	288	68.24
	No	134	31.75
Not sharing utensils	Yes	122	28.90
	No	300	71.10

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 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 determine the prevalence and the associated risk factors for tuberculosis. The data for this study was obtained from TB health record of Warder Hospital for retrospective study (Jan 2012 to December 2016) and AFB and questioner survey for cross sectional study (October2016 - December 2016).

A total of 1482 all forms of TB patients were registered during the last five years (2012 to 2016) in Warder Hospital. Based on the type of TB, the most frequent TB was PTB+ (45.88%) followed by PTB- (28.20%) and EPTB (25.91%). The trend in the prevalence of all forms of TB showed that there was a small difference between years of attendance.

The finding from ten years recorded data (2012-2016) shows that the prevalence and the trend of all forms vary from to year with a small fluctuation in all years 2012 (540/100000) 2013 (495/100000), 2014 (605/100000),2015 (573/100000) and 2016 (750/100000)in the study area. The finding of the cross sectional study carried on from October 2016-December,2016 also showed that the current prevalence rate of smear positive PTB among TB suspects in Warder hospital was 9.7% by direct Ziehle-Nelson staining technique. The associated risk factors to smear positive pulmonary tuberculosis were found age, marital status, TB contact history, chat chewing, smoking cigarette in the study area.

The finding of this study showed that 90.04% had no access to health education and 48.10% of the study participants were not aware of the causative agent of PTB and finding of this study also showed that respondents had lack of knowledge concerning bacteria as a causative agent of TB. Another important aspect noted in this study was that most of the participants

were aware of the prevention and treatment methods of TB. In general awareness of respondents regarding the cause, transmission and symptoms were varying one another.

5.2 Conclusions

TB was predominant in males than females and the prevalence of all forms of TB were dominant within the age groups from 15-38 (47.2%) and >38 (43.6%) in both sexes. This demands special attention in the study area as the disease is affecting the productive age of the population. Males are more exposed to TB than females to the associated risk factors of TB. Then measures should be taken up on those risk factors to be minimize on the study area by create awareness and by educate the society on the risk factors of TB.

However 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.

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 on the study area.

5.3 Recommendations

Based on the findings of this study the following recommendations can be forwarded:-

- Farther detail study has to be done in future to ascertain the contributing factors and the strain of the mycobacterium that circulate in the study area by using advanced techniques such as molecular genetics by other researchers.

- Intervention on the identified associated risk factors is required to control TB on the study area.

- Public awareness programs using the electronic media and literature are crucial in educating causes of TB, mode of transmission, symptoms, preventions and treatment methods at wider scale.

- Strengthening and improving the accessibility of healthcare services is essential in TB control in the study area.

- A reliable health management information system and the functional integration of DOTS program should be implemented in the TB clinic of Warder Hospital to control the high prevalence of TB in the area.

- Regular 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.

- 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

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7.APPENDICES

Questionnaire

A. <u>Socio demographic characters</u> of the study Participants

1. Age of respondent's 0-14 □ 15-34 □ >38 □

2. Sex of respondent's Male □ Female □

3. Residence Urban □ Rural □

4. Life style pastoralist □ non-pastoralist □

5. Educational Status. Illiterate□ Primary□ secondary□ Higher□

6. Occupation, government employed □ Daily Labor □ student □ Merchant □ Farmer □

7. Marital statuses, single □ married □ divorced □

8. Family size 1-5 □ >5 □

9. Total monthly income in Ethiopian birr. <100 □ 100-500 □ 600-1000 □ 1100 2000 □ >2000 □

10. Number of rooms Homeless □ 1 □ 2 □ 3&abov malnourished □

B. Behavior of respondents

11. Do you drink alcohol? Never □ Sometimes □ □ Always

12. Do you chew chat? Never □ Sometimes □ Always □

13. Do you boil milk before use it? Never □ Sometimes □ Always □

14. Do you cook meat before use it? Never □ Sometimes □ Always □

15. Do you smoke cigarettes? Never □ Sometimes □ Always □

16. 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

17. Do you have other disease before? Yes □ No □

18. Have you ever had long contact with TB patients? Yes □ No □

D. Awareness of respondents to Tuberculosis.

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

20. What is the cause of Tuberculosis? Bacteria or germ □ Aging □ Genetic disorder □ sexual intercourse □ Insect bite □ .

21. How is Tuberculosis transmitted? Through air droplet □ through overcrowding □ through sexual intercourse □ through blood contact □ traveling in a crowded bus □ Sharing the same utensils □ Mosquito bites □ Hand shaking □

22. What are the signs & symptoms of Tuberculosis? Cough (2 weeks or greater) Cough with blood □ Fever □ loss of weight □ night sweating □ chest pain □Loss of appetite □

23. Is it possible to prevent TB infections? Yes □ No □

24. 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 □ Avoiding shaking hands and blood contact □

25. Did you know that the TB treatment is available free of charge? Yes □ No□

26. Do you know any danger if a TB patient is not treated? Yes □ No □

27. Is it possible to purchase TB drug from drug shop? Yes □ No □

Suaasha Af- Somali

1. Dada 0-14 □ 15-38 □ >38 □

2. Sinji Gabdho □ Wiilasha □

3.Masha Uudaganyahay Magalo □ Badiya □

4.Xaalada nolosha Xolo dhaqoto □ aan xolodhaqan □

5.Xalada waxbarashada Waxbaaanbaran □ dugsidhexa □ DugsiSare □ waxbarashada Sare □

6.Xalada Shaqada Beeralay □ Arday □ Ganacsada □ Shaqo malinla □ Shaqala Dawlada □

7. Xalada Guurka guursaday □ Aanguursan □ lafuray □

8.Xubnaha Qoysika 1-5 □ >5 □

9.lacagtaa Ethiopa bisha lahasho Bila lacag □ 100-500 □

600-1000 □ 1100 2000 □

>2000 □

10. Tiradaa Qoolka qol laan □ 1 □ 2 □ 3& kabadan □

11. Khamri ma cabta badana □ marmar □ waligay □

12. Jaadka macuntaa badana □ Marmar □ Waligay □

13.Canaha makarkarisaa intaadan cabin badana □ marmar □ waligay □

14.Miyadkarkarsaa hilibka intaa adan cunin badana □ marmar □ waligay □

15.Sigaar ma cabtaa Haa □ Maya □

16.Miyuu jira qof guriga kunool oo sigarka caba Haa □ Maya□

17. Cudur kala makugudhacay hada kahor Haa □ Maya □

18. Waligaa xidhiidh malayelata bukan qaba TB Haa □ Maya □

19. Miyaad dhagaysatay waxbarasho cafimad oo kusabsan TBda tafishin ama idcad

Haa □ Marmar □ Maya □

20. Maxa sababa TB da bagteriya ama jermis □ dada □ hidaha oo xumada galmada □ qaniinyada cayayaanka □

21. Siday ugudubtaa TBdu dhibcaha hawada □ in aad laisuguyimado □ in laisugalmodo □ in dhiig latabto □ inlagusafro bas buuxa □ in lawada isticmalo macunta □ qaninyada kaneecada □

24. Calaamadaha TB da qufac □ qufac dhiigwata □ qandho □ dhidid habeenkii ah □ misanka oo hoos udhaca □ daal jid cuncun □ lab xanuun □

25. Ma ogtahay in dawada TB du lacag la:aantahay Haa □ Maya □

26. Ma ogtahay qofkaTB da qabahadi aanladawayin inuu khataryahay Haa □ Maya □

27. Dawa da TB malagadi kara Haa □ Maya □