ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL SCIENCES

EVALUATION OF MILLENIUM DEVELOPMENT GOAL FOR CONTROL OF TUBERCULOSIS *(TB)* IN NEKEMTE TOWN (2010/11– 2014/15)

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THESIS SUBMITTED TO DEPARTMENT OF ZOOLOGICAL SCIENCES, SCHOOL OF GRADUATE STUDIES, ADDIS ABABA UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTERS OF SCIENCE IN BIOLOGY

Addis Ababa, Ethiopia

August, 2016

ACKNOWLEDGEMENT

I would like to express my deepest gratitude and heartfelt thanks to my advisor
Dr. Fassil Assefa, for his scholarly assistance in guidance, support, encouragement and expert comments throughout the work of my thesis. His corrections and critical remarks from the preparation of the proposal to the completion of the thesis were very useful and constructive.

I owe special thanks to Nekemte Refferal Hospital, Nekemte Health Center and Cheleleki Health Center administration and TB Centers for their cooperativeness in providing me with appropriate documents and data.

Furthermore, I would like to extend my gratitude to Nekemte Preparatory School administration for their support in many aspects in this thesis work.

Finally, I would like to take this opportunity to forward my deepest gratitude to my wife Koriche Garuma for her support and encouragement in this thesis work and my graduate study.

ACRONYMS AND ABBREVIATIONS

AFB	Acid Fast Bacilli
ART	Antiretroviral therapy
BCG	Bacille - Calmette-Gue'rin
CDR	Case Detection Rate
CHC	Cheleleki Health Center
CNR	Case Notification Rate
CXR	Chest X-ray
DOTS	Directly Observed Therapy –Short Course
EPTB	Extrapulmonary tuberculosis
FMOH	Federal Ministry of Health
HBCs	High burden countries
HIV	Human immune deficiency virus
HMIS	Health Management Information System
IUATLD	International Union Against Tuberculosis and Lung Disease
LED microscope	Light emitting diode microscope
LTBI	Latent Tuberculosis infection
MDG	Millennium Development Goal
MDR TB	Multidrug resistant tuberculosis
MTB	Mycrobacterium tuberculosis
NHC	Nekemte Health Center
NRH	Nekemte Referral Hospital
NTLC	National Tuberculosis and Leprosy Control
NTP	National Tuberculosis Control Program
PTB	Pulmonary Tuberculosis
SPPTB	Smear positive pulmonary tuberculosis
SNPTB	Smear negative pulmonary tuberculosis
TB	Tuberculosis
TSR	Treatment Success Rate
W HO	World Health Organization
ZN	Ziehl –Neelsen

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ABSTRACT

Tuberculosis (TB)is one of the major public health problem wide spread world wide.AS Global TB report of 2014 showed, in 2013 alone there were about 9.0million newly infected and 1.5 million deaths. The problem was worse in Africa where our country Ethiopia is found. The present study was carried out in Nekemte town, one of the areas highly affected by the disease. The aim of the study was to examine the prevalence of 'all TB cases' in the study area in sex and age category, case detection rate(CDR), those co-infected with HIV and the treatment outcome of those attended DOTS(Directly Observed Therapy - Short course) service in the three government health care facilities found in Nekemte town in relation to MDG. A retrospective cross-sectional study design based on document analysis of TB Registry Unit of the patients found in the TB Center was used. The study results revealed that there were1246TB cases registered on the TB Registry Units in the five years (2010/11-2014/15) period of the study. Out of these cases644(51.7%) were males and 602(48.3%) females. Ninety eight point one percent(98.1%) of the cases were new TB cases. Results of age specific prevalence of TB cases revealed that the majority 1124(90.2%)patients were within the active productive age group(15 -64 years)that made TB a dangerous disease that affects the economy of the individual, family and the country as a whole. The case detection rate (CDR) in the study area was 38.9% which was lower than the national (62%),Regional(Africa)52% and global 64%. The area is not on track to meet the global target of 70% CDR by2015. In this study area, all TB patients were tested for HIV, indicating it has met the global target(100%) by 2015.The prevalence of TB/HIV co-infection in the study area was higher(18.7%) compared to the national prevalence (11%), that requires a collaborative activity of TB and HIV control program. Results for treatment outcome showed an overall treatment success rate of 85.5% .The treatment success rate of this study area has met the global target of 85%by 2015,but is lower to the national achievement of 91%, suggesting an improvement .

Keywords: Tuberculosis, TB/HIV co-infection, Prevalence, case detection rate, Treatment outcome, treatment successrate

1. INTRODUCTION

Tuberculosis(TB) is an infectious air borne disease that has become a major global health problem. Each year, there are around 9 million new cases of TB, and 1.5 million deaths of whom 360,000 were HIV positive patients (Global TB report 2014).

In 1993, WHO declared TB as a global public health emergence and recommended Directly Observed Therapy – Short Course (DOTS) as a standard strategy to control the disease. All countries are affected, but more in the 22 high burden countries (HBCs) of the world where 80% of the cases are found (Global TB report, 2014).

The Stop TB Partnership was established in 2000 as a global movement to accelerate social and political action to stop the spread of TB around the world, eliminate TB as a public health problem, and secure a world free of TB (Stop TB partnership, 2010). In 2006, the plan was launched with a target of decreasing the prevalence, incidence and mortality rate of TB by half (50%)a level of the status of the disease in 1990. To get to this level screening of all TB patients (100%) for HIV, and smear positive pulmonary TB detection or Case detection rate (CDR) of 70% and reach treatment success rate of 85% by the year 2015 was recommended(Stop TB partnership, 2010).

Ethiopia is one of high TB endemic countries in the world. It ranks 13th in the list of 22 high burden countries, and 7th in Africa .The report also revealed that Ethiopia is among the 41 high TB/HIV co-infected countries in the world (Global TB report, 2014). The country had, a high TB burden, high TB/HIV co-infection and had attempted to adapt and implement the Global plan to Stop TB for one decade 2006-2015.

A recent report from Federal Ministry of Health (FMOH) showed that there is a trend in declining of prevalence, incidence and mortality rate of tuberculosis (FMOH, 2014). Even WHO has declared that Ethiopia has met the global target of 2015 in TB prevalence, incidence and mortality reduction by 50% compared to the level of the TB burden in the 1990's. Accordingly, the prevalence of TB that was recorded 425/100000 in 1990 has decreased to 211/100000 in the year 2013. Similarly, the incidence which was 367/100000 in 1990 was reduced to 224/100000 in the same year. However, the global target of TB patients to know

their HIV status by 2015 was adjusted as 100%, but in Ethiopia only 71% of TB patients knew their HIV status by 2013 (Global TB report,2014). In addition the available data in the country suggests wide variations in the TB prevalence, case detection rate, TB patients with known HIV status, prevalence of TB/HIV co-infection, treatment success rate and among the different localities.

Although attempts were made in case studies of some localities in Oromia Region, there is little if any information about the current status of TB and Co-infection with HIV in Nekemte town. Hence, investigation was necessary to look into the prevalence of TB cases and TB/HIV co-infection and treatment success in relation to the socio-demographic risk factors .

1.1 Research question

The study attempted to answer the following research questions:

- What was the prevalence of male and female TB patients(M: F ratio)among patients that attended DOTS(Directly Observed Therapy-Short course**)** service in Nekemte government health care facilities 2010/11-2014/15?
- What was the prevalence of TB cases among different age groups?
- Did the trend of TB cases show a decline between 2010/11 to 2014/15 as a global plan?
- What was the case detection rate (the proportion of smear positive pulmonary TB patients among total pulmonary TB patients) in the study area in relation to 70% of global target by 2015?
- What proportion of TB patients did know their HIV status in relation to 100% global target, and what was the prevalence of TB/HIV co-infection in the study area?
- What was the treatment outcome of TB patients especially the treatment success rate in Nekemte town health care facilities in relation to 85% of global target by 2015?

1.2 Objective of the study

1.2.1Generalobjective

The general objective of the study was to evaluate the Millennium development goal strategic achievements for the control of TB based on secondary data from the government health care facilities TB Center Registry Unit of Nekemte Referral Hospital, Nekemte Health Center and Cheleleki Health Center in Nekemte town during the past five

years 2010/11 - 2014/15.

1.2.2 Specificobjectives

The specific objectives were:

1. Determine the prevalence of TB cases by sex and age category among TB patients attending DOTS service in Nekemte health care facilities
2. Assess the trend of TB prevalence in the specific year between (2010/11-2014/15).
3. Examine case detection rate for smear positive PTB by the health care facilities in the study area in relation to national achievement and the global target of 70% by 2015.
4. Determine the extent of TB patients with known HIV status in relation to 100% global target by 2015 , and prevalence of TB/ HIV co-infection among TB patients attended DOTS service from 2010/11-2014/15.
5. Assess treatment outcome especially treatment success rate of TB patients during the years (2010/11-2014/15) in the study area in relation to 85% global target by 2015.

1.3 Significance of the study

This study gives a base – line data on prevalence of tuberculosis in Nekemte at the time of this study amongst TB case prevalent groups and evaluates whether or not the TB control in the area was in accordance with the Global Stop TB partnership target of 2015 in PTB case detection rate, HIV screening status in TB patients and treatment success rate.

1.4 Scope of the study

Geographically, the study was limited to Nekemte town, Oromia Regional State, West Ethiopia. The study is an assessment based on secondary data of TB cases rather than population and research based. The study focused on the three government health care facilities (Nekemte Referral Hospital, Nekemte Health Center and Cheleleki Health Center) that provide the DOTS service to the TB patients in Nekemte town.

2. LITERATURE REVIEW

2.1 Tuberculosis

2.1.1 Etiology

Tuberculosis is a bacterial disease caused by *Mycobacterium*. The genus *Mycobacterium* is divided in to two main groups: *M. tuberculosis* complex and environmental mycobacterium or non-tuberculosis mycobacterium. The *M. tuberculosis* complex comprises the closely related species *M. tuberculosis, M. bovis, M. africanum, M. microti and M. canettii*. These species are the causative agents of TB in humans and animals. *M. tuberculosis* is the major cause of human TB all over the world (Smith,2003).

There are two types of tuberculosis; pulmonary tuberculosis (PTB) and extra pulmonary tuberculosis (EPTB). Pulmonary TB is any bacteriologically confirmed or clinically diagnosed case of TB involving the lung parenchyma or the tracheobronchial tree. Extrapulmonary TB is tuberculosis of organs other than the lungs, such as lymph nodes, abdomen, genitourinary tract, skin, joints, bones, and meninges (FMOH,2008)

2.1.2Modeof Transmissionof Tuberculosis

M. tuberculosis infection occurs through inhaling an aerosol droplet that is generated when patients with PTB cough, talk, sneeze, spit and sing. For *M. bovis*, it can be transmitted through drinking of raw milk that may infect the tonsils presenting as scrofula (cervical lymphadenitis), or the intestinal tract, causing abdominal TB (Bass *et al,*1990). In case of PTB, once the organism enters the alveolar region, alveolar macrophages engulf and control multiplication of bacillus in most of the exposed individuals. This primary infection leads to an active disease in about 10% of individuals only. In the remaining 90% of cases, individuals remain asymptomatic and non-infectious, i.e. latent infection stage. However, in some circumstances where the immune response is weakened, reactivation of latent infection can result (Tufriello*etal.,*2003).

2.1.3ClinicalManifestationofTuberculosis

Once a person develops the disease PTB, there will be several suggestive clinical features,

especially 2weeks' or above duration of cough, sputum production and weight loss are important for the diagnosis of PTB. Others respiratory symptoms like chest pain,

Haemoptysis , breathlessness and/or constitutional symptoms like fever, night sweats, tiredness, loss of appetite can also occur (WHO,2004)

2.1.4PathogenesisofPulmonaryTuberculosis

When a healthy individual inhale bacilli, the first implant is done in the lungs at bronchiole or alveolar level. The bacilli multiply and produce the primary lesion there. Some bacilli pass in to the hilar lymph nodes causing lymph node enlargement. The bacilli from alveolar lesion, the Ghon focus and the enlarged hilar lymph nodes can be more widely disseminated via the lymphatic system or blood stream, leading to serious complications such as meningitis, bone, joint, and renal tuberculosis (Festenstein&Grange1999). The host response to tuberculosis is through cell-mediated immunity, and the cells involved include, Macrophages, and T-lymphocytes. The lymphocytes recognize TB antigen and release cytokines such as gamma interferon, which activates macrophage at the site of the lesion (Riley,1982).

Hypersensitivity to the organism appears at 8-10 weeks and the infected individual becomes tuberculin test positive. It is estimated that10% of the infected individuals develop clinical tuberculosis during their lifetime. Around 50% of these will develop TB during the first year of infection and the rest many years later (Bass*etal.,*1990).

2.1.5 DiagnosisofTuberculosis

Early detection of the cases and prompt treatment are crucial for TB control. TB diagnosis mainly depends on the clinical presentation of the disease and identification of the offending bacilli. Many TB diagnostic tests are available although no single diagnostic test for TB exists that can be performed rapidly, simply, inexpensively, and accurately as a stand-alone-test. Thus, the diagnosis of active TB is a clinical exercise; and sputum microscopy remains the main stay of diagnosis because of its availability, operational feasibility and ability to identify the highly infectious forms of TB, the smear- positive PTB case(ReichmanandHershfield's2006).

The diagnosis of PTB in adult is mainly done by collecting a sputum sample. Due to the

nature of the waxy coat of *Mycobacterium* cell wall, it retains an aniline dye(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.

There are two procedures commonly used for acid fast staining.

- Carbolfuchsin method which include ZN and Kinyoun methods(Light/ bright field microscope)
- Flourochrome procedure using auramine-O or auramine-rhodamine dyes(Fluorescent microscope)

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

ZN- Staining procedure:

  - Reagents required; Carbolfuchsin stain, Acid- alcohol 3%v/v, Malachite green 5g/l or Methylene blue 5g/l

- Spread the sputum evenly over the central area of the slide using a continuous rotational movement.
- Place slides on drier with smeared surface upwards and air dry for about 30 minutes.
- Heat fix dried smear.
- Cover the smear with Carbolfuchsin stain.
- Heat the smear until vapor just begins to rise (about 60^{o}c).
- Wash off the stain with clean water.
- Cover the smear with 3% v/v acid-alcohol for 2-5 minutes.
- Wash with clean water.
- Cover the stain with Malachite green stain for 1-2 minutes with Methylene blue
- Wash off stain with clean water.
- Wipe the back of the slide clean, and place it in a draining rack for air dry.

- Examine the smear microscopically, using the 100x oil immersion objective lens

AFB seen as red, straight or slightly curved rods, occurring singly or in small groups with back ground appearing as green for Malachite stain or blue for Methylene blue stain (Tankeshwar A. 2013).

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). However it is less applicable in low resource countries (WHO,1998).

The diagnosis of extrapulmonary TB is based on fine needle aspiration cytology or biochemical analysis of the cerebrospinal, pleural, ascetic fluid or histopathological examination or strong clinical evidence consistent with active EPTB. EPTB occurs more commonly in immunosuppressed persons and young children. In those with HIV, it occurs in more than 50% of cases(FMOH,2008).

Direct microscopy of sputum-smear using the Ziehl-Neelsen (ZN) method is the only means to diagnose PTB in Ethiopia. Two diagnostic algorithms(sputum microscopy and chest x-ray)developedbytheNational Tuberculosis and Leprosy control program (NTLC) are used to detect PTB and lymph node TB. Other diagnostic services such as *Mycobacterial* cultures and pathological services are not available for routine purposes and as a result the NTLC advocates adherence to the two diagnostic algorithms. The diagnosis of smear-negative PTB primarily relies on patients' clinical conditions, response to broad spectrum antibiotics and chest radiographic evidences (Mengiste*etal.,*2005). Similarly, the report of USAID(2008),documented that the limited diagnostic capacity for TB in the country remains a challenge to improving case detection rates.

Under DOTS strategy case detection rate (CDR) was one of the global target planed to detect diagnostically 70% of new smear positive cases of pulmonary TB by the year 2000, but it still serve as a reference point at 2015.The target was first set in 1991 by 44th World Health Assembly(Stop TB Partnership,2010).

CDR is the number of new and relapse TB cases that were notified divided by the estimated number of incident cases of TB in that year. The CDR is expressed as a percentage and gives an approximate indication of the proportion of all incident TB cases that are actually diagnosed, reported to NTP started on treatment. CDR was originally used for smear positive pulmonary TB cases.

According to the global TB report of 2014 the global trend of estimates of CDR for new and relapse cases from 1995 -2013 showed an improvements in that in 1995 CDR was (39%), in 2000 (40%), in 2005(54%),2010(63%) and 2013 (64%). This shows presence of improvement in diagnosis capacity of laboratory facilities(Global TB report,2014).

In Ethiopia the trend of CDR showed in 1995(11 %), 2000(33%), 2005(48%), and in2013(62%). The trend indicates increase in case detection capacity but still lower to global target and achievements comparatively. In 2013 the six WHO regions CDR was; West Pacific region 83% with highest achievement, Europe 80%, America 77%, South east Asia 62%, Eastern Mediterranean 58% and Africa region 52% with least achievement (Global TB report,2014).

According to Ethiopia MDG report of 2012, regionally disaggregated data shows that the highest case detection rate are in urban areas with 95% in Harar,81%in Dire Dawa and 63% in Addis Ababa .The lowest case detection rate observed in rural areas with 19% in Somale region , 23% Amhara region and 25% in Tigray region (Ethiopia MDGs report, 2012).

More improvement in laboratory facilities ,like availability of Light emitting diode(LED) fluorescent microscope at the most peripheral level of the health care system, availability of reagents and following diagnostic algorithm can increase CDR capacity of health care facilities.

2.1. 6Treatment and Management of Tuberculosis

The significance of TB diagnosis is high if and only if it is complemented by prompt treatment. If not treated in the earliest five years,50% of PTB cases die,25% self cure and 25% remain sick and infectious. Un treated smear-positive PTB patient can infect 10-15 people per year on average(Friede*netal.,*2003).Thus, treatment of TB is not only a matter of treating the individual patient, but also is an important public health intervention. Treatment is the center

piece of TB control and can reduce the risk of infection if implemented with adequate coverage and acceptable quality (Styblo,1982; Styblo,1989)

The treatment of TB is targeting four objectives:–

- Preventing death from active TB or its late effects;
- Preventing TB relapse or recurrent disease;
- preventing the development of drug resistance and
- decreasing TB transmission to others.

The drugs that are used for first line treatment of TB are safe and effective if properly used. In Ethiopia, these include rifampicin(R), isoniazid(H), ethambutol(E), pyrazinamide(Z) and streptomycin(S). The administration of chemotherapy has two phases. First, the intensive (initial) phase that consists of 3 or more drugs(rifampicin, ethambutol, isoniazid, and pyrazinamide)for the first 8weeks for new cases and 12 weeks for re-treatment cases. In this phase, drugs must be collected daily and swallowed under direct observation of a health worker.

Secondly, the continuation phase has at least 2drugs (Rifampicine, and isoniazid) that will be taken for 4-6months. In this phase, drugs must be collected every month and self-administered by the patient, except for some conditions(WHO,2004;WHO,2008). But currently drugs are collected weekly even in some health facilities daily as that of the intensive phase . this is used to increase treatment success rate. Thestrategy ofTBtreatmentis called Directly Observed Therapy-Short course (DOTS). It was adopted for the control of TB and formulated global targets for the year 2000,namely to detect70% of infectious new case smear positive PTB and to cure 85% of the detected infectious cases at the World Health assembly in1991.

WHO and the International Union Against TB and Lung Disease(IUATLD) have adopted Directly observed therapy short course(DOTS) as the main strategy for TB control .DOTS consists of political and administrative commitment; case detection by sputum microscopy; standardized short-course chemotherapy given under direct observation by a health professional; adequate supply of good-quality drugs; systematic monitoring; and accountability for every patient diagnosed (Frieden&Munsiff,2005). DOTS programs concur to decrease mortality rates, which are often drastically lower than in non-DOTS programs.

According to WHO data and details given by(FriedenandMunsiff;2005) DOTS has saved more than1million lives in the last10 years and could save millions of lives over the next10years. Nevertheless, there are a number of obstacles to DOTS expansion, four of which were identified to be of over riding importance by WHO: shortages of trained staff, lack of political commitment, weak laboratory services, and inadequate management of MDR-TB and TB in people infected with HIV.

A recent global report revealed cumulative lives saved by TB prevention, diagnosis and treatment interventions through DOTS strategy between 2000 and 2013 was 37 million lives. Out of these 30 million were HIV negative TB patients and 7 million were HIV positive TB patients or TB/HIV co-infected. Regionally lives saved were South east Asia 12 million (highest),Africa 9 million, West Pacific region 8.9 million, East Mediterranean 2.6million,Europe 2.2 million and America region 1.6 million (Global TB report, 2014). This is truly one of the great public health success stories of the past decade. In Ethiopia DOTS coverage is estimated at 100% geographically and 95% at health facility level (FMOH,2011).

Global trends in treatment success rate (TSR) for all new cases of TB since 1995 to 2012 was; in 1995(57%), in 2000(69%), in 2005(84%) and in 2010 and on wards(86%) . The trend of TSR in Ethiopia showed in 1995(61%), 2000(80%), 2005(78%), 2010(77%), 2011(89%) and 91% in 2012 (Global TB report,2014). In 2012 the global TSR was 86% while during the same period WHO Regional TSR among the six regions were Western Pacific 92% (the highest TSR), South East Asia 88%, Eastern Mediterranean 87%, Africa 81%, America 76% and European region 75% with least achievement.

A ten year retrospective assessment carried out on 'Trends of TB Case Notification and Treatment Outcome in the Sidama Zone (2003-2012)' showed a treatment success rate of 89%(Dangisso, *et al* 2014). Other research in Dabat district, North West Ethiopia showed treatment success rate(TSR) of 87.8%(Sebsibe & Takele,2014). A high performance was recorded in Afar 92% and Gambella 89 Ethiopia MDG report, 2012).

2.1.7 Riskfactorsof acquiringTuberculosis

Age

The risk of acquiring TB infection increases with age from infancy to early adult life, probably, because of increasing number and frequency of contacts (Sutherlandand Fayers,1975). TB is mainly a disease of adults in the age group of 15-64years

In addition prevalence of TB in children is low due to that use of vaccine Bacille- Calmette-Guerin (BCG) decreases the risk of getting the infection by 20% and the risk of infection turning in to disease by nearly 60%. BCG is the most widely used vaccine worldwide, with more than 90% of all children being vaccinated. However the immunity it induces decreases after about ten years (Cole & Cook,1998).

In Asia there is a progressive increase in the prevalence of TB with age. As transmission declines, levels of infection in younger age groups fall and the burden of disease shifts to older age groups . This is reinforced by the demographic transition in these countries, which is associated with a general ageing of the population The age distribution of TB cases in Africa is more mixed ,with some countries like Gambia and Rwanda having a pattern similar o that observed in Asia and other countries like Ethiopia and Nigeria having a peak prevalence in younger age groups (Sandgren*etal.,*2011)

With poor epidemic control and ongoing transmission, children might carry10–20% of the total disease burden; an estimated 500000 children develop tuberculosis yearly, resulting in around70,000 deaths(WHO,2011). In Europe and the USA where tuberculosis transmission is well controlled less than 5% of reported cases occur in children (Menzies*etal,* 2010) but prevalence is highly variable, depending on immigrant status and country of origin. Global TB report of 2014 also showed in 2013, most notified TB cases were adults. Children aged less than 15 years accounted for only 6% of notified cases

Gender

Reports show that men account for high proportion of notified TB cases than women (OttmaniandUplekar, 2008). Worldwide tuberculosis notification data for 2012 show a male-to-female ratio of 1.9:1 and that of the 22 high-burden countries for which data are available, the median male-to-female ratiowas 1.8:1(WHO report,2013). According to Global TB report

notifications of new and relapse TB cases by sex in 2013 showed a global proportion of male to female ratio1.6:1. The six WHO regions male to female ratio was Africa 1.4:1, America 1.7:1, Europe 2.0:1,South East Asia 1.5:1,West Pacific region 2.2:1, East Mediterranean region1:1.In Ethiopia as national level the ratio was 1.2:1(Global TB report,2014).

In Ethiopia the first population –based National tuberculosis prevalence survey2010-2011 showed the male to female ratio as 1.2:1(Amha, *et al*. ,2014) . A research carried out on 'Trends of Case Notification and Treatment Outcome in the Sidama Zone on Retrospective analysis of 10years (2003-2012)' showed that out of 37,070 total TB cases registered 20,193(54.5%) were male and 16,867 (45.5%) were females i.e in a ratio of 1.2:1 respectively (Dangisso *et al*, 2014). Other research done at Yirga Cheffe Health Center on pulmonary TB prevalence of 6 year (2008-2013) retrospective study showed, out of 1190 total TB cases 676(56.6%)were male while 514(43.19%) were females with 1.3:1 ratio respectively(Fekadu, 2015). Similar research in Gambella region also showed out of a total 2303 TB patients registered at Gambella regional hospital within five years (2006- 2010) , 1255 (54.5%) were males and 1048 (45.5%) were females i.e with a ratio of 1.2:1 (Demeke&Legesse, 2013)

Two major hypothesis have been put forward to explain sex bias in tuberculosis, the behavioral and the physiological (Abad- Franch,Guerra, 2013). The behavioral hypothesis relates primarily to sex-specific exposure to infection, while the
physiological hypothesis to biological differences between the sexes that render one more susceptible to the disease.

In behavioral hypothesis gender can affect *M. tuberculosis* exposure because of differences in social roles, risk behaviors (like smoking, alcohol consumption, drug addiction), and activities. Males may travel more frequently; have more social contacts; spend more time in settings that may be conducive to transmission, such as bars; and engage in professions associated with a higher risk for tuberculosis, such as mining (Wood et al,2013)

Physiological hypothesis emphasize on hormonal differences in that males testosterone is

thought to down regulate the T-helper immune response, where as estrogen in females is believed to enhance it .It is also known that estradiol enhance macrophage activation in females while testosterone down regulate it (Neyrolles& Quintana ,2009).Due to such cases gender inequalities in prevalence of TB has occurred, however it needs basic research for more detail explanations

Residence

More TB patients were reported from urban than rural areas because of overcrowding, poverty and HIV infection. In contrast, the presumed lower risk of TB infection in rural settings could be misleading and should be cautiously taken in high burden countries.In the rural settings, access to the health service is limited; health seeking behavior is poor and the living condition favors disease transmission. As a result, understanding the burden of TB in rural areas will have a wider implication for TB control in such settings (Sudha*etal.,*2003;Cambanis*etal.,*2005)

Socio-economicconditions

TB has been associated with factors linked to socioeconomic deprivation: poverty, over crowding and malnutrition. The magnitude of TB is high among the poor, displaced, homeless, drug addicts and malnourished (Cambanis*etal.,*2005).The association between TB and poverty was shown by the decline in TB burden with the improved living condition in developed countries prior to the introduction of treatment. Improved living condition was also found to reduce the risk of infection from 4-6%per annum.

In contrast, the resurgence of TB in developing countries as the living condition worsens shows its association with poor living conditions. TB was also found to disproportionately affect the poor(GrimesandSchulz,2002;).Therefore, free diagnosis and treatment was offered to TB patients to reduce the economic burden for seeking diagnosis and treatment and treat the highly infectious cases. However, limited access to the service because of the poor socioeconomic condition of the patients and their house holds has reduced the utilization of the available service(Muniyandi*etal,.*2006). Thus, interventions that improve access to health service need serious consideration.

2. 2 TuberculosisandHIVco-infection

In2006,a new comprehensive TB control strategy, the Stop TB Strategy, was developed and endorsed by the international TB control community. The Stop TB Strategy expands and enhances the basic components of DOTS and includes TB control strategies to address TB/HIV, multidrug-resistant TB and other challenged populations like prisoners. At the same time, the International Standards for TB Care were developed and describes a widely accepted level of care that all practitioners should follow for persons suspected of or having TB especially for those co-infected with HIV. A complex interaction exists between TB and HIV infection. HIV increases the risk of infection, as it reactivates LTBI and increases the progression to active disease(Shargae,2006). The human immunodeficiency virus (HIV) pandemic presents a significant challenge to global tuberculosis control. TB-HIVco-infection has fatal consequences as TB becomes the leading cause of death in HIV infected individuals and patients with acquired immunodeficiency syndrome (AIDS). HIV lowers the host's immune response to MTB.

The life time risk of developing active TB in HIV infected individuals is10% per year compared with life time risk of 5-10% in individuals with out HIV. As a result, the TB case notification rate (CNR)has increased four to six fold in Sub-Saharan Africa(Kassu*etal.,*2007). HIV affected the performance of TB control programs by increasing the number of TB cases and by compromising the treatment out comes. It created a huge challenge to the already overstretched and under staffed health system in high burden countries. It reduced the proportion of smear-positive cases; and increased the rate of treatment failure, defaulter and death, which in turn compromised the progress towards achieving the targets recommended for TB control under DOTS strategy(Datiko,2011).

There has been a strong link between TB and HIV, as they are capable of disarming the host*'s* immune responses. TB is the most common opportunistic disease which kills those infected with HIV (Modjarrad et al, 2010). Similarly, HIV co-infection which increases the risk of latent TB reactivation 20-fold, is the most known risk factor for progression of *M. tuberculosis* infection to active disease (Getahun*et al*. 2010, Ernst 2011).Therefore, TB-HIVcollaboration

is an appropriate intervention to improve TB case finding in HIV infected individuals and reduce the risk of HIV infection in TB patients(WHO2004; MaherD*etal.,*2005).

According to Deribew *et al.,(*2009),study in Oromia region;out of the 620 patients asked to participate in the study 591(95%) accepted, of whom124(21%)were TB/HIV co-infected. Of the co-infected patients, 42(33.8%) smear positive,61(49.2%)were smear negative, and 21(17%)extra-pulmonary TB patients. According to their study, income, depression and lack of family support were predictors of poor quality of life among TB/HIV co-infected patients. Participants with out adequate income and family support might have a poor nutritional and immune status which in turn could affect the quality of life(Deribew*etal.,*2009). In western Kenya district, HIV prevalence among the TB patients was 50%, where the notification rate increased and in other district HIV prevalence among TB was 29-27% (Odhiambo*etal.,*1999). HIVinfectioncontributedtotheincreaseoftuberculosisinthedeveloping countries. Studies in Sub-Saharan Africa showed that, 31% of adult TB cases were attributed to HIV infection(Corbett*etal.,*2006).

According to the Global Plan to Stop TB 2011-2015 the target set for TB patients with known HIV statusby 2015was to screen 100% of TB patients for HIV globally. Based on this an assessment carried for 2013 showed the global achievement for HIV screening among TB patients was 48% and the six WHO regions achievement in the same period was Africa region 76%, Americas 69%, Europe 59%, Southeast Asia 43%, Western Pacific 35%and Eastern Mediterranean11%. Nationally the achievement was among high burden countries(HBCs) like Kenya 94%, Zimbabwe 92%, Uganda 91%, Nigeria 88%, Ethiopia 71%(WHO, Global TB report 2014). A recent report showed in 2013, among all TB cases tested for HIV globally 18% were co-infected.(Global TB report,2014). Among the six WHO regions, TB/HIV co-infection prevalence in 2013 was ; Africa region 41%, America 14%, Europe 8%, Southeast Asia 6.1%,West Pacific 2.7% and East Mediterranean region 2.4%, showing higher prevalence TB/HI co-infection in Africa.

The proportion of TB cases co-infected with HIV was highest in countries of African region accounted for 78% of TB cases among people living with HIV worldwide .High burden TB/HIV co-infected African countries were like Zimbabwe 69%, South Africa 62%, Mozambique 56%, Kenya 38% and Ethiopia has decreased TB /HIV co-infection prevalence to 11% (Global TB report,2014) .

A research carried on TB/HIV co-infection among TB patients in Dabat ,North West Ethiopia showed , out of 1086 TB patients on the medical records of the two health facilities in the district from 2009 to2012, HIV status was determined on 849(78.2%) patients. Among these the prevalence of HIV co-infectionwas 97(11.4%). The majority 90(92.8%) belonged to socio-economically productive age group(Sebsibe andTakele ,2013). Other research carried out in Dire Dawa showed TB/HIV co-infection prevalence of 24.8%(Gashaw, 2013).

2.3Global Burden of Tuberculosis

TB is still a priority in the global public health agenda, despite efforts and interventions that lasts several decades. It is the second most common cause of death due to an infectious disease. Current trends suggest that TB will remain among the top leading causes of global disease burden over the next decades (MurrayandSalomon,1998). It was estimated that 9.2 million new cases of TB (139per100,000population),including 4.1 million (62per100,000population) new smear-positive cases occurred globally during 2006. About 95% the new cases and 98% deaths due to TB occur annually in the developing world. Asia and Africa account for 55% and 32% of cases globally, respectively(Raviglione,2008;).

The burden of TB is predominately accounted by men; reported as the disease of men. For instance, countries (2004) reported 1.4 million smear-positive cases in men, but only 775,000 in women. This epidemiological difference is suggested to be due to gender differences in behavior and physiology that contributes differences in exposure to infection and susceptibility to develop an active disease. For many years, TB cases occurred predominantly among young adults, where approximately 6-8million cases in the economically most productive age groups (15-49yearsold). However, in Western Europe and North America countries, which have low incidence rate, TB cases tend to be in the old indigenous population, where as patients who are immigrants from high-incidence countries tend to be young adults(Dye,2006).

In the 20th century, morbidity and mortality due to TB steadily dropped in the developed world. This was aided by better public health measures, improving living standards and

widespread use of BCG vaccine as well as the development of antibiotics in the1950s. This down ward trend ended and the number of new cases started to increase in the mid 1980s. The major causes were risk of reactivation of latent TB by increased life expectancy, poor compliance with anti-TB treatment, and increased risk of exposure through HIV, urbanization, migration and destitution.

But, using massive expenditure of funds and human resources, the epidemic has been well controlled and reversed in Western Europe and United States. In most Western Europe and North America countries, TB is often attributable to immigrants from high-incidence countries; they remain at increased risk of active TB(Bjune,2009).For instance, a study in Norway showed that immigrant had 7 up to 90 times higher than the crude incidence of TB in the country(Farah*etal.,*2005).

The global increase in TB burden has sizeable contribution from Eastern Europe countries(mainly the former Soviet Union) since1990 and South East Asia since mid1980s.The resurgence of TB in the Eastern Europe countries is due to dramatically worsened living conditions, poor nutrition, and economic decline during breakdown of the former Soviet Union, substandard TB treatment, inadequate TB control program, emergence of MDR-TB, and increased prison population. The epidemic in this region is also strongly linked to the emerging of successful strains that are highly virulent and drug resistant, and has higher degree of transmission(Toungoussova*etal.,*2006).

In Africa, the increasing of TB morbidity and mortality was caused by multiple factors; such as wide spread poverty, poor political commitment to TB control, inadequate donor support and the HIV epidemic. Predominantly, HIV epidemic has made a momentous contribution since1980s(Fatkenheuere*tal.,*1999). The rate of TB among HIV patients is documented ranging from 20-44%. TB is known as the primary cause for death among HIV infected patients. So, HIV infection has profoundly lead on the epidemiology of TB(Fatkenheuer*etal*.,1999).

Evidences tend to demonstrate that TB prevalence and TB death rates are globally decreasing after having reached a peak. Since 2005,the TB incidence rate is in decline in all six WHO regions. Between 2000 and 2013,the average rate of decline per year was 1.5%.This down

ward trend needs to be sustained to ensure that the MDG target is met in 2015. The fastest decline in incidence rate was in European region4.5% per year and slowest in Eastern Mediterranean region with less than 1% per year.

Global TB report of 2014 also revealed that prevalence rates are declining in all six WHO regions. The region of America halved the 1990 level of TB prevalence by around 2005,well in advance of the target year of 2015. The Western Pacific region achieved the 50%reduction target in 2012. Reaching the 50% reduction target by2015appears feasible in the South East Asia region. The target appears out of reach in Africa, Europe and Eastern Mediterranean region.

In 2013, the prevalence of TB globally was 159 per 100000 population. The prevalence among the six WHO regions were; African region 300, South East Asia 244, East Mediterranean 165, West Pacific region 121, Europe 51 and America 38 per 100000 population. This shows that the burden of TB is still very high in Africa region. Theprevalence in Ethiopia during the same period was 211 per 100000 populations. Compared to global prevalence (159/100000) that of Ethiopia is high. Even if the prevalence is still high global target of 50% reduction in prevalence rate by 2015 compared with 1990(425/100000) was met in Ethiopia just before the dead line (Global TB report ,2014).

2.4 Tuberculosis Epidemiology in Ethiopia

Tuberculosis remains a major public health problem claiming the lives of thousands of Ethiopians every year. Ethiopia is among the 22 high TB burden , 27 high MDR- TB burden and 41high TB/HIV co-infected countries. The estimates of TB prevalence rate in Ethiopia had increased during the first 4-5 years since 1990 from 425 per 100000 population per year and reached 482 per 100000 population per year in 1994. Since 1995 onwards however , the estimates for TB prevalence rate have shown a steady decline at an average rate of 4% per year, with an increased rate of decline for the last 5 years (5.5% per year) and reached a level of 237 per 100000 population in 2011(FMOH,2014). By 2013,the prevalence decreased to 211per 100000 population (Global TB report,2014)

Similarly , the estimates for TB incidence rate had also increased from 367per 100000 population in 1990 to a peak value of 431 per 100000 population in 1997 and has been

declining at an average rate of 3.9% per year since 1998. The incidence estimates for all forms of TB in 2011 was 258 per 100000 population (FMOH,2014) and by 2013 the incidence was 224 per 100000 (Global TB report,2014). Hence the prevalence of TB from which 425 per 100000 in 1990 decreased to 211 per 100000 by 2013 showing a 50% reduction before the dead line 2015. The incidence also decreased from 367 per 100000in 1990 to 224 per 100000 in 2013 in which Ethiopia has met the global target in both prevalence and incidence reduction before 2015.

The declining trends in prevalence and incidence rates follow the adoption of the Stop TB strategy in 2006/7 by the National TB Control Program (NTP). During the same period , there has been massive expansion of DOTS centers in the country with 100% geographical coverage and 95% health facility coverage (FMOH,2014).TB mortality rate has also been declining steadily since 1990 and reached a level of 18 per 100000 deaths in2011 showing the country's achievement of 2015 target for reducing TB related mortality rate.

However, further examination of the available data suggests wide variations in the local TB epidemiology.HIV pandemic presents a massive challenge to the control of TB and deriving the TB epidemics. Ethiopia is one of the 41 global high TB/HIV burden countries(Global TB report,2012). Close to 11% of all TB patients were co-infected with HIV in 2013 (FMOH report 2013). The prevalence of HIV among children with TB is generally similar to that of adults. Findings from TB surveillance showed that TB/HIV co-infection rate is highest in Gambella, Addis Ababa and Dire Dawa which is in line with the regional variation in the prevalence of HIV (FMOH report 2013).

Ethiopia is providing a TB/HIV collaborative services which has been available since 2004 . The services include HIV testing for all patients with presumptive and diagnosed TB patients, Providing Antiretroviral therapy(ART) and Co-trimoxazole preventive therapy for HIV positive TB patents. According to the standard definitions of the Ethiopian National Tuberculosis and Leprosy control Program (NTLCP) guideline (FMOH,2008),the type of TB was defined as:

- **smear-positivepulmonary TB** -apatientwithatleasttwosputumspecimenswhichare positiveforacid-fastbacilli(AFB)bymicroscopy, orapatientwithonlyonesputum specimenandpositive forAFBbymicroscopy,andchestradiographic abnormalities consistent withactivepulmonaryTB

- **smear-negativepulmonaryTB-** a patient with symptoms suggestive of TB, with at least two sputum specimens which are negative for AFB by microscopy ,and with chest radiographic abnormalities consistent with active pulmonary TB(including interstitial or military abnormal images),or a patient with two sets of a tleast two sputum specimens taken at least two weeks apart, and which are negative for AFB by microscopy, and radiographic abnormalities consistent with pulmonary TB and lack of clinical response to one week of broad spectrum antibiotic therapy and
- **ExtrapulmonaryTB(ETB)-**this included tuberculosis of organs other than the lungs;such as lymph nodes, abdomen, genitourinarytract, skin, joints, bones, and meninges.

In Ethiopia many studies show that there are more proportion of smear negative pulmonary TB than smear positive pulmonary TB. According to 2005/06 health institutions report in Southern Ethiopia, out of a total 120,163 TB patients (97.7%) were new cases;of which,36,674(31%) were smear-positive cases.The seven year trend of TB case notification record indicated that proportional increment of extrapulmonary TB(EPTB) and smear-negative PTB, while there is a down ward trend for smear positive PTB. A report on prevalence of smear positive pulmonary tuberculosis among all TB forms in Agaro Teaching health centre, was found to be 10.9%, which indicates that the disease is of major clinical significance in the study area(Huussien et al,2012).

Other longitudinal study carried out in Addis Ababa, summarized socio-demographic and medical information of 6,450 registered TB patients. Among the total,25.6% were smear positives, 33.9% were smear negatives and 40.5% were extrapulmonary TB patients. Majority of the study participants(88.9%) were new cases(Getahun*etal.,*2011).

The increasesin smear-negativePTB diagnosisinEthiopiacouldbeattributedtoseveralfactors:

- nonadherence todiagnostic algorithm,
- poor qualityofsputum-microscopyand
- HIV-TBco-infection.

Non-adherence to the national diagnostic algorithm is a common problem in hospitals; contributing to the over-diagnosis of smear-negative PTB in the study areas(Mengiste*etal.,*2005).

Poor quality (under-reading) and examination of a suboptimal number of sputum-smears

could partly be contributing to the high diagnosis of smear negative PTB diagnosis (Hawken,*etal.,*2001).A positive acid fast bacilli(AFB) smear requires about 5,000-10,000 AFB present per milliliter of sputum and the AFB are released intermittently from the lungs. This gives AFB smear a sensitivity of only 50-60%(Siddiqi*etal.,*2003).Smear-negative PTB could also be a result of inadequate sputum collection, storage and staining, human error etc(Harries*etal.,*1998).

Such conditions resulted in low case detection capacity of the country for a long time. However recent studies show an increment in detection of smear positive pulmonary TB. AccordingtoDatico(2011),inSouthernpartofEthiopia,136572caseswereregistered intenyears;ofthese,47%weresmear-positive,25%weresmear-negativeand28%had ETB. The smear positive case notification rate increased from 45 to 143 per 10,000populations.Similarly,the CDR increased overtime. Estimates of case detection rate (CDR) in Ethiopia for new and relapse TB cases from 1995 to 2013 showed an increasing trend; in 1995 (11%), 2000(33%), 2005(48%)and 2013(62%).

2.5 Operational Terms Definition

Case detection rate(CDR)- is the number of new and relapse TB cases that were notified, divided by the estimated number of incident cases of TB in that year. In context of this research it concerned to smear positive pulmonary TB

DOTS(Directly ObservedTherapy-Shortcourse):is the main strategy for TB control Which is adopted by WHO and the International Union Against TB and Lung Disease (IUATLD).

It is a patient centered health system which provides support by observing patients on the process of taking their treatment, and thus ensures that they complete their treatment.

Epidemiology: is the scientific corresponds to the study of the distribution and determinants Of health related states and domain events in populations and the control of the problem.

Extrapulmonary Tuberculosis (ETB):this includes tuberculosis of organs other than the lungs, such as lymphnodes, abdomen, genitourinary tract, skin, joints, bones and meninges.

Incidence:is the occurrence of new cases of diseases per population size for a certain period Of time or the number of cases reported per100,000populations.

Prevalence: is defined as the ratio of the number of cases of a disease present in a population at a given time and the number of individuals in the population at that time.

In this study it refers to proportion of variable in question among TB patients attending the DOTS service

Pulmonary tuberculosis -is any bacteriological confirmed or clinically diagnosed case of TB involving the lung parenchyma or the tracheo-bronchial tree.

SmearNegativePulmonaryTuberculosis:a patient with sputum suggestive of TB, with at least two sputum specimens which are negative for AFB by microscopy, and with chest radiographic abnormalities consistent with active PTB and lack of clinical response to one week of broad spectrum antibiotic therapy.

SmearPositive PulmonaryTuberculosis:a patient with at least two sputum specimens Which are positive for acid fast bacilli(AFB) by microscopy, or a patient with one

sputum specimen positive for AFB by microscopy, and chest radiographic abnormalities consistent with active pulmonary TB.

Treatment outcome variables:

- **Cured**- a pulmonary TB patient with bacteriological confirmed TB at the beginning of treatment who and became smear negative in the last months of treatment.
- **Completed treatment**- a TB patient who completed treatment with out evidence of failure but with no record to show that sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either between tests were not done.
- **Died** – a TB patient who died from any cause during treatment
- **Failed**- a TB patient whose sputum smear or culture is positive at month five or later during treatment.
- **Loss to follow up** – a TB patient who did not start treatment or whose treatment was interrupted for two consecutive months or more.
- **Successfully treated**- a TB patient who was cured or who completed treatment

-provides treatment success rate.

3. RESEARCH MATERIALS AND METHODS

3.1Descriptionof theStudyarea

The study was conducted in Nekemte town, capital of East Wollega in Oromia Regional State, West Ethiopia. It is located at $9^0$5'N and $36^0$33'E with altitude of 2088m above sea level with Dega climatic classification. The town is 312 km from Addis Ababa to the west. It has a population size projected for 2014 as 105,358 with male 53,332(50.6%) and female 52,026(49.4%). The town has one governmental Referral Hospital, two Health Centers and a number of Private Clinics. The government health care facilities have TB centers that provide DOTS service to TB control program.

3.2Designof theStudy

The study involved a retrospective cross-sectional survey design using document analysis from TB Registry Unitof the TB Center at the three government health care facilities (Nekemte Referral Hospital, Nekemte Health Center and Cheleleki Health Center) inNekemte town from2010/11-2014/15.

3.3 Sampling technique

The selection of the three health care facilities was done by using purposive sampling technique. These three health facilities were selected due to that majority of TB treatment (DOTS service) takes place in government health care facilities that made high inflow of TB Patients to the center.The samples of the study were all TB patients recorded on the Registry Unit of the health care facilities from 2010/11-2014/15.

3.4 Data Quality Assurance

Pretest was conducted to check the feasibility of the methodology and availability of the needed data and necessary modification was made accordingly.

3.5 Data Collection Procedure

Data were collected from the three government health care facilities providing DOTS service.

The health care facilities TB Center has TB RegistryUnit on which TB patient information was recorded. The variables on the record were names of TB patient, age ,sex, address, forms of TB (smear positive PTB, smear negative PTB & Extra PTB),TB category (new cases , retreatment cases), HIV status , treatment date started and completed, treatment outcome (cured, complete treatment, died, loss to follow up, transferred out). The data were collected From February 1, 2016 to April 30, 2016.

3.6Data Processing andAnalysis

The data from all TB patients of the five years (2010/11 to 2014/15) was checked for completeness, accuracy and clarity. Then theprevalenceof tuberculosis was determined by sex, age,andco-infectionwithHIVwasdeterminedasaproportion of the number of individualswith variable of interesttothetotalnumberof TB patient. Additionally case detection rates and treatment outcomes were processed and analyzed using descriptive statisticsin percentages and ratios and the data was presented in tables and graphs.

4. RESULT AND DISCUSSION

4.1 Prevalence of Tuberculosis amongst the sex attending DOTS service

The study on the prevalence of TB from secondary data from the year (2010/11 to 2014/15) showed that a total of 1246 TB cases were registered on the TB Registry Unit, and attended their DOTS service. From these TB cases 644(51.7%) were male and 602 (48.3%) were females.Generally from the total TB cases 21.3% were smear positive,33.5% smear negative and 45.2% were EPTB. Among the males 144(22.4%) were smear positive PTB and 244(37.8%) were smear negative PTB, while 256(39.3%) were Extra Pulmonary TB cases. Likewise, among females 122 (20.2%) smear positive PTB and 174(28.9%)were smear negative PTB. while 306(50.8%) were Extra Pulmonary TB. The re-treatment cases among the total TB cases were only 1.9%, showing most of the TB patients were new cases, hence more spread of the disease in the population.

Table1. Prevalence of TB cases by sex in Nekemte Referral Hospital , Nekemte Health Center & Cheleleki Health Center (2010/11 -2014/15)

Characteristics (sex)	**Total TB cases**	Pulmonary TB cases		Extra Pulmonary TB cases
		Smear positive PTB	Smear negative PTB	
	N(%)	N (%)	N (%)	N(%)
Male	**644(51.7%)**	144(22.4%)	244(37.9%)	256(39.7%)
Female	**602(48.3%)**	122(20.2%)	174(28.9%)	306(50.8%)
Total	**1246(100%)**	**266(21.3%)**	**418(33.5%)**	**562(45.2%)**

In this study the proportion of male to female ratio of TB case was 1.1: 1 which was slightly different from other studies in some parts of the country (Sidama Zone, and Gambella region). Accordingly, a research carried out on 'Trends of Case Notification and Treatment Outcome in

the Sidama Zone on Retrospective analysis of 10years (2003-2012)' showed that, out of 37,070 total TB cases registered (54.5%) were male and (45.5%) were females in a ratio of 1.2:1 respectively (Dangisso et al, 2014). Similar research in Gambella region also showed out of a total 2,303 TB patients registered at Gambella regional hospital within five years (2006-2010) , (54.5%) were males and (45.5%) were females with a ratio of 1.2:1 (Demeke&Legesse, 2013).Other Retrospective study done at YirgaCheffe Health Center on pulmonary TB prevalence for 6 years (2008-2013) showed, out of 1190 total TB cases (56.6%) were male while (43.2%) were females with 1.3:1 ratio respectively(Fekadu,2015).In all cases, the data showed that male were more vulnerable to TB than females**.**

In Ethiopia the first population –based national tuberculosis prevalence survey in 2010-2011 year showed the male to female ratio of 1.2:1(Amha, et al. ,2014). A similar ratio was also reported fromGlobal TB report of 2014.

Table 2 summarizes the comparison with regard to TB cases between male and females nationally, regionally (Africa) and globally . The data showed that most of hitherto studies in the country, with the exception of the retrospective study at YirgaCheffe showed male to female ratio within the slightly higher category of the Global TB report of 1:1 -2.2:1 (Global TB report,2014).

Table 2 :Trends of Male : Female ratio in TB cases from local , regional and global studies

Study area	**Study period**	**Ratio (M:F)**	**References**
Nekemte	2010/11-2014/15	1.1 : 1	This study
Ethiopia	2013	1.2 : 1	Global TB report,2014
-Sidama Zone	2003-2012	1.2 : 1	Dangisso et al.,2012
-YirgaCheffee	2008- 2013	1..3 : 1	Fekadu.2015
-Gamballa	2006-2010	1.2 : 1	Demeke& Legesse,2013
Africa	2013	1.4 : 1	Global TB report, 2014
Global	2013	1.6 : 1	Global TB report, 2014

Hence, the present study showed more prevalence of TB cases in males than females (1.1 :1) that is in accordance with the national (1.2:1) and many other local areas of the country, even if lower variation in comparison with Africa (1.4:1) and global (1.6:1)(Global TB report,2014).

Two major, hypothesis have been put forward to explain sex bias in tuberculosis, the behavioral and the physiological (Abad- Franch,Guerra,2013).The behavioral hypothesis relates primarily to sex-specific exposure to infection, while the physiological hypothesis to biological differences between the sexes, that render one more susceptible to the disease.
In behavioral hypothesis sex can affect *M. tuberculosis* exposure because of differences in social roles, risk behaviors (like smoking, alcohol consumption, drug addiction) and certain activities. Males may travel more frequently; have more social contacts; spend more time in settings that may be conducive to transmission, such as bars.

Physiological hypothesis emphasize on hormonal differences in that males testosterone is thought to down regulate the T-helper immune response, where as estrogen in females is believed to enhance it. It is also suggested that estradiol enhance macrophage activation in females while testosterone down regulate it(Neyrolles& Quintana ,2009). Due to such cases it is assumed that sex inequalities in prevalence of TB has occurred, however it needs basic research for more detail explanations.Therefore, in general a sex based plan is needed to overcome the more burden of TB cases among males.

In the above Table 1(this study) among the total 1246 TB cases,266(21.3%) were smear positive pulmonary TB, 418(33.5%) were smear nagative PTB and 562(45.2%) were extraPTB. This shows the prevalence of TB forms is higher in smear negative and extrapulmonary compared to smear positive.
Alongitudinalstudycarried out inAddisAbaba, thatsummarizedsocio-demographic andmedical information of6 ,450registered TBpatients, show among the total,25.6% were smear positives, 33.9%weresmearnegativesand40.5%wereextrapulmonary TB patients.(Getahun*etal.,*2011). This shows a comparable prevalence of all TB forms to this study. Other research by Gashaw on prevalence of tuberculosis co-infection with HIV on DireDawa hospital showed a 26.1% smear positive, 39.7% smear negative and 34.2% EPTB(Gashaw, 2013). The result was also in

agreement with the study in Nekemte (present study). That is in all the above studies the proportion of smear positive was low. The decrease in smear positive in this study and other local areas of the country could be attributed to: non-adherance to diagnostic algorithm (Mengiste et al,2005), poor sensitivity of sputum microscopy for AFB less than 5000 in number in the sputum(Siddiqi et al.,2001), inadequate sputum collection, storage and staining and personal errors (Harries et al.,1998).

4.2 Prevalence of TB cases amongst the age groups

In this study the prevalence of tuberculosis in Nekemte town was also evaluated amongst age groups based on WHO category system; as under five (0-5 year), children (6-14year), adult or high productive age (15-64year) and old age (65 and above). Based on this category out of 1246 total TB cases 90.2% was in the age category of 15-64years followed by 4.0% infection in age groups (6-14 years) and the age of 65 and above, and with only 1.7% cases was in the age group of(0-5 years).

Table 3 : Prevalence of TB casesby age category in Nekemte government health care facilities (NRH,NHC&CHC) 2010/11 -2014/15

Age groups	Total TB cases	Pulmonary TB		Extra pulmonary TB
		Smear positive	Smear negative	
	N(%)	N(%)	N(%)	N(%)
0-5	**21(1.7%)**	0(0%)	3(0.2%)	18(1.4%)
6-14	**51(4.0%)**	5(0.4%)	11(0.8%)	35(2.8%)
15-64	**1124(90.2%)**	260(20.8%)	381(30.6%)	483(38.8%)
65+	**50(4.0%)**	1(0.08%)	23(1.8%)	26(2.0%)
Total	**1246**	**266(21.3%)**	**418(33.5%)**	**562(45.1%)**

The distribution of TB amongst the different groups in this study showed the same trend with previous studies in Ethiopia. Although age categories differed, all showed that the age group above 15 were more vulnerable to TB infections. Accordingly, the highest prevalence within

the age group of 15-64 years in this study was comparable with the highest prevalence of 94% within the age group greater than 15 years from TB patients of Dire Dawa (Gashaw, 2013) and 80% of TB patients from 'Assessment on the prevalence of pulmonary tuberculosis atYirgaCheffe health Center on registered data of DOTS program (2008-2013)' (Fikadu, 2015).

StudieshaveshownthatTBismainlythediseaseofadults (with age greater than 15 years). This is becauseofincreasingnumberandfrequencyofcontacts and more exposure to risk factors, that madetheriskofacquiring TBinfectionincreasewithagefrominfancytoadultlife(SutherlandandFayers,1975).Other study also showed,TBcasesoccurpredominantly amongyoungadults (15-49years) where approximately6-8millioncases were in the economically most productive age group(15-49 years old) (JohnsonandEllner,2000;Dye,2006).

Table 4: Summary of TB cases among different age groups

Sampling site	Age groups	Prevalence (%)	Reference
Nekemte	0-5	1.7	This study
	6-14	4.0	
	15-64	90	
	>65	4.0	
YirgaCheffe	0-14	10	Fekadu. 2015
	15-49	80	
	>50	10	
Dire Dawa	0-4	1.8	Gashaw, 2013
	5-14	4.5	
	>15	94	

In this study, the prevalence of TB cases in age group (0-5 years) was very low ,only (1.7%), this could be due to the vaccine Bacille-Calmette-Guerin (BCG) given at infant age, that decreases the risk of getting the infection by 20% and the risk of infection turning

in to disease by nearly 60% (Cole & Cook,1998). It can be also attributed to low number and frequency of contacts to the causative agent (SutherlandandFayers,1975)

In the same way, the prevalence of TB in the age group of 6-14 was 4%(this study) which was similar (4.5%) to the study from Dire Dawa (Gashaw, 2013). The trend was concurrent with the Global Report of 2014 in which among the 9.0million incident of TB cases in 2013, 550 000 (6%) were children with age less than 15 years (Global TB report,2014).

4.3 **Trends of the prevalence of TB between 2010/11-2014/15**

In this study the highest prevalence of TB was detected in 2010/11 contributing to 26% of all cases between 2010/11-2014/15, followed by the prevalence of 20.3% in 2014/15 (Table 5). In general, there was a decline in TB between 2010/2011 and 2014/15 years by 5.9%, which is 1.47% per year. A research carried out on the prevalence of TB from Dire Dawa Hospitals showed a decreasing trend in a total TB cases from 650 cases in 2008/9, to 275 in 2011/12 indicating a sharp decline by 16.4% (Gashaw, 2013)). Similarly, the 'Assessment of the prevalence of PTB patients at YirgaCheffe Health center from 2008-2013' showed a decline in the prevalence of TB from 223 cases in 2008, to 160 cases in 2013 by 5.3%

(Fekadu,2015).

Table 5: Trend in year-specific prevalence of TB cases in Nekemte government health care facilities(2010/2011-2014/15)

Year	Total TB cases		Pulmonary TB	Extra pulmonary TB
	N	%	N (%)	N (%)
2010/11	**327**	**26.2**	173(52.9%)	154 (47.1%)
2011/12	**224**	**18.0**	96 (42.9%)	128(57.1%)
2012/13	**230**	**18.4**	129 (56.o%)	101(44.0%)
2013/14	**212**	**17.0**	128 (60.4%)	84(39.6%)
2014/15	**253**	**20.3**	158 (62.5%)	95 (37.5%)
Total	**1246**	**100**	**684 (54.9%)**	**562 (45.1%)**

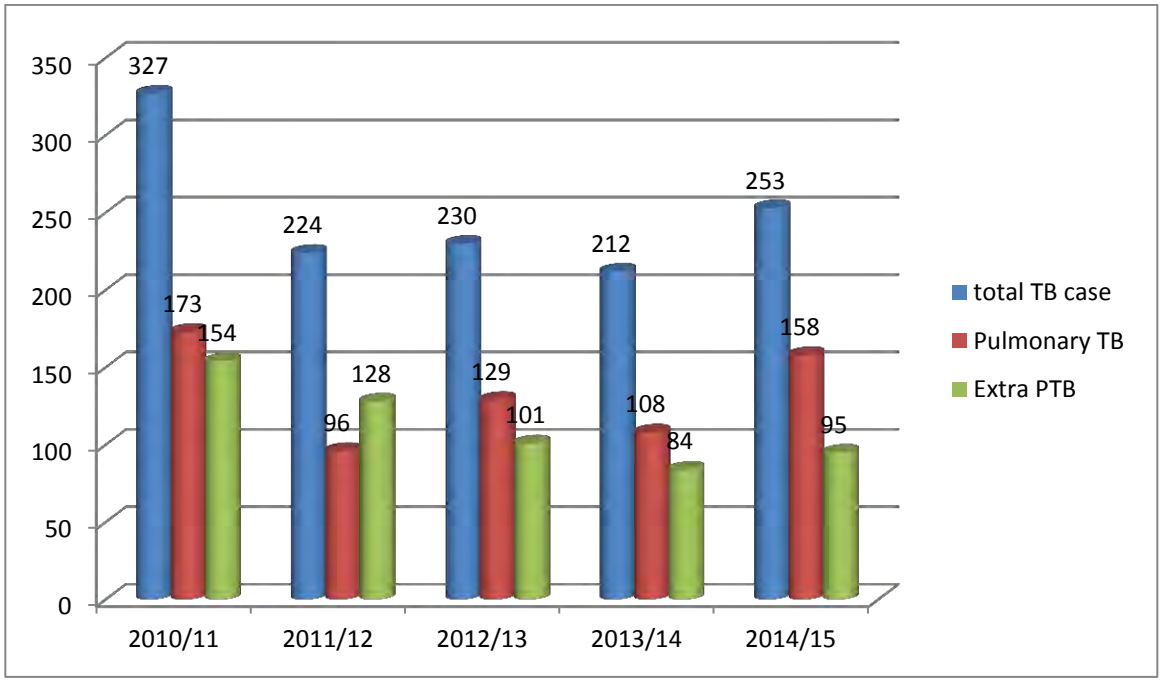

Fig 1: Trend in the prevalence of TB cases (2010/11 -2014/15) in the three government health care facilities in Nekemte town

All these studies showed a decrease in TB cases across the country with a decline of TB infection in Nekemteby(5.9%) in (5 years), inYirgaCheffe (5.3%) (5 yeras), but a high decline of 16.4% in Dire Dawa (5 years), respectively. However, in case of Nekemte (this study) even if there is an overall decreasing trend of TB prevalence 327 cases in 2010/11 and 253 cases in 2014/15 there is a fluctuation in a years in between for instance 224 cases in 2011/12 and 230 cases in 2012/13. This shows the burden of the disease is still high in the study area that is, the transmission rate is not tackled as needed.

The data also showed variations in the prevalence of pulmonary and extra pulmunary TB between the years (Table 5). Accordingly, pulmonary TB showed the highest incidence of 62.5% in the year 2014/15 and the lowest incidence of 42.9% in the year 2011/2012; whereas the highest and lowest infections of extrapulmonary TB were recorded in years 2014/2015 and 2011/2012 years with prevalence of 57.1% and 37.5%, respectively.

In both cases the difference in the prevalence of pulmonary TB and Extra-pulmonary TB

between the highest and lowest records was almost 20.6% (Table5)

However when we consider the difference in pulmonary TB prevalence between the year of the start of the study 2010/11 and the last study year 2014/15 the prevalence of pulmonary tuberculosis decreased only by 2.3% showing that PTB is declining slowly. In the same way EPTB declined by 10.5% which shows a better decrease.

In general, the data did show a certain pattern in the prevalence of total TB cases with pulmonary and extra-pulmonary TB between the years (fig 1). Consequently, the prevalence of pulmonary tuberculosis was higher than extra-pulmonary TB in all the years,except in year 2011/12 EPTB was higher by14.2%.

4.4Detection rate of smear positive PTB among all pulmonary TB cases

Attempts were made to investigate the detection rate (smear positive pulmonary TB diagnosed) among pulmonary TB cases. During the five years of 2010/11-2014/15 out of the total 684 Pulmonary TB cases, 266 (38.9%) were smear positive and 418 (61.1%) were smear negative.The year specific detection rate of smear positive cases was between 41.6% in the years 2010/2011 and 2011/12, and 35.4% in 2014/2015 showing a slight decline as function of years (Table 5).

Table 6 : prevalence of Smear positive PTB cases indicating case detection rate(CDR) (2010/11- 2014/15) in Nekemte government health care facilities

Year	Total Pulmonary TB cases	Smear positive PTB	Smear negative PTB
	N	N (%)	N(%)
2010/11	173	72(41.6%)	101(58.4%)
2011/12	96	40(41.6%)	56(58.3%)
2011/13	129	48 (37.2%)	81(62.8%)
2013/14	128	50(39.1)	78(60.9)
2014/15	158	56(35.4)	102(64.6)
Total	**684**	**266(38.9%)**	**418(61.1%)**

The Global Stop TB Partnership plan for 2011-2015 has set a 70% CDR as a reference point for its projected achievement by 2015 (Global Stop TB Partnership,2010).

According to Ethiopia MDG report of 2012, regionally disaggregated data showed that the highest case detection rate in urban areas of Harar was 95% followed by smear positive cases of 81% in Dire Dawa and 63% in Addis Ababa, respectively (Table 7). The lowest case detection rate of 19% was observed in rural areas in Somale region and smear positive cases of 23% and 25% were reported in Amhara and Tigray regions, respectively (Ethiopia MDG report 2012).

Global TB report of 2014 showed the global and African case detection rate at 2013 was 64% and 52%, respectively. The report also showed that the detection rate for African countries at national level was 62% for Ethiopia, 75% for Kenya, and 16% for Nigeria (WHO Global TB repot 2014).

Table 7: summarizes the detection rate of PTB of the different regions in the country in relation to African and global records.

Study area	Study period	CDR	References
Nekemte	2010/11-2014/15	38.9%	This study
Ethiopia(National)	2013	62%	Global TB report,2014
-Harar	2011	95%	Ethiopia MDG report,2012
-DireDawa	2011	81%	Ethiopia MDG report,2012
-Addis Ababa	2011	63%	Ethiopia MDG report,2012
-Tigray(rural)	2011	25%	Ethiopia MDG report,2012
-Amhara (rural)	2011	23%	Ethiopia MDG report,2012
-Somale region	2011	19%	Ethiopia MDG report,2012
Africa	2013	52%	Global TB report,2014
Global	2013	64%	Global TB report,2014

The present study carried out in Nekemte showed the case detection rate (38.9%) for smear positive PTB was very low compared to Global target of 70% by 2015 and still lower than the National detection rate of 62%, Africa(Regional) 52% and Global 64%. This low detection rate in this study area could be attributed to:

- Non-adherence to the national diagnostic algorithm which is a common problem in hospitals; contributing to the over-diagnosis of smear-negative PTB in the study areas(Mengiste*etal.,*2005)

- Poor quality (under-reading) and examination of a sub optimal number of sputum-smears could partly be contributing to the high diagnosis of smear negative PTB diagnosis (Hawken,*etal.,*2001).
- A positive acid fast bacilli (AFB) smear requires about 5,000-10,000 AFB presence per milliliter of sputum and the AFB are released intermittently from the lungs. This gives AFB smear a sensitivity of only 50-60%(Siddiqi*etal.,*2003).
- Smear-negative PTB could also be a result of inadequate sputum collection, storage staining and human error, etc(Harries*etal.,*1998)

There for improving such diagnosis problems can help to increase the case detection rate of the study area which serve as one mechanism to fight TB distribution.

4.5 Prevalence of TB patients co-infected with HIV

The total TB cases registered in the five year in Nekemte town health care facilities were 1246. All TB patients were tested to know their HIV status by the DOTS program. Of the total TB patients tested for HIV for 5 years, 233 (18.7%) were HIV positive ranging from the highest co-infection of 22.1% in the year 2012/2013 to the lowest 16.8% in the year 2010/2011 (Table 8) . The prevalence of TB/HIV co-infection showed an increasing trend from 2010/11 which was 16.8% to 22.1% in a year 20112/13 then decreased to 16.9% in 2014/15.

Table 8: Prevalence of TB/HIV co-infection among TB patients attended DOTS service in Nekemtehealth care facilities (NRH,NHC&CHC) 2010/11-2014/15.

Year	TB cases	Tested for HIV	HIV positive	SPPTB	SNPTB	EPTB
	N	N	N(%)	N(%)	N(%)	N(%)
2010/11	327	327	55(16.8%)	15(27.2%)	20(36.4%)	20(36.4%)
2011/12	224	224	44(19.6%)	10(22.7%)	14(31.8%)	20(45.5%)
2012/13	230	230	51(22.1%)	13(25.5%)	21(4.2%)	17(33.3%)
2013/14	212	212	40(18.8%)	7(17.5%)	11(27.5%)	22(55.0%)
2014/15	253	253	43(16.9%)	9(20.9%)	15(34.9%)	19(44.2%)
Total	**1246**	**1246**	**233(18.7%)**	**54(23.2%)**	**81(34.7%)**	**98(42.1%)**

Table 9(below) summarizes the prevalence of TB/HIV co-infection in the different parts of the country in relation to the national, regional and global distribution of the disease. Accordingly, the prevalence of TB/HIV co-infection in this study was slightly higher than TB patients in Dabat, North West Ethiopia. The study showed out of 849 TB patients tested for HIV (11.4%) were HIV positive (Sebsibe and Takele,2013) and the national co-infection rate of 11% in Ethiopia ((Global TBreport2014) , but lower than the prevalence of 24.8% co-infection in Dire Dawa(Gashaw, 2013) and that of TB/HIV co-infection of 45.3% reported from Addis Ababa (Demmissie,1999) which was an earlier research carried out when HIV prevalence was high compared to the present prevalence.

Table 9 : Summary of the prevalence of TB/HIV co-infection among TB patients in different areas from local to global

Study area	**Study period**	**TB/HIV co-infection**	**References**
Nekemte	2010/11-2014/15	18.7%	This study
Ethiopia	2013	11%	Global TB report,2014
-Dabat district	2009-2012	11.4%	Sebsebe&Takele,2013
-DireDawa	2007/8-2011/12	24.8%	Gashaw,2013(unpublished)
-Addis Ababa	1998	45.3%	Demissie et al,1999
Africa	2013	41%	Global TB report,2014
-Sudan	2013	6.1%	Global TB report,2014
-South Africa	2013	62%	Global TB report,2014
-Zimbabwe	2013	69%	Global TB report,2014
-Lesotho	2013	74%	Global TB report,2014
Global	2013	18%	Global TB report,2014

The prevalence of TB/HIV co-infection in this study was comparable to the global co-infection rate of 18%, and much lower than the percentage (41%) of TB/HIV confection in Africa (Global TB report of 2014). Although the regional co-infection in Africa was 41%, it differed from county to country, ranging from 6.1% in Sudan to 74% in Lesotho, Southern Africa (Global TB report 2014).In western Kenya district, HIV prevalence among the TB patients was 50%,where the notification rate increased and in other district HIV prevalence among TB was 29-27% (Odhiambo*etal.,*1999). It shows the TB/HIV prevalence in Kenya was higher than the prevalence in Nekemte.

Although TB/HIV co-infection in Nekemte (18.7%) was lower than that of Dire Dawa(24.8%) and Addis Ababa (45.3%), at which the study was carried out where HIV was highly distributed in the country still higher compared to the national prevalence at the national (11%) and the global(18%) level. This indicates occurrence of more prevalence of HIV in the area. As a result there is a requirement of high TB/HIV collaborative activities that are essential to ensure that HIV positive TB patients are identified and treated appropriately . According to Deribew*etal.,*2009,study in Oromia region; out of 591 patients participated in the study124(21%)were TB/HIV co-infected which indicates the present study prevalence(18.7%) is lower comparatively indicating a decreasing trend.

In this study among the HIV positive TB cases,54(23.2%) were smear positive, 81(34.7%) smear negative and 98(42.1%) Extra pulmonary, showing more prevalence of smear negative and extra pulmonary TB cases (Table 8). Study show that diagnosis of smear positive TB disease in HIV infected person is difficult ,because patients with HIV associated TB have fewer bacilli intheir sputum than do HIV uninfected patients with PTB(Brindle et al.,1993) This is why in this study the proportion of smear positive PTB is low.

In this study, all (100%) of the TB patients were tested and knew their HIV status (Table 8) and met the global target for TB patients to know their HIV status by 2015.. This is also better than the 48% of TB patients attended DOTS service knowing their HIV status worldwide in 2013, and also 76% and 71% TB patients knowing their HIV status from Africa and Ethiopia, respectively (Global TB report2014).

4.6 **Treatment outcome of TB patients in the study area (2010/11-2014/15).**

Regarding the treatment outcome of TB patients attended DOTS service from 2010/11 to 2014/15 in Nekemte town, 85.5% of the attendants were successfully treated, whereas 6.6% of the patients died, 2.4% lost to follow the treatment,0.8% treatment failure and 4.5% of the patients were transferred to other area. The treatment success rate among the years was within the lower range of 82.5% in 2013/2014 and the higher range of 88.6% in (2010/2011) (table 10)

Table 10: Treatment Outcome of TB patients attended DOTS service in NRH,NHC& CHC in Nekemte town (2010/11-2014/15)

Year	Total TB Cases	Treatment Outcome				
		Successfully treated(TSR)	Died	Loss to follow up	Failure	Transferred out
	N	N (%)	N (%)	N (%)	N (%)	N (%)
2010/11	327	290(88.6%)	12(3.6%)	12(3.6%)	1(0.3%)	12(3.6%)
2011/12	224	188(83.9%)	12(5.3%)	3(1.3%)	1(0.4%)	20(8.9%)
2012/13	230	196(85.2%)	24(10.4%)	3(1.3%)	2(0.8%)	5(2.1%)
2013/14	212	175(82.5%)	20(9.4%)	5(2.3%)	4(1.8%)	8(3.7%)
2014/15	253	216(85.0%)	15(5.9%)	8(3.1%)	3(1.0%)	11(4.3%)
Total	**1246**	**1065(85.5%)**	**83(6.6%)**	**31(2.4%)**	**11(0.8%)**	**56(4.5%)**

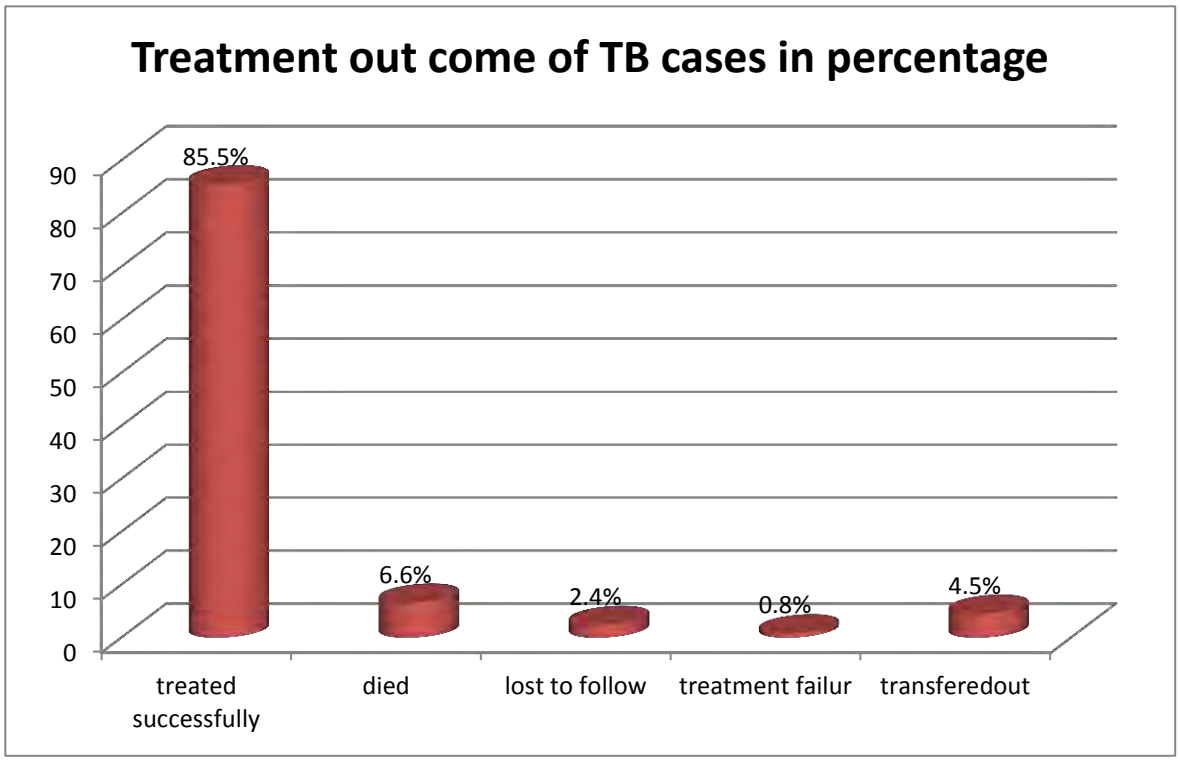

Fig 2: Treatment outcome of TB patients in Nekemte government health care facilities (2010/11-2014/15)

In the mid of 1990s, the Stop TB Partnership launched the 'Global Plan To Stop TB' by 2015and targeted treatment success rate of 85%.The Global TB report of 2014 showed the treatment success rate globally reached 86%, that of Africa 81% and Ethiopia 91% (WHO Global TB report, 2014). The treatment success rate in Ethiopia was increasing from 61% in 1995 to 91% in 2012, showing that Ethiopia has achieved the global target of treatment success rate before the dead line. However the achievement is not similar in all regions of the country. The treatment success rate of TB patients (85.5%) in this study was comparable to different studies in the country and from Global TB report (Table 11). One research carried out in Nekemte on 'Treatment of TB patients Under DOTS program 2009-2011', showed 70.8% patients treated successfully, 8.1% died, 7.1% loss to follow,0.2% failure and 13.8% transfer out (Eyasu,et al.,2013). A ten year retrospective assessment carried out on 'Trends of TB Case Notification and Treatment Outcome in the Sidama Zone (2003-2012)' showed a treatment success rate of 89% (Dangisso, et al 2014). Other research inDabat district, North West Ethiopia showed treatment success rate(TSR) of 87.8% (Sebsibe& Takele,2014).

According to Ethiopia Millennium Development Goal report of 2012, a high performance of treatment was recorded in Afar 92% and Gambella 89% (Ethiopia MDG report, 2012)

Table 11: Summary of Treatment Success rate(TSR) from this study to global level

Study area	**Study period**	**TSR**	**References**
Nekemte	2010/11-2014/15	85.5%	This study
Nekemte	2009 – 2011	70.85	Eyasu et al.,2013
Ethiopia(National)	2012	91%	Global TB report,2014
-Sidama Zone	2003-2012	89%	Dangisso, et al.,2014
-Afar	2011	92%	Ethiopia MDG report,2012
-Gambella	2011	89%	Ethiopia MDG report,2012
-Dabat district	2007-2012	87.8%	Sebsibe and Takele,2014
Africa	2012	81%	Global TB report,2014
-Zimbabwe	2012	81%	Global TB report,2014
-South Africa	2012	77%	Global TB report,2014
-Kenya	2012	86%	Global TB report,2014
-Mozambique	2012	87%	Global TB report,2014
Global	2012	86%	Global TB report,2014

The treatment success rate of Nekemtein this study 85.5% has improved highly compared to the research carried by Eyasu *et al*,2013 with TSR of (70.8%).

This study also revealed that Nekemtetown has achieved the treatment success rate of the global target before the dead line (85% by 2015). However, it has fell short slightly, but not significantly of the national achievement (91%) and treatment success of other areas of the country. This shows the TSR achievement can be increased yet; by minimizing the number of deaths, loss to follow up and transfer out.

With regard to death from tuberculosis, a research by Eyasu *et al*, 2013 showed 8.1% deaths, but in this study reduced to 6.6% which shows improvement. However the deaths from tuberculosis is still much higher than the 3% death in Sidama zone of Southern Ethiopia (Dangisso, *et al* 2014), 3.1% in Dabat district(Sebsibe& Takele,2014) and 3.6% in Gambella , 4% in Addis Ababa and 3% of the national level in Ethiopia.(Demeke *et al*., 2013). This shows that death is still higher than the other localities in the country and the National level, hence the health care facilities in Nekemte are recommended to work more to reduce the deaths due to tuberculosis. .

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This study showed, a total 1246 TB cases were recorded in Nekemte government health care facilities from the year (2010/11to 2014/15) of which, 644(51.7%) were male patients and 602(48.3%) were female patients with a ratio of 1.1: 1(M:F) indicating presence of a gender difference in TB prevalence among the sex.

The data also showed that the majority of the patients (90.2%) were in age group of 15-64years which was the active productive age groups followed by children and old age (4.0%) each, with least prevalence in under five age category(1.7%).

The prevalence of TB in 5 years showed a decrease from 327 incidence in 2010/11 to 253 in 2014/15 indicating a 5.9% decrease. The proportion of smear positive PTB patients among Pulmonary TB patients indicating a detection rate (CDR) of 38.9% lower than the national CDR rate of 62%. The low case detection rate in the study area indicated that the chance of tuberculosis transmission could be high due to inability to diagnose the smear positive PTB patients which are active transmitter of the disease.

In the present study area all TB patients attended DOTS service were tested for their HIV status, and 18.7% were co-infected with HIV. Since all (100%) of TB patients in the study area knew their HIV status,it has met the global target for 2015.

Regarding the treatment outcome, out of the total TB patients attended DOTS service 85.5% were treated successfully whereas 6.6% died, 2.4% loss to follow treatment, 0.8% treatment failure and 4.5% transfer of patients were recorded. The study area TSR of 85.5% is lower to the national (91%) and slightly lower to the global (86%) , but higher to the regional TSR (81%) of the 2014 Global TB report.

5.2 Recommendations

Based on the findings of this study, the following recommendations are suggested:

- ☞ High proportion of TB cases in male indicates the need for gender based intervention, such as TB health education targeting men to bring behavioral change or active screening of TB in men should be pursued.
- ☞ Since the prevalence of TB is very high in active productive age category(15-64 years),strengthening health workers extension in the town for provision of counseling and educating the community on the mode of TB transmission and prevention is recommended . On other side the prevalence of TB cases in under five age category is very low only (1.7%), this could be mainly due to BCG vaccine effect that has a half life of about 10 years ,hence improvement of the half life of BCG vaccine may reduce TB prevalence among adult age group. This may require the need for the basic research for new vaccine development that has longer half life.
- ☞ To improve the case detection rate (smear positive PTB case detection) in the study area adherence of personnel to diagnostic algorithm, collection of high quality sputum, availability of LED microscope and culture tests are recommended.
- ☞ Additional active-detection is recommended rather than following only passive detection method to eliminate the disease from the population for global targets to be achieved.
- ☞ The treatment success rate in the study area could be improved by strengthening the DOTS program like direct observation supply of both intensive and continuation phase of therapy as practiced in Nekemte Health Center. Transfer out cases should be minimized by counseling the patients to complete their therapy just in the health facility after they started.

- ☞ Strengthening TB/HIV collaborative activities are needed to reduce as well treat the co-infection properly in the study area

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