JIMMA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
COLLEGE OF NATURAL SCIENCES
DEPARTEMENT OF BIOLOGY

Prevalence of MultidrugResistant *Mycobacterium tuberculosis* and Associated Risk Factors atGimbiGeneral Hospital, West Wollega Zone, Oromia Regional state, Ethiopia

By: TadeleGuta

A Thesis submitted to Department of Biology, College of Natural Sciences, Jimma University, in Partial Fulfillment of the Requirement for the Degree of Master of Science in Biology

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Advisor: TsigeKetema (PhD)

Co- Advisor: AregaTsegaye (MSc)

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Approval form

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Declaration

I, the under signed, declare that this is my original work, has never been presented in this University or other University, and that all the resources and materials used for the thesis have been dully acknowledged.

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Acronyms

- AFB - Acid Fast Bacilli
- CDC - Center for Disease Control
- DOTS - Directly Observed Treatment, Short-course
- DST - drug susceptibility testing
- EMB - Ethambutol
- FMOH - Federal Ministry of Health
- GHE - Global Health Education
- HIV - Human Immunodeficiency Virus
- INH - Isoniazid
- LJ - Lowenstein-Jensen
- MDR - Multi-drug resistant
- MDR-TB - Multidrug resistant tuberculosis
- MTB - *M. tuberculosis*
- PAS - Para amino salicylic acid
- RIF – Rifampicin
- STM – Streptomycin
- TB - Tuberculosis
- WHO - World Health Organization
- XDR TB - extensive drug-resistant tuberculosis

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Abstract

Tuberculosis is a communicable disease caused by *Mycobacterium tuberculosis*. Tuberculosis is a major public health problem in Africa including Ethiopia. Multidrug-resistant tuberculosis has continued to be a challenge for tuberculosis control globally. Ethiopia is one of the countries with Multidrug-resistant tuberculosis burden. The aim of this study was to assess the prevalence of Multidrug-resistant tuberculosis burdenbacteria and its associated risk factor among patients attending Gimbi General Hospital, west Wollega, OromiaRegional state, Ethiopia. A retrospective study design was used to collect recorded data of Tuberculosisand Multidrug-resistant tuberculosis patients attending the hospital from 2012-2017. In addition, questionnaire survey was used to determine the awareness of patients towards the Tuberculosisand Multidrug-resistant tuberculosis infection from the patients currently on the follow-up. Primarydata was collected fromTuberculosispatients attending Gimbi General Hospital from September 2017 to September 2018by trained personnel. Finding of the study showed that, the overall prevalence of Tuberculosiscases was 2.38%, among which the prevalence of Tuberculosiscases in male and female were 3% and 1.85%,respectively. Theprevalence of Multidrug-resistant tuberculosis over the years from 2012 to 2018was 0.09%.From the analysis, illiterate, nutritional status, previous treatment, poor lifestyle, low income, misuse of drug, working conditions, and family size were among the major associated risk factors ($P<0.001$) for the prevalence of Tuberculosisinfection and Multidrug-resistant tuberculosis. So implementation of health education and awareness creation by the concerned bodies using different mechanisms and further research is recommended.

Key words:Gimbi Hospital,MDR-TB, *Mycobacterium tuberculosis,*Prevalence,risk factors

1. Introduction

Tuberculosis (TB) is an infectious bacterial disease caused by *Mycobacterium tuberculosis* that most commonly affects the lungs. Despite the recent progress of global control efforts, TB remains a major public health burden (Gandhi *et al*, 2010). *M. Tuberculosis* has an unusual, waxy coating on its cell surface primarily due to the presence of mycolic acid. This coating makes the cells impervious to Gram staining, and as a result, *M. Tuberculosis* can appear either Gram-negative or Gram-positive(Fu-Liu, 2002).Cells are curved rod-shaped and are often seen wrapped together, due to the presence of fatty acids in the cell wall that stick together(Kennethand Madison, 2016). Physiologically *M. Tuberculosis* is highly aerobic and requires high levels of oxygen *(*Ryan*et al.*, 2004). Sporulation has been demonstrated in a number of different bacteria but *Mycobacterium* spp. has been considered to be non-sporulating bacteria. Evidence from some research showed that *Mycobacterium marinum* and likely also *Mycobacterium bovis* can form spores (Thanky*et al*., 2007). Mycobacterial spores were detected in old cultures and sporulation might be an adaptation of lifestyle for mycobacteria under stress (Ghosh*et al*. 2009).Under favorable conditions, a growing bacterial population doubles at regular intervals. Bacterial growth rates during the phase of exponential growth, under standard nutritional conditions (culture medium, temperature &PH), define the bacterium's generation time (Thanky*et al*., 2007).

When TB causing bacteria replicate, some may naturally change (mutate) and become resistant to anti-TB drugs (Rattan *et al.,* 1998). *M. tuberculosis* is considered to be multidrug-resistant (MDR TB) if it has developed drug resistance to both rifampicin and isoniazid, which are the most important antibiotics used in treatment. Additionally, extensively drug-resistant *M. tuberculosis* (XDR TB) is characterized by resistance to isoniazid and rifampin, plus any fluoroquinolone(i.e., ciprofloxacin, levofloxacin, ofloxacin and moxifloxacin) and at least one of three injectable second-line drugs (i.e., amikacin, kanamycin, or capreomycin) (CDC, 2014).

Drug-resistant TB disease can develop in two different ways, called primary and secondary resistance (WHO, 2016). Primary resistance occurs in persons who are initially infected with resistant organisms (Tesema *et al*., 2012). Secondary resistance, or acquired resistance, develops during TB therapy; either because the patient was treated with an inadequate regimen (Millard *et*

al, 2015) or the TB bacteria have natural defenses against some drugs, and can acquire drug resistance through genetic mutations **(**Li, 2017**)**.Rapid transmission of MDR-TB is a major public health problem globally especially for resource-limited countries and represents a major challenge for TB control program (Moonan*et al*., 2013). When an untreated individual with active TB coughs, droplet nuclei containing the TB bacillus are expelled into the air and can be inhaled by others in close proximity (Bashar*et al*., 2001).

All suspects of any form of TB must be examined according to the standardized diagnostic procedures of which the microscopic examination of sputum is the most important and reliable (Biohme, 2010). TB diagnosis mainly depends on the clinical presentation of the disease and identification of the offending bacilli (Hershfield, 2007).Drug resistant TB often develops when treatment is interrupted or when appropriate drugs required for treatment are unavailable(Cox *et al*., 2004).The longer treatment course of MDR-TB results in poor treatment outcome, leading to the emergence of XDR-TB (Miglior*iet al*., 2010).

Emerging and spread of drug resistance TB has encountered as a great challenge in Africa region, Sub-Saharan Africa in particular (Mekonnen*et al*., 2015).

The impact of MDR-TB is especially serious in low-income countries like Ethiopia, where health resources, finances, andthe skilled personnel required for diagnosis and management are limited, making containment and the prevention of further spread more difficult (WHO, 2012).Prevention and control of TB depend on DOTs(directly observed treatment short course) strategy, which is measured by case notification and treatment success rate developed by WHO and almost all countries had adopted the strategy, which have considerable progress towards global targets. Ethiopia, adopt the strategy since 1992 as pilot in Oromia region at Arsi and Bale zones (FMHE, 2008).

Because of the absence of patient-based studies and adequate laboratory testing facilities in the region, it is difficult to have a reliable estimation on the prevalence of MDR-TB bacteria and associated risk factors in town. However, this patient-based study conducted in Gimbi General Hospital West Wollega zone Oromia Regional State, was the first attempt in the area to cover the prevalence of MDR-TB bacteria and associated risk factors in Gimbi General Hospital.

1.2. Statement of the Problem

The global burden of TB and MDR-TB bacteria remains enormous. The bacteriological cause is the transmission of MDR-TB strains in new cases or the selection of single drug resistant strains induced by the previous treatment. The extent of occurrence and its burden varies significantly from country to country and from region to region being high in resource poor countries(Ormerod, 2005).Sub-Saharan Africa stands the burden of both very high TB incidence and the highest HIV prevalence rates in the world, and represents 14 % of the global burden of new MDR-TB bacteria cases (Maher, 2013).In Ethiopia MDR-TB bacteria is becoming a challenge, because of poor adherence to treatment, HIV infection, nutritional status, poverty(poor lifestyle), a few diagnostic and treatment facilities and inadequate trained health professionals (Selamawit *et al*, 2013). A nationwide drug resistance surveillance project was under taken from 2003-2006 and showed 1.7% and 11.8%MDR-TB bacteria cases in new and previously treated cases, respectively (Kebede, 2016). Although the country claimed to have achieved the millennium development goals for TB in 2015 and now adopted new post Global TB strategy called 'end TB strategy' (MOH, 2016).TB is one of the major diseases affecting the population in Oromia region. All strategic plans of the country have been introduced in the Region. Accordingly, Ghimbi General Hospital of West Wollega Zone has been a beneficiary of programs such as Directly Observed Treatment, Short-course (FMHE, 2014). The present study is to identify the prevalence of MDR TB bacteria and its risk factors in GimbiGeneral Hospital. The study will narrow the huge diagnostic, nutritional status, poor lifestyle and attend the treatment effectively gap needed to confront the MDR TB bacteria. Although MDR-TB is a growing concern in resource limited countries like Ethiopia, it is largely under-reported, compromising control efforts. Information concerning the true extent of the problem of MDR-TB in the Gimbi is limited. Since, there are significant gaps in treatment, and lack of awareness. The overall epidemiology of drug resistant TB is not well understood in Gimbi area. Hence, understanding the burden of the most prevailing infections like MDR-TB is urgently required to guide public health interventions that are both specific and effective.Therefore, the aim of the study was to identify the prevalence of multidrug resistant *Mycobacterium tuberculosis* and risk factors at Gimbi General Hospital.

Research Questions

The study is designed to answer the following research questions:

- What is the prevalence of Tuberculosis, and multi drug resistancetuberculosis among different age groups, and sex of multi drug resistancetuberculosis patients that attended Directly Observed Treatmentprogram at the study area?
- What are the risk factors for prevalence of multi drug resistancetuberculosis in Gimbi area?
- In which age group Tuberculosisand multi drug resistancetuberculosis is more common in Gimbi?

HYPOTHESIS

In this study it is hypothesized that there are risk factors for the high prevalence ofmulti drug resistancetuberculosis in Gimbi area, west Wollega, Ethiopia.

Operational Definitions

MDRTB: a form of TB caused by bacteria that do not respond to, at least, isoniazid and rifampicin, the two most powerful, first-line (or standard) anti-TB drugs.

Primary drug resistance: Drug-resistant TB in a person with no history of TB treatment, implying they were infected with a resistant TB. This reflects person-to-person transmission of drug-resistant TB bacilli.

Acquired drug resistance: Drug-resistant TB in a person with a history of TB treatment. This reflects drug resistance acquired during TB treatment but may also reflect infection or re-infection with resistant TB bacilli.

Suspected MDRTB: Patients, who had failed previous TB treatment, relapsed after treatment, contacted known MDRTB patients or defaulted during previous treatment, and HIV patients are considered to suspect MDRTB.

Rifampicin monoresistant TB: TB caused by strains of M. tuberculosis that are resistant to only Rifampicin. Rifampicin resistance is a predictor of MDR TB because resistance to RIF, in most instances, co-exists with resistance to isoniazid.

1.3 Objective of the study

1.3.1 General objective

- To assess the prevalence of multi drug resistancetuberculosisand determine its risk factors, in Gimbi General Hospital, Oromia Regional State, Ethiopia.

1.3.2 Specific Objectives

- To determine the prevalence of multidrug resistant tuberculosis.
- To identify factors associated with multidrug resistant tuberculosis.

1.4 Significance of the study

The study will serve as the base line data to estimate the prevalence of multidrug resistant tuberculosisin relation to efforts for multidrug resistant tuberculosis control in the study area. The study helps the local people and Gimbi town administration department to have clear understanding about the prevalence of multidrug resistance tuberculosis and associated risk factors. The study also serves as a source of information and as a starter for other researchers who want to assess similar study in the area.Thus, it would give a new insight for the Hospital and an organizations working on tuberculosisand multidrug resistant tuberculosisPolicy maker ,programmer,manager and the public in general in order to control tuberculosis and multidrug resistant tuberculosisin the hospital and as well as in the community.

2. Literature Review

2. 1. Prevalence of MDR-TB bacteria

The emergence of MDR-TB bacteria is defined as resistance to the first line drugs isoniazed and rifampicin (WHO, 2013). The development of drug resistance during the course of TB treatment, leading to multidrug-resistant tuberculosis (MDR-TB), poses even greater risks for long-term survival of patients. MDR-TB is a major health hazard and is associated with sub-optimal rates of treatment success and concurrent high rates of mortality (Nations *et al*., 2006). Most cases of MDR-TB are arising from a mixture of physician error(when health-care providers prescribe the wrong treatment, the wrong dose, or length of time for taking the drugs), inadequate and incomplete treatment, and patient non-compliance during treatment of susceptible TB (Jain *et al.,* 2008). The prevalence of TB patients estimated to have MDR-TB bacteria was under 10% in all of the 27 high MDR-TB bacteria countries outside the European Region, with the notable exception of South Africa with the expectation of reducing incidence rate by 81%. The prevalence of MDR-TB in South African adults was 1.8% (1.4% - 2.3%) amongst new treatment cases, and 6.7% (5.5% - 8.1%) in previously treated individuals (Dhammika, 2013). According to WHO 2010 report, Ethiopia stands 15th out of the 27 high priority countries in the world and 3rd in Africa following south Africa and Nigeria with 5200 MDR TB cases estimated to have occurred in 2008.According to the Ethiopian national TB drug resistance surveillance reported, 2.3% of new TB cases and 17.8% of previously treated TB cases were estimated to have MDR-TB (WHO, 2011).The prevalence of MDR-TB bacteria is increasing throughout the world both among new tuberculosis cases as well as among previously treated (Telles *et al.*, 2012). Although previous treatment for TB is the strongest risk factor for development of MDR-TB bacteria, treatment naive patients are also at risk due to either spontaneous mutations or transmission of resistant strains (Surendra *et al.*, 2011).

2.2 Epidemiological evidence of MDR-TB bacteria in Ethiopia

Drug resistant tuberculosis is a manmade problem. The emergence of Drug Resistant TB bacteria in an individual could be microbial, clinical and programmatic (Gao, 2013). However, largely being the consequence of human error following an inadequate or improper administered treatment which is further exacerbated by human immunodeficiency virus (Mirsaeidi*et al*., 2005). Multidrug resistant tuberculosis (MDR-TB) bacteria have become a major public health

problem and presents new barriers to the control of MDR TB bacteria (Metcalfe *et al*., 2014).Globally, due to MDR-TB, 450,000 new cases and 170,000 deaths occurred in 2012.The incidence of MDR-TB bacteria strains is a continuing challenge to the TB control program(Masjedi *et al*., 2013).The current WHO estimate of MDR-TB bacteria prevalence among all cases in South Africa is 15,419(Berhan*et al*.,2013). In Ethiopia, the first national surveillance data during the 2003-2005 study periods showed 1.5% MDR-TB bacteria (Jango and Demeke, 2013). After falling from 145 to 130 in 2008, it rose to 284 in 2012, indicating a proportional increase of MDR-TB bacteria with time(Sanchez *et al*., 2012). Among the TB cases in 2014, 1300 (1.6%) of new cases and 11.8% of previously treated TB cases were estimated to harbor DR-TB bacteria in Ethiopia (Yaregal, 2014).Similarly, a study done in Ethiopia identified long treatment, poor treatment follow up & interruption of treatment were identified as risk factors for significant increases in MDR-TB (Hirpa, 2013). Other studies done in Ethiopia revealed that HIV infection, cigarette smoking, and alcohol drinking, overpopulated, and weak DOTS program were the major risk factors for spread of MDR-TB infection (Deressa, 2014).

The appearance and spread of drug-resistant TB strains in new and previously treated cases worsens the TB problem in Ethiopia (WHO, 2013). In Addis Ababa 12%MDR-TB bacteria cases reported (Abate and Miomer, 1998).Another report on northwest Ethiopia showed a higher rate at 5% of MDR-TB patients (Tesema *et al*.,2012). MDR-TB bacteria in all of the reported studies indicate the spread of MDR-TB strains and that the local control measures for the prevention of these deadly disease facilities for early case detection and treatment of MDR-TB bacteria are unsatisfactory (Biadgeligne *et al.,* 2014).In addition, high prevalence of TB, poor treatment, limited access to health care, and several other related factors have constrained the ability of the sub-Saharan region, including Ethiopia to effectively control MDR-TB. Finally, the rapid transmission of XDR-TB has recently emerged as yet another challenge for TB control program (WHO, 2011).

2.3 Risk Factors of MDR-TB bacteria

International studies have identified various risk factors for drug-resistant TB bacteria; these include inappropriate previous TB treatment with anti tubercular drugs, high prevalence of drug resistant tuberculosis in the community and contact with patients known to have drug resistant

tuberculosis, poor adherence to treatment regimens, inadequate regimens and positive smear result at the end of the second and third month of treatment (Caminero, 2010). Patients with prior exposure to anti-TB treatment have an increased chance of developing additional resistance (Chung *et al*., 2015), to anti-TB drugs, which limits the number of effective drugs available for inclusion in a treatment regimen. Such ineffective regimens will result in poor survival (Pietersen *et al*., 2014).

Factors such as inadequate chemotherapy, poor drug quality, poor adherence to treatment, treatment failure, prior treatment, nutritional status, cavity pulmonary TB, HIV infection and diabetes accounted for the development of drug resistance in TB (AklandMahalli, 2012). Other major factors significantly contributing to the higher complexity of the treatment of MDR-TB is non- adherence to prescribed treatment (Farley *et al.,* 2011).

Psychiatric illness, alcohol consumption, and travel to different places, symptom relief, adverse drug reactions, drug addiction, homelessness and inability to afford treatment do predict non-adherence to treatment(Hamid *et al*., 2009). Poor compliance with treatment is also an important factor in the development of acquired drug resistance (Baghaei*et al*., 2009). Other reported associated factors include previous hospitalization, having a household member with MDR-TB, older age (45–64 years), male sex,underlying health conditions like HIV infection and diabetes mellitus personal behaviors like alcoholism and smoking, and poor socio-economic conditions (poverty) (Zhao *et al*.,2012).

Under-nutrition is the most widely prevalent risk factor, accounting for the highest population attributable risk (PAR) for TB in India (Lönnroth *et al*., 2010). In India more than one third of women and men in the age group of 15-49 years are under-nourished(BMI <18.5 kg/m^2), and nearly half of children under the age of five years have moderate to severe under-nutrition(as defined in WHO child growth standards) (IIP, 2007). Tuberculosis can lead to or worsen pre-existing under-nutrition, by decreasing appetite, and by increased catabolism. High prevalence of under-nutrition in TB patients has been reported in other settings, and has been linked to excess deaths, and increased risk of relapse (PrayGod *et al*., 2011).

2.4 Transmission of Drug-Resistant TB (DR TB) bacteria

M. tuberculosis is carried in airborne particles, called droplet nuclei, of 1– 5 microns in diameter. Infectious droplet nuclei are generated when persons who have pulmonary or laryngeal TB

disease cough, sneeze, shout, or sing (Abubakar*et al*., 2007).*M. tuberculosis* is transmitted through the air, not by surface contact (Kenneth and Madison, 2016). Transmission occurs when a person inhales droplet nuclei containing *M. tuberculosis*, and the droplet nuclei traverse the mouth or nasal passages, upper respiratory tract, and bronchi to reach the alveoli of the lungs (Pedrazzoli*et al*., 2013). Infection occurs when a person inhales droplet nuclei containing tubercle bacilli that reach the alveoli of the lungs (CDC, 2012).These tubercle bacilli are ingested by alveolar macrophages; the majority of these bacilli are destroyed or inhibited(Sharma *et al*., 2011). A small number may multiply intracellular and are released when the macrophages die (Kidenya*et al*., 2014). If alive, these bacilli may spread by way of lymphatic channels or through the bloodstream to more distant tissues and organs (Global TB report, 2014). Circumstances in which an exposed person is at an increased risk of infection with drug-resistant TB include the following: Exposure to a person who has known drug-resistant TB disease; Exposure to a person with TB disease who has had prior treatment for TB (treatment failure or relapse) and whose susceptibility test results are not known; Exposure to a person with TB disease from an area in which there is a high prevalence of drug resistance, or travel to one of these areas(Javaid *et al*., 2004). Exposure to a person who » Has known drug-resistant TB » Had prior treatment for TB(Pednekar *et al*., 2008). .It's from an area in which there is a high prevalence of drug resistance » Continues to have positive smears and cultures after 2 months of combination chemotherapy (Biadglegne *et al.,* 2014). Travel in areas with a high prevalence of drug-resistant TB disease Develops because the patient should not take TB medicine exactly as prescribed by doctor (Moges *et al*., 2015).

2.5 Mechanisms of drug resistance in Mycobacterium tuberculosis

The TB bacteria have natural defenses against some drugs, and can acquire drug resistance through genetic mutations (WHO, 2016)**.**A mutation in the *rpoB* gene, which encodes the beta subunit of the bacteria's RNA polymerase. In non-resistant TB, rifampin binds the beta subunit of RNA polymerase and disrupts transcription elongation. Mutation in the *rpoB* gene changes the sequence of amino acids and eventual conformation of the beta subunit (Sandhu, and Akhter, 2017). Manymutations that confer resistance to isoniazid (INH), including in thegenes *katG*, *InhA*, *ahpC* and others. Amino acid replacements in the NADH binding site of InhA apparently result in INH resistance by preventing the inhibition of mycolic acid biosynthesis, which the

bacterium uses in its cell wall (Young, 2016). Mutations in the *katG*gene make the enzyme catalase peroxidase unable to convert INH to its biologically active form (Rosales*et al*, 2012). Drug associated gene mutation isoniazid (H) katG, inh A Rifampicin (R) rpoB Pyrazinamide (Z) pncA Streptomycin (S) rrs, andEthambutol (E) embB. Strains of *Mycobacterium tuberculosis* have undergone a number of mutations that enable them to "resist" treatment with a number of antibiotics (Hirpa *et al*., 2013). A bacterium that has acquired resistance to one or more antibiotics will transfer these traits to its offspring; this is referred to as vertical gene transfer that occurs when bacteria divide giving rise to two daughter cells by fission. However, resistance to antibiotics can also be spread through a process called horizontal gene transfer (Acharya, 2013).

2.6 Diagnosis of TB and MDR-TB bacteria

All suspects of any form of TB must be examined according to the standardized diagnostic procedures of which the microscopic examination of sputum is the most important and reliable. TB diagnosis mainly depends on the clinical presentation of the disease and identification of the offending bacilli (Hershfield, 2007). Conventional light microscopy of Ziehl-Neelsen-stained smears prepared directly from sputum specimens is the most widely available test for diagnosing TB in resource-limited settings. Ziehl-Neelsen microscopy is highly specific, but its sensitivity is variable (Raj *et al*., 2012). Convectional fluorescence microscopy is more sensitive than the Ziehl-Neelsen and takes less time, but it is limited by the high cost of Mercuric vapor light sources, the need for regular maintenance, and the dark room requirement (Ryu, 2015). Early diagnosis is vital for DR-TB patients. A delayed diagnosis can result in progressive lung destruction, higher bacillary loads, a worsening clinical condition and ongoing transmission (Rahel, 2015). Late diagnosis of DR-TB results in lower treatment success and failure rates (Mukherjeeand Rich, 2004).In order to diagnose MDR-TB bacteria, drug-resistance testing should be conducted to determine if the TB strain is resistant to any drugs other than rifampicin and isoniazid (Nathanson*et al*., 2010). Patients who test GXP positive for TB with rifampicin resistance are classified as having laboratory confirmed MDR-TB if the organism exhibits resistance to first line drugs including isoniazid on conventional DST tests and or LPA (Schnippel *et al*., 2015).

2.6.1 Rapid Molecular Tests

Rapid molecular tests are now available to detect resistant strains (Yon, 2015). These tests are not universally available, but WHO strongly recommends that these be used in the first-line of diagnosis when MDR-TB is suspected or when working with HIV-infected patients (WHO, 2014). The XpertMTB/RIF diagnostic test produces results within the same day so patients can begin treatment quickly (Singh *et al.,* 2013).In South Africa, patients who screen positive for TB submit sputum for GeneXpert MTB/RIF (GXP) testing. GXP detects the presence of *Mycobacterium tuberculosis*, and determines its susceptibility or resistance to rifampicin (NDH, 2015).

2.6.2 Conventional Drug-Susceptibility Tests

Conventional drug-susceptibility tests can be conducted using solid or liquid culture from the patient. Diagnosis using this route can take more time since it typically cannot be conducted on-site. The common turnaround time using this method is about two months (Bwanga*et al*., 2009). The use of these tests is crucial among patients at risk of MDR-TB. According to the Center for Disease Control, these groups include: Prior TB disease treatment; Contact with a patient with known anti-TB drug resistance; Demonstrated resistance to first-line anti-TB drugs; or Positive cultures after more than 3 months of treatment (ECDC, 2012).

2.7 Prevention

MDR-TB bacteria can occur in two ways: through incorrect treatment of TB or when MDR-TB bacteria are present in the community and the airborne disease spreads to others. The best practice for prevention is to ensure that TB patients complete their treatment course (ALA, 2013). There are several ways that drug resistance to TB, and drug resistance in general, can be prevented (Zumla *et al.,* 2012). Rapid diagnosis & treatment of TB is one of the greatest risk factors for drug resistant TB is problems in treatment and diagnosis, especially in developing countries. Completion of treatment, if the patient does not complete his/her antibiotic treatment, or if the physician does not prescribe the proper antibiotic regimen, resistance can develop (Van der et *al*., 2012).Patients with HIV/AIDS should be identified and diagnosed as soon as possible and Identify contacts that could have contracted TB: i.e. family members, people in close contact (Deressaand Demissie, 2012). The principal ways to prevent drug resistant TB: early detection and high quality treatment of drug susceptible TB, early detection and high

quality treatment of drug resistant TB, effective implementation of infection control measures and strengthening and regulation of health systems (WHO, 2016).

2.8 Treatment

Once MDR-TB bacteria are present, it must be treated to prevent further health issues for the patient and to prevent the spread of MDR-TB bacteria to others in the community. Treatment may involve taking multiple medications for up to two years that include adverse side effects such as headache, upset stomach, dizziness and skin rash (MOHE, 2013).Currently, TB care and treatment has become more complicated due to the emergence of M/XDR-TB. Second-line drugs that are used for the treatment of MDR-TB are listed as amino glycosides; e.g., amikacin (Am) and Kanamycin (Km); polypeptides: e.g., capreomycin (Cm), viomycin and enviomycin; fluoroquinolones;e.g., ciprofloxacin (Cip), levofloxacin (Lfx), ofloxacin (Ofx), moxifloxacin (Mxf) and gatifloxacin; and thioamides: e.g., ethionamide (Eto), prothionamide and cycloserine (Cs), and P-aminosalicylicacid (PAS) (WHO,2013).Second-line anti-TB drugs are less potent, need to be administered for a much longer time, are more toxic and are high-cost compared to first-line anti-TB drugs (Miglior*iet al*.,2010). Agents with unclear roles in drug-resistant TB treatment are called third-line anti-TB drugs such as clofazimine (Cfz), linezolid (Lzd), amoxicillin (Amx), thioacetazone (Thz), imipenem (Ipm) and high-dose isoniazid(Jemal*et al*., 2015).

2.8.1 Direct Observation Therapy (DOT)

DOT is a process where medication adherence is observed(Ottmani *et al*., 2008). Once the treatment course is prescribed, a trained healthcare worker gives prescribed MDR TB drugs to the patient and then observes the patient swallow the drugs or receive the injection. Healthcare workers may also check for side effects and ensure the patient is healthy (Belknap *et al.,* 2013).

2.8.2 Surgical Therapy

Surgery may be done to remove damaged areas of the lungs if drug treatments fail for Tuberculosis especially, XDR TB. Surgical therapy may be an option for MDR-TB patients that meet the following criteria: Such drug resistance that there is a high likelihood of treatment failure or relapse, localized disease amenable to resection sufficient drug activity to reduce remaining mycobacterium burden enough to allow bronchial stump healing, and other considerations(Jango and Demeke, *et al*., 2013).

3. Methodology

3.1 Study Area

The study was conducted in Gimbi General Hospital, West Wollega, Oromia Regional state; Ethiopia (Figure 1).The town covers an area of about 49.13 Km^2 and has 4 Kebeles. Gimbi district is located 441kms South West of Addis Ababa, Ethiopia. Geographically, the district is situated between 35° 44'-36° 09' East longitude and 90° 10'-90° 17'North Latitude with an elevation of 1600 to 2500 meters above sea level (masl).June to September is the main rainy season and October to November is known aslight rainy season. It haswet climatic condition with annual rainfall of 311mm to 525.2mm and its annual temperature ranges between 10^0C to 21.33^0C and mean temperature of 17.67^0C.

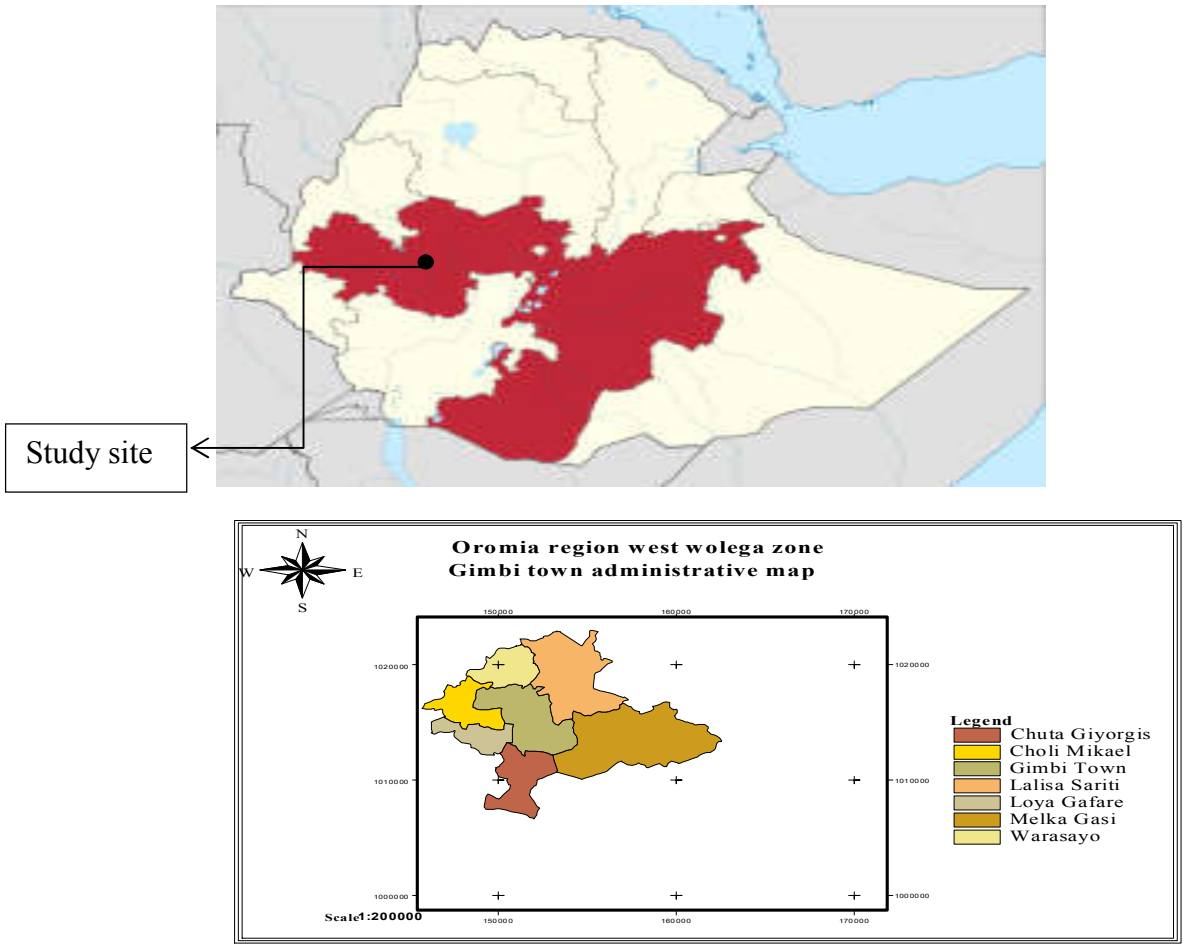

Figure**1:** Map of the study area (Source: http://reliefweb.int'sites'files'resources'21-adm-eth-081517 ao)

3.2 Study Design and period

A facility based retrospective cross sectional study design was employed by reviewing medical records of patients registered for MDR TB bacteria infection, interviewing of key informants' of MDR TB and TB patients registered from 2012 to 2018, at GimbiGeneral Hospital Administration Health Department. Datacollection tools used was questionnaire (both open and close ended), focus group discussion and structured interview. The data collection based on patients who had MDR TB and smear-positive TB in the Gimbi where TB can be diagnosed by the direct microscopi-cal examination of sputum.

3.3 Study population

In this study patients diagnosed with active TB disease (Smear positive and smear negative),and on anti-TB treatment regimens, members of all MDR-TB bacteria suspected patients attending Gimbi General Hospital were source of the study population for the questionnaire and face to face interview. In addition, TB unit focal persons of all selected public health facilities andTB officersat the hospital wereincluded in the study.

3.3.1 Inclusion criteria

All data of MDR TB patients' registered at the hospital and with a record of MDR TB treatment outcomes (MDR-TB or non MDR-TB) during 2012 to 2018, including those who started at different health post and transferred to theHospital, were included in the study.

3.3.2 Exclusion criteria

All MDR TB patients' registrations that are transferred out to other health facilities, died and defaulted were excluded from the study.

3.4 Variables

3.4.1 Independent variables

In this study socio-demographic variables such as Age, Sex, Residence, Nutritional status, HIV Co-infection status, educational status TB treatment status, compliance to drug use, physician errors, religion, ethnicity, poverty (poor lifestyle) were considered as independent variables.

3.4.2 Dependent variables

Prevalence of Multi drug-resistant TB

3.5 Sampling and Sample size determination

Purposive sampling techniquewasemployed, because MDR TB patients are registered in an organized manner in thecenters compared to many private health facilities available in the town. Accordingly, 233 patients whose sputum tested and found positivewere considered inthe study. All patients with Tuberculosis enrolled in the hospital and those were suspected to have MDR TB and investigated by Gene X pert machine

3.6 Data collection Technique

The data ofMDR TB patients treated from 2012 to 2018 wasincluded in this study. The data was collected from the Gimbi General Hospital providing DOTs services to determine the prevalence of TB and MDR TB. Demographic and related data was collected by trained health personnel using a standardized questionnaire (Annex 1 and 2). Accordingly, MDR-TB category, and treatment date started and completed, andthe treatment outcome were collected from the DOTs registration unit at the hospital. Questionnaire wasadministered via face-to-face interview. Structured interview and focus group discussionwasemployed to cross check information obtained through questionnaire and enhance the validity of the information.Acid-fast stains such asZiehl-Neelsen, or fluorescent stains, auramine were used to identify *M. tuberculosis* with a microscope (Cudahy *et al*, .2016). Gram stain is a common type of differential staining method used to distinguish between two large groups of bacteria: Gram-positive and Gram-negative bacteria. The characteristic feature of bacteria used in the Gram stain is the presence of peptidoglycan in the cell wall. Therefore, the bacteria with peptidoglycan in their cell wall are characterized as Gram-positive bacteria and bacteria without peptidoglycan in their cell walls are characterized as Gram-negative bacteria.

The steps of the Gram stain are as follows.Applying the primary stain, crystal violet on to a heat-fixed bacterial smear.The addition of Gram's iodine as a mordant. Here, the mordant is responsible for stabilizing the stain by acting as a trapping agent. Generally, this involves the formation of the crystal violet-iodine complex clump in the thick layers of peptidoglycan in the cell wall. This gives Gram-positive bacteria a purple color.The addition of a decolorizing agent such as ethanol or acetone\ethanol solution, which washes out the dyes remaining in the thin peptidoglycan layers. This makes Gram-negative bacteria colorless.Counterstaining with safranin, which stains the decolorized cells in pink color.Finally, Gram-positive bacterial cells

appear in the smear in purple color while Gram-negative cells or safranin-stained cells appear in the smear in red color.

Acid-fast stain is technique which help to distinguish between Gram-positive bacteria with waxy mycolic acids in their cell walls. Also, Ziehl-Neelsen technique and Kinyoun technique are the two methods of acid-fast staining. The main difference between the two acid-fast staining methods is the use of heat during the primary staining process. The Ziehl-Neelsen method uses heat to infuse the primary stain into the acid-fast cells. However, the Kinyoun method does not use heat.Moreover, the common steps of the acid-fast staining are as follows.Applying the primary stain, carbolfuchsin on to the bacterial smear. Here, the waxy, acid-fast cells retain the red color of the carbolfuchsin.Applying the decolorization agent, which is mainly an acid-alcohol solution. Importantly, the primary stain retains in the acid-fast cells even after the decolorization.Counterstaining with methylene blue, which renders non-acid-fast cells blue.Therefore finally, the acid-fast cells or carbolfuchsin-stained cells appear in red color while the non-acid-fast cells or methylene blue-stained cells appear in blue color.

Isolates were identified by using typical colony characteristics on Lowenstein-Jensen (LJ) media and standard biochemical tests.These biochemical and phenotypic methods for identification of mycobacteria were observation of rate of growth, colony morphology, pigmentation and biochemical profilesand 68°C labile catalase tests (Nagarajan*et al.,*2012). If there are mixtures of Bacteria first each of them as to be purified based on the colony characteristics. First go for staining like gram, endospore, capsule, and acid fast, flagella. Then can go for Biochemical tests like carbohydrate fermentation, nitrate reduction, casein hydrolysis, starch hydrolysis, lipid hydrolysis, gelatin liquefaction, catalase test, beta-galactosidase, decarboxylase and growth characteristic like whether the colony is pigmented, mucoid, swarming and size of cell.Gene x-pert machine was used to assess rifampicin resistant strains, after a while RIF resistant *MTB* isolates were tested for isoniazid and RIF using the indirect proportional method on LJ medium (Chakravorty*et al*., 2005).GeneXpert is a nucleic acid amplification test which simultaneously detects DNA of *Mycobacterium tuberculosis* and resistance to rifampin (i.e. mutation of the rpoB gene) in less than 2 hours.Sputum sample collected from the patient with suspected TB.The Xpert MTB/RIF purifies and concentrates *Mycobacterium tuberculosis bacilli* from sputum samples, isolates genomic material from the captured bacteria by sonication and subsequently amplifies the genomic DNA by PCR. The process identifies most of the

clinically relevant Rifampicin resistance inducing mutations in the RNA polymerase beta (rpoB) gene in the *Mycobacterium tuberculosis* genome in a real time format using fluorescent probes called molecular beacons. The sputum is mixed with the reagent that is provided with the assay, and a cartridge containing this mixture is placed in the GeneXpert machine. 3mls of sputum was added to 3mls of 4% sodium hydroxide (NaOH). The mixture was vortexed and left to stand at room temperature for 15 min. Here, the raw sputum sample is liquefied, decontaminated either with 2% N-acetyl cysteine-sodium hydroxide (NALC-NaOH) or 4% NaoH, centrifuged, concentrated and neutralized using phosphate buffer. Thereafter, sterile distilled water was added to a 50 mark of falcon tube and concentrated by centrifugation at 3000 g for 15 min. This system integrates and automates sample processing, nucleic acid amplification, and detection of the target sequences.The primers in the Xpert TB/RIFamplify a portion of the *rpoB* gene containing the 81 base pair "core" region. The probes are able to differentiate between the conserved wild-type sequence and mutations in the core region that are associated with rifampicin resistance. All processing from this point on is fully automated.http://www.cdc.gov/tb/publications/factsheets/testing/xpertmtb-rif.htm**.**

3.7 Data quality management

The structured data abstraction form for review of medical records and guiding questions to key informants' interview and guiding questions for MDR-TB and TB patients interviewwere prepare in English and translate into Afan Oromo. The collected data was supervised and checked for completeness and quality during data collection by principal investigator before data entryfreshly prepared chemical of good standard and media were used.

3.8 Data analysis

Questionnaire wascoded before entry into the softwareand analyzed using Statistical Package for the Social Science (SPSS), version 25.0.Data of all patients of the period in terms of case detection rates and treatment outcomes were processed to assess the proportion of MDR-TB bacteria and finally analyzed using descriptive statistics in percentages and ratio. Simple descriptive statistics such as mean, frequencies and percentage of different variables were also computed. Statistical inference was made at 95% confidenceinterval (CI).The strength and magnitude of association was estimate for each variable from the corresponding univariate model and was expressed in terms of an Odds Ratio (OR).

3.9 Ethical considerations

The study was ethically approved by Research and Ethical Review Committee of the College of Natural Sciences, Jimma University and permission was obtained from Ghimbi town Administration Health Department. After the detail purpose of the study was explained to each presumptive patient to participate in the study,their willingness was confirmed by giving their oral or written consents and data was collected. Participants' confidentiality or privacy of information was assured by using staff of the health facility as data collectors and excluding any potential identifiers (names, mobile number and specific residence area) from the medical records review check list. Finally, study findings ought to be disseminatingto the respective study sites.

4. Results

4.1 Prevalence and proportion of TB and MDR TB among patients from 2012-2018.

During the study period (2017-2018), a total of 2165 TB (1441male and 724female) suspected patients were diagnosed at GimbiGeneral Hospital. From this figure, 210patients were found TB positive (127 males and 83 females), showing 9.7% (210/2165) prevalence of Tb in the study area. Among these TB patients whose data recorded, a total of 23(1.06%, 23/2165) were found infected with MDR-TB, among which 16were male and 7were female. A total of 35,971 (16,504 male and 19,467 female) suspect patients were diagnosed at Gimbi General Hospital from data recorded over a period of 2012- 2017.From this figure, 857 patients were TB positive (496 males and 361 females, showing 2.38% (857/35,971) prevalence of TB in the study area. Many new cases of MDR-TB develop due to error in TB management such as the use of a single drug to treat TB, the addition of a single drug to a failing regimen, the failure to identify pre-existing resistance, the initiation of an inadequate regimen using first line anti-TB drugs. Patient with Active TB that develops in those living in the same household and those sharing the same indoor space (such as co-workers), of patients with MDR-TB will most likely be MDR-TB. The duration of prior treatment also increased the number of patients in the study area, but this more likely reflected the results of treatment failure in patients with TB. Distribution of the prevalence among patients with different age groups showed that, 1.66, 3.7, 2.13, 1.4, and 0.88% were patients aged <15 years, 16-30 years, 31-45 years, 46-60 years and >60 years, respectively(Table 1).

Table1: Prevalence and proportion of TB and MDR TB among Patients in Gimbi General Hospital from 2012-2018.

Year	Age group	TB infection						MDR TB		
		Male		Female		Total		Male	Female	Total
		No of Exam	No of +ve (%)	No of Exam	No of +ve (%)	No of Exam	No of +ve (%)	No of +ve (%)	No of +ve (%)	No of +ve(%)
2012 -2017	≤ 15	1689	33(1.95)	1732	24(1.38)	3421	57(1.66)	1(0.05)	0	1(0.02)
	16-30	5411	267(4.9)	6916	195(2.8)	12327	462(3.7)	8(0.14)	7(0.10)	15(0.1)
	31-45	4631	118(2.5)	5311	94(1.76)	9942	212(2.13)	5(0.10)	6(0.11)	11(0.1)
	46-60	3146	58(1.8)	3396	35(1.03)	6542	93(1.4)	4(0.12)	2(0.05)	6(0.09)
	≥61	1627	20(1.2)	2112	13(0.6)	3739	33(0.88)	2(0.12)	0	2(0.05)
	Total	16504	496(3.0)	19467	361(1.85)	35971	857(2.4)	20(0.12)	15(0.07)	35(0.1)
2017/ 2018	≤ 15	248	8(3.22)	156	8(5.12)	404	16(3.96)			
	16-30	369	61(16.5)	200	50(25)	569	111(19.5)	11(2.98)	2(1)	13(1.9)
	31-45	402	30(7.5)	215	19(8.83)	617	49(7.94)	4(0.99)	3(1.39)	7(1.13)
	46-60	310	23(7.4)	97	6(6.18)	407	29(7.12)			
	≥61	112	5(4.5)	56	0(0.00)	168	5(2.97)	1(0.89)	2(3.57)	3(1.78)
	Total	1441	127(8.8)	724	83(11.46)	2165	210(9.69)	16(1.11)	7(0.96)	23(1.1)

4.2. Distribution of TB cases in different years

The trend of TB patients' distribution at different years showed that, there is an increasing pattern from year to year (from 86 cases in the year 2012 to 178 in 2017) in the study area. A study incorporating data from the hospital found that prior ineffective treatment was strongly linked to the increase number of patients. Drug susceptibility test results were available for 63 previously treated patients. Patterns of resistance were even rise in patients previously treated for TB, those who previously received anti tuberculosis drugs for a minimum of 1 month. The cases TB recorded was observed in the year 2017 with male 12.7% and female 8.05% total 20.77%, and the lowest prevalence was documented for year 2012 with male 6.18% and female 3.8 % and total 10.03% (Figure 2).

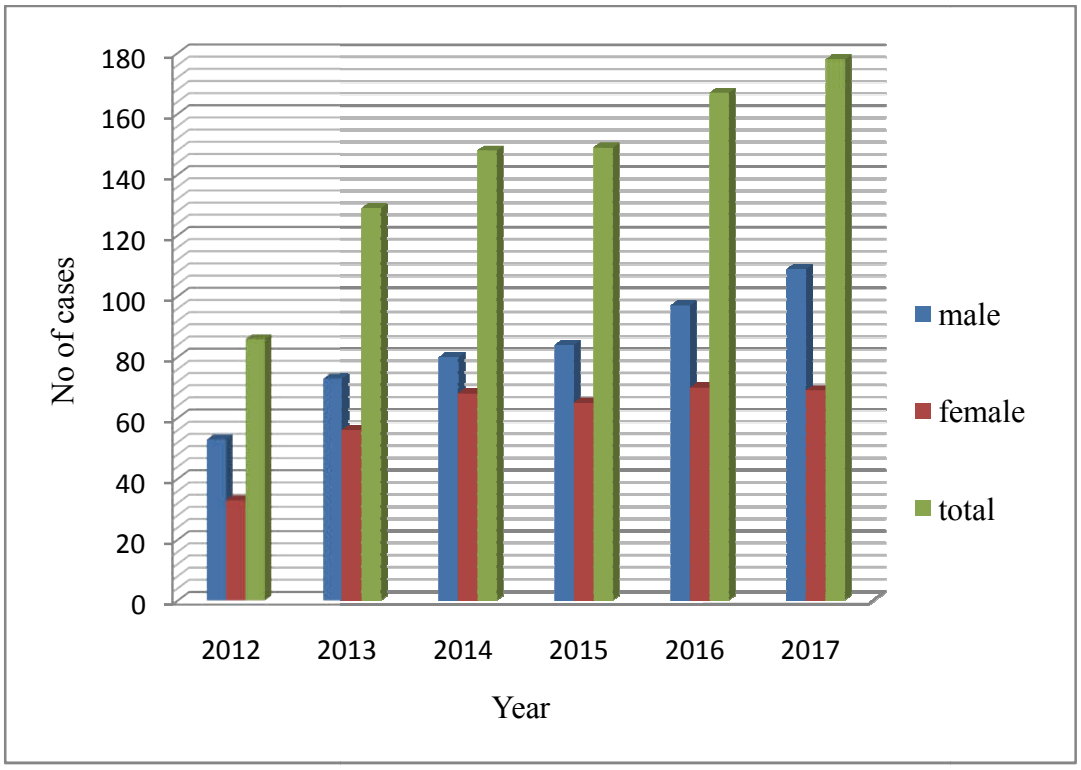

Figure2Distribution of TB patients with year and sex of patient's atGimbi General Hospital from January 2012 to September, 2017.

4.3. Association between socio-demographic characteristics of Study participants and TB infection rate

Majority of Tb infected patients were male [127(60.47%)], found in age group 16-30 years [111(52.9%)], were able to read and write [84(40%)], occupationally unemployed [153(72.85%)], has lowest income, earn <1000Birr per month [157(74.76%)], rural dwellers [183(87.14%)], andmarried [106(50.47%)]. Most of the participants had 1or 2 rooms and had 0 to 3 children in their house. There were no significant association between socio-demographic variables (age, gender, educational status, religion, ethnicity, and Occupational status) and development of MDR-TB.These socio-demographic variables has shown significant association ($P<0.001$) with Tb infection in the study area (Table 2).

Table 2Socio-demographic characteristics of thestudy participants and TB infection inGimbi General Hospital, 2017/18

S/N	Variables	Alternative	Frequency (%) Of TB +ve	AOR(95% CI)	Statistical significance
1	Sex of respondent	Male	127(60.47)	1.38(1.32-1.45)	0.001
		Female	83(39.5)		
2	Age of respondents	≤15	16(7.6)	2.52(2.40-2.63)	2.52(2.40-2.63)
		16-30	111(52.85)		
		31-45	49(23.33)		
		46-60	29(13.8)		
		≥61	5(2.38)		
3	Educational status of the patient	Illiterate	25(11.9)	1.21(1.15-1.26)	0.000
		Read and write	84(40)		
		Primary	49(23.33)		
		Secondary	22(10.47)		
		≥Diploma	17(8.09)		
4		Student	19(9.04)	3.06(2.95-3.16)	0.000
		Civil servant	5(2.38)		
		Unemployed	157(74.76)		
	Occupational status	Private worker	29(13.8)		
		House wife	4(1.9)		
		≤1000	157(75.7)	1.47(1.36-1.58)	0.001
5	Income	1001-2000	27(12.85)		
		2001-3000	17(8.09)		
		3001-4000	7(3.33)		
		≥4001	2(0.95)		
6		Urban	27(12.85)	1.12(1.08-1.16)	0.000
	Permanent residence	Rural	183(87.14)		
7		Single	95(45.23)	1.64(1.56-1.91)	0.000
	Marital status	Married	106(50.47)		
		Divorced	7(3.33)		
		Widowed	2(0.95)		
8	Religion	Protestant	118(56.19)	1.78(1.65-1.91)	0.000
		Orthodox	75(35.7)		
		Muslim	13(6.19)		
		Other	4(1.9)		
9	Ethnicity	Oromo	187(89.04)	1.18(1.11-1.24)	0.000
		Amhara	13(6.19)		
		Other	10(4.76)		
10	number of rooms in the house	1	89(42.38)	1.81(1.71-1.90)	0.000
		2	78(37.14)		
		Above 2	43(20.47)		
11		No	95(45.23)	1.97(1.81-2.12)	0.001
	family number in the household	1-3	100(47.6)		
		4-6	12(5.7)		
		Above 7	3(1.4)		

4.4. Patients' level of awareness about TB, its treatment and associated risk factors.

Awareness of the study participants on cause of Tb infection and transmission showed that those who know that TB is caused by bacteria 60(28.6%) and it is through air droplet 49 (23.33%) were significantly different (χ^2=3.28, P= 0.000) compared toothers (Table 3). Likewise, those respondents that mentioned not coughing/sneezing infront of other people as a prevention method 101(48.09%) were significantly different (χ^2= 2.14, P= 0.000) than those that stated spiting in a container 49(23.33%) and ventilating living room/open windows 33(15.7%). Participants were well aware about symptoms of Tb infection such as coughing for more than two weeks, persistent fever, loss of weight, night sweating, chest pain, loss of appetite, swelling and body weakness. On these response significant differences were not observed (χ^2= 3.25, P=0.076) among the participants. Most of the respondents 161(76.66%) still assumed that TB is un-curable disease. This number was significantly higher (χ^2=1.76, P=0.000) than those who knew Tb as a curable disease. With regard to the feeding habit, 108(51.42%) of the respondents replied that they did not get their breakfast, lunch and dinner on time, while only 102(48.57%) participants nearly fed on time. Most of the respondents 156(74.28%) indicated that there was no awareness creation activities in the study area (Table 3).

In this study awareness about TB caused by bacteria is good except for some factors like cigarettes smoking and lack of balanced diet. Regarding modes of transmission, 36.2% were aware of overcrowding as a mode of spread compared to a 30% were aware as sleeping together. Only 48% were aware about not coughing infront of the other as a method of prevention and efforts have to be made to create more awareness spiting in a container who have cough more than two weeks. About 23% were aware of the treatment for TB. Treatment for TB is generally costlier in private settings pushing the family into poverty, and it may lead to treatment default after few weeks of treatment. Carrying out representative focus groups, community dialogues, and in-depth health education will identify the gaps in knowledge and practices of the community thereby providing clues to improve the problem of TB infection, especially the case detection and adherence to treatment. Regarding feeding habit related to prevention of spread of TB, though 48% were aware of spread because of poor feeding habit.

Table 3Level of awareness of participants about TB infection and associated risk factors atGimbi General Hospital during September, 2017 to September, 2018

S/N	Items	Variable	Frequency (%) N=210	Mean difference(χ^2)	Statistical significance
		Bacteria	60(28.6)		
1	Causes for TB	Previous treatment	56(26.66)		
		Cigarettes smoking	14(6.66)	3.28	0.000
		Lack of balanced diet	28(13.33)		
		Ingesting raw milk	8 (3.81)		
		I don't know	44(20.95)		
		Air droplet-	49(23.33)		
2	Mode of Tb transmission	Over crowding	76(36.19)		
		Using utensil that a patient used	13(6.19)	3.12	0.000
		Sexual contact	9(4.28)		
		Sleeping together	63(30)		
3	Prevention methods	Not Coughing/sneezing infrontof the people	101(48.09)		
		Spiting in a container/not on open field	49(23.33)		
		Ventilating living rooms	33(15.7)	2.14	0.000
		Not using utensils that a TB patient used	23(10.95)		
		Avoid sexual contact/sleeping together	4(1.9)		
4	Tb status:treated and cured spread	Yes	49(23.33)		
		No	161(76.66)	1.76	0.000
5	Sign and Symptoms	Cough for more than two weeks	26(21.8)		
		Persistent fever	17(16.8)	3.25	0.076
		Loss of weight	12(10.08)		
		Night sweating	9(7.56)		
		Chest pain	9(7.56)		
		Loss of appetite	25(21.0).		
		Swelling	5(4.2)		
		Body weakness	16(13.4)		
6	Risk factors	Drug use	16(13.4		
		Poor living	60 (50.4)	1.87	0.000
		Working conditions	21(17.6)		
		Chewing chat	10(8.4)		
		Other	12(10.08)		
7	Presence of Health Education	Yes	54(25.7)	1.88	0.000
		No	156(74.28)		
8	On time feeding habit	Yes	102(48.57)	1.66	0.000
		No	108(51.42)		

4.5 Pattern of Tb bacteria drug resistance

Among the total of 233 patients diagnosed in 2017/18 and who were AFB sputum smear positive (had a positive culture for *M. tuberculosis*) enrolled in the study, 210 (90.12%) were susceptible to first line anti tuberculosis drugs. Sputum sample collected from the patient with suspected TB.The Xpert MTB/RIF purifies and concentrates *Mycobacterium tuberculosis bacilli* from sputum samples, isolates genomic material from the captured bacteria by sonication and subsequently amplifies the genomic DNA by PCR. The rest 23 (9.87%) were resistantto one or to a combination of the first-line anti-TB drugs.Drug resistance Tb bacteria to one or more anti-tuberculosis drugs wererecorded among the isolates recovered. The pattern of resistance observed were to isoniazid 7(30.43%), rifampin 8(34.78%), Ethambutol 3(13.04%)and Streptomycin 5(21.7%).Most frequent resistance in the study was against RIF (34.78%) followed by INH (30.43%). Strains that were resistant to only one drug were mainly resistant to INH and RIF (9.09%) or STM and EMB (8.33%). The lowest resistance was against EMB (13.04%). There were no resistances to three combinations of drugs (Table 4).

Table 4Drug resistance pattern to first-line anti-TB drugs among culture positive pulmonary TB cases in Gimbi General Hospital, west WollegaZone of Oromia Region, western Ethiopia, 2017.

Drug resistance pattern	New cases ($N=11$)	Re-treated cases (N=12)	Total ($N=23$)
	3 (%)	6(%)	9(%)
Any Resistance to one drug	0	1 (8.33)	1 (4.35%)
Any INH	1 (9.09 %)	1 (8.33)	2 (8.69%)
Any RIF	2(9.09%)	2 (16.66)	4 (17.39%)
Any STM	0	1 (8.33)	1 (4.35%)
Any EMB	0	1 (8.33)	1 (4.35%)
Mono resistance	2	3	5
Only INH	1 (9.09%)	1 (8.33)	2 (8.69%)
Only RIF	1 (9.09%)	0	1 (4.35%)
Only STM	0	1 (8.33)	1 (4.35%)
Only EMB	0	1 (8.33)	1 (4.35%)
Two-drug resistance	7	3	10
INH + RIF	1 (9.09)	1 (8.33)	2 (8.69%)
INH + EMB	1 (9.09)	0	1(4.35%)
INH + STM	2 (18.18)	0	2 (8.69%)
RIF + EMB	0	1	1 (4.35%)
Three drug resistance			
INH+RIF+STM	00	00	00
RIF+ETM+STM	00	00	00
INH+ETM+STM	00	00	00
INH+RIF+ETM	00	00	00

NB: INH= Isoniazid, RIF= Rifampicin, EMB=Ethambutol, STM= Streptomycin

4.6 Risk factors associated with Multidrug resistance (MDR-TB)

Among the dependent variables assessed, gender of the patients (being male), presence of previous history of treatment, alcohol consumption, presence ofHIV infection, poor life style, poor feeding habit, residence, small number of rooms and large family size were significantly ($P<0.05$) associated with MDR-Tb or associated risk factors for the emergence of MDR-Tb infection. Active TB that develops in close contacts, including those living in the same household and those sharing the same indoor space (such as co-workers), of patients with MDR-TB will most likely be MDR-TB.While contact with a known Tb patient, and history of prison were not risk factors documented in the current study as significant differences were not ($P<0.05$) observed among the responses. High level of MDR TB observed from non prison with up to 78% patients. Because no all prisoners who had active TB were culture positive (Table 5).

Table 5the risk factors associated with MDR-TB in patients receiving anti-TB treatment at Gimbi General Hospital during September, 2017 to September, 2018.

Variables	**Alternatives**	**Frequency of MDR-Tb (%)**	**AOR(95% CI)**	Statistical significance
Sex	Male	16(69.57)	1.30(1.10-1.51)	0.001
	Female	7(30.43)		
Previous treatment	Yes	12 (52.17)	1.48(1.26-1.70)	0.001
	No	11(47.83)		
Contact with a known TB Patient	Yes	8 (34.78)	1.65(1.44-186)	0.099
	No	15(65.22)		
Residence	Rural	19(82.61)	1.74(1.01-1.34)	0.000
	Urban	4 (17.39)		
Alcohol consumption	Yes	11 (47.83)	1.52(1.30-1.74)	0.000
	No	12 (52.17)		
Good feeding habit	Yes	7(30.43)	1.69(1.49-1.90)	0.003
	No	16(69.57)		
History of prison	Yes	5(21.74)	1.78(1.60-1.96)	0.099
	No	18(78.26)		
Poor life style	Yes	19(82.61)		0.000
	No	4(17.39)	1.17(1.01-1.34)	
HIV infection	Yes	16(69.57)	1.69(1.49-1.90)	0.001
	No	7(30.43)		
Number of rooms	1	11(47.82)	1.69(1.36-2.03)	0.001
	2	8(34.78)		
	> 2	4(17.39)		
Family size/children	0	6(26.08)		0.000
	3	14(60.86)	1.96(1.38-2.53)	
	6	2(8.69)		
	>7	1 (4.34)		

5. DISCUSSION

During the study period (2012-2018), the overall prevalence of Tb infection documented was 2.38% (857/35,971). From this figure, 35(0.09%, 35/35,971) were due toMDR-Tb. In 2017/18 the overall prevalence of Tb infection documented was 10.7% (233/2165), among which 1.06% (23/2165) was due to MDR-Tb.According to WHO (2018), the severity of national Tb epidemics varies widely among countries, from fewer than 10 cases in most developed countries to 500 cases in high Tb burden countries per 100,000 populations, which is 0.5% prevalence. As Tb is one of the major public health problems in the Ethiopia, the prevalence documented in 2014 was 211 per 100,000 populations on average (WHO, 2014). Compared to this report, the prevalence observed in the study area [2.38% (857/35,971)] far exceeds the global and national Tb prevalence estimates. Likewise, the MDR-Tb prevalence observed over the study period (2012-2018) has shown afinding is lower(from 0.09 to 1.06%) than the national trends of multidrug resistance TB, from 2% in 2006 to 4.5% among new cases in 2016 (Eshetu*et al*., 2017).

Also the WHO (2018) report showed that the number of people died due to Tb infection in 2017 was estimated to be more than 1.3 million. In the same year, the global estimate was 10million, among which >90% were adult. In addition tuberculosis reported as common among men than women, and affects mostly adults in the productive age group; around two-thirds of cases were estimated to occur among people aged 15-59 years (WHO, 2011). There were studies reporting the prevalence of childhood tuberculosis, estimates indicate that there were very few cases among 0–14 year olds, even in areas of high transmission (10% of all new cases in Africa(Dye,2006). Rather those in age ≥15 years were the most affected (Nigusso*et al*., 2013).In agreement to this reports, the prevalence of Tb and MDR-TB infections documented in the study area were higher among young adult.This study could be explained by the fact that prevalence of HIV infection might lead the bacteria to resist the drugs.HIV infection, leads to low immunity status among the individuals and highly susceptible to MDR TB bacteria. When the immunity levels comes down, it will manifest as active TB leading to MDR TB.The HIV-negative patients who reported MDR TB bacteria as their sole risk factor.This is mainly due to the high prevalence of HIV infection observed among the MDR/TB infected cases andsupportedby finding from south Africa where young adults most at risk of acquiring HIV infection (Wood *et al*.,

2010).This is further supported by WHO (2009) report where, HIV/AIDS was described as a major cause to increase the burden of TB.Similarly, the number and proportion of male TB patients were found higher than female (54.5%). A similar distribution of Tb patients was reportedfrom Nigeria in which the number and proportion of male TB patients were higher than female TB patients (Makpa*et al.,* 2011). This could be explained bythe fact that men are usually use substances such as khat, cigarette and share cups for drinking water while chewing, moving from place to place for various purposes, sharing utensils, and haveexposure to dust due to their work nature (Mengistu*et al.,* 2010).Likewise, the study noted that MDR/TB prevalence is significantly higher among male than female patients which was consistent to a report from Ethiopia, pointing out being male is a risk factor for MDR-TB (Daniel *et al*., 2006). This is probably explained by the fact that women are more compliant with treatment and therefore less likely to receive inadequate treatment than men. Furthermore, men are almost always outdoors and therefore more susceptible to community-acquired resistant strains.

Among the different risk factors to Tb infection documented in this study being poor feeding habit and low income were found as the associated risk factors for Tb. This finding is similar to the report from India, where prevalence of TB was significantly higher in population with low standard living, compared to those with highstandard living (Muvunyi*et al*., 2007). This is likely best explained by not societal improvements, such as poor living conditions with high overcrowding and poor nutrition.

In this study the prevalence of MDR-TB observed was lower (1.06%) than reports from other parts Africa such as Burkinafaso (Sangare*et al*.,2011).The prevalence of TB patients estimated to have MDR-TB bacteria was under 10% in all of the 27 high MDR-TB bacteria countries outside the European Region, with the notable exception of South Africa with 81% (Dhammika, 2013). Accordingly, the proportion of MDR-TB bacteria among all TB cases varies from place to place. In Addis Ababa 12%MDR-TB bacteria cases reported (Abate and Miomer, 1998).

Factors such as nutritional status (poor feeding habit), Poverty, presence of HIV infection, large family size, previous treatment, number of the room in house and a history of alcohol consumption were found as risk factors for the emergence of MDR-Tbinfection.Besides associated risk factors reported from developing countries (Daniel *et al*., 2011), these risk factors

including income, previous treatment history of pulmonary TB, imprisonment, contact with TB patient and immunosuppressive conditions other than HIV/AIDS, were reported as determinants of MDR-TB in developed countries (Casal*et al*., 2005).However, although history of History of imprisonment and contact with a known TB patient had shown to have strong association with incidence of MDR-TB in several studies, in the current study significant differences were not observed among those with these variables. This finding was similar to a report of Pradipta*et al.* (2018), a global systematic review and meta-analysis on risk factors of multidrug-resistant tuberculosis, where lack of association between these variables was not observed.
The association between contact with known TB patient and MDR-TB was similarly observed in another very recent study conducted in the Oromia region. Several other studies have also supported the hypothesis that contact with a known TB patient is linked with MDR-TB due to exposure to resistant TB resistant (Alam, 2013).

Different explanation has given for this to happen:the extensive use of drugs of suboptimal quality, the widespread practice of using wrong medical prescriptions, inadequate drug supply, and incomplete adherence of patients to treatment are the most likely reasons for widespread of MDR/TB observed in the study.In addition, limited (inadequate, incomplete) and expensive medication is the biggest challenge in managing and treating MDR-TB. Often, patients experience many adverse effects from the drugs and tend to stop taking them in between, further decreasing their chances of survival. In some cases, extensively drug-resistant TB (XDR-TB) may develop with additional resistance to more anti-TB drugs, and this responds to even fewer available medicines. Thus, to prevent these challenges, it is best to control drug-resistant TB is by curing every TB cases the first time around, providing immediate access to diagnosis for early management, ensuring adequate infection control in hospitals/health facilities to prevent spread and ensuring appropriate use of recommended second-line drugs (WHO, 2016).

Loss of appetite due to prolonged exposure to second-line anti-TB medication might have also predisposed to persistence of severe malnutrition in cases that stayed for>4 month of treatment or development of acute malnutrition in others (Mpagama*et al*., 2013).However, MDR-TB cases not gaining weight during the course of treatment could also signify MDR-TB treatment failure. Further evaluation of second-line anti- TB drug susceptibility testing could have also been performed to exclude bacteriological failures (Heysell*et al.,* 2015). In this study, Monitoring of

weight at least monthly has been proposed as the standard of care for MDR-TB program. As body mass index (BMI) monitoring can be used to guide a nutritional management plan and make weight-based medication dose adjustments, promote at least this monthly BMI assessment, but data suggest the need for an even more intensive frequency in setting.

MDR TB is a poverty-related disease that affects all countries in the world but it *is*curable (WHO, 2016). All individuals with active MDR TB should receive an assessment of their nutritional status and appropriate counselling based on their nutritional status at diagnosis and throughout treatment. Patients with active multidrug resistant TB should be provided with locally available nutrient rich or fortified supplementary foods, as necessary to restore normal nutritional status. Malnutrition can be related to poverty. Malnutrition, leads to low immunity status among the individuals and highly susceptible to diseases. When the immunity levels comes down, it will manifest as active TB leading to mortality. TB and Malnutrition has direct association. Malnourished persons do not have good immunity. Their immune system is weak due to lack of essential proteins in their diet. So here chances of infection is very high and once they develop tuberculosis and if they are not taking proper diet chances of MDR Tb is also very high.

The combination of disease and malnutrition makes a small part of the body's metabolism, triggering a vicious cycle of infection and malnutrition, and on the other hand susceptible to disease. Tuberculosis is a bacterial infection that most often affects the lungs. Most people, who are infected, never develop symptoms because their immune system was able to control bacteria. When the infection is active, it is no longer contained by the immune system (Hanrahan*et al*., 2010). The nutrients could help patients recover from the disease by strengthening the immune system and improving weight gain and muscle strength to an active life. Good nutrition requires a daily intake of macronutrients (carbohydrates, proteins and fats) and micronutrients (vitamins and minerals). But if the TB patient is not able to eat correctly and well, his body will not be able to defend as the disease.A daily multiple micronutrient supplement nutrient intake should be provided in situations where fortified or supplementary foods should have been provided in accordance with standard management of nutrition.This study was similar with the WHO reports on management of nutrition in TB patients however suggest hospitalization of such patients in view of their mortality risk, concomitant treatment of the medical illness, and dietary supplementation till a their immune system is developed.

In this study MDR-TB is treated with second-line drugs, usually four or more anti-TB drugs. The minimum duration of the treatment is six months. In case of identified rifampin resistance in the specific strain of TB with which the patient is infected, the duration could be extended to 18-24 months. MDR-TB may also require surgery. Preferred agents used to treat MDR-TB include fluoroquinolone (e.g., moxifloxacin and levofloxacin) and amino glycosides (amikacin, capreomycin, and kanamycin) (WHO, 2016).

New WHO recommendations for management of MDR-TB aim at speeding up disease detection, and simultaneously improving its treatment outcomes by using the novel rapid diagnostic test and a shorter, cheaper treatment regimen. The new treatment regimen is less expensive and can be completed in 18-24 months. First, INH is an integral component of standard DOTS regimen. Secondly, in high INH resistance settings the effectiveness of INH preventive therapy may be compromised. It is also expected to improve outcomes and potentially decrease deaths due to better adherence and reduced loss to follow-up. If this treatment regimen applied in the study area the outcome of the treatment will be improved.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This study revealed important information on prevalence of MDR TB and risk factors for MDR-TB patients that would provide base line information for high TB burden area like Gimbi, West Wollega zone, Ethiopia. In this study, previous TB treatment failure, poverty, and low socioeconomic status were the major predictors for having TB. I the study have revealed that the prevalence of multidrug resistant tuberculosis in the study area was lower as compared to WHO data and other previous study done in Ethiopia. The major risk factors for the development of MDR TB were nutritional status, previous treatment, HIV infection, family size; low incomeand poor living.

Therefore, strict adherence to DOTS, basic TB infection control practices, appropriate treatment, good life style, appropriate management of TB patients and advice on the value of nutrients are imperative to control the spreading of MDR-TB.

6.2. Recommendation

Based on findings of this study and literatures information, the following recommendations were made:

- Patients played a significant role ineffective implementation of disease prevention and control strategies, therefore using patients as TB and MDR TB advocate groups to advocate favorable attitude and increase community awareness is recommended.
- Different mass media could give chance to the community to enhance the awareness and risk factors of TB and MDR TB bacteria, mode of transmission, symptoms, preventions and treatment methods and outcomes.
- Recommend researchers and health institutions including universities, to stress, surveillance of drug resistance trends, and health seeking behavior related studies, in order to be used by health policy makers.
- The nutritional support should be considered for severely underweight patients with pulmonary TB and MDR TB to decrease their risk of mortality, although community based nutritional interventions for such patients in West Wollega Zone, require further investigation.

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APPENDIX-1

JIMMA UNIVERSITY

COLLEGE OF NATURAL NATURAL SCIENCE

DEPARTIMENT OF BIOLOGY

1: Questionnaire

The purpose of this questionnaire is to obtain information about the perception of MDR TB bacteria. Your genuine response contributes a lot to the research to be undertaken. Hence you are requested to kindly fill the questionnaire. Thank you

Part I. Socio-demography characteristics

1. Sex of respondent, 1. Male □ 2.Female □

2. In which age group TB is more common in Gimbi town, 1. ≤15□2. 16-30 □

3. 31-45 □ 4. 46-60 □ 5.>61□

3.Educationalstatusoftherespondent, 1. Illiterate □ 2.Readandwrite □ 3.Elementaryschool □ 4.Juniorhighschool □ 5.High school □ 6.College 7.diplomaand above □

4. Occupational status of the patient 1. Student □

2. Civil servant□ 3.Unemployed□ 4.Private worker□ 5.other specify-------

5. Income level of the patient <1000 □1001-2000 □ 2001-3000 □ 3001-4000 □ >4001□

6. Living Area (Residence): 1. Urban □ 2. Rural □

7. Marital statuses, 1. single□ 2.Currentlymarried □ 3.Divorced/separated □4.Widowed□

8. Religion of respondent, 1.Protestant 2.Orthodox 3. Muslim 4. Others

9. Ethnicity 1. Oromo 2.Amhara 3.Others

10. How many children do you have? No Child □ 1-3□4-6 □ above7 □

11. Do you use smoking, chat chewing and alcoholic drinking while you were under TBtreatment?1. Yes □ 2. No □

Part II. Medical Knowledge of MDR TB bacteria

1. Do you know that TB is completely curable?Yes□No□

2. Do you take any traditional medicine or holly water during TB treatment?Yes□No□

3. Do you have/had any TB patient in your home? Yes □ No□

4. Do you have/had any TB patient in your relatives or neighbors? Yes □ No □

5. Do you know multi drug resistant tuberculosis (MDR TB)? 1. Yes□ 2. No □

6. Do you think that mdrtb is non curable? 1. Yes□ 2. No □

7. Do you have knowledge about treatment duration of MDR TB? 1. 4 months 2. 8 months 3. 12.Months 4.18 months 5. 24 months

8. Doyoutake health education (train) about MDR TB bacteriafrom doctors?

1. Yes□ 2. No □

9. What is the cause (risk factor) ofMDR TB bacteria? 1. Bacteria 2. HIV3. Previous treatment 4. Other specify_____

10. Do you know the common sign and symptoms of MDR TB disease? 1. Yes□ 2.No□

11.Is it possible to prevent MDR TB bacteria infection? 1. Yes □ 2.No□

12. How could a person with MDR TB bacteria prevent the spread of MDR TB bacteria to others? 1.Notcoughing /sneezing in front of other people □ 2.Spit in a container with cup or notspittingout in the open every where □ 3. Ventilatingthe living room/open windows □4. Other

13.How is MDR TB bacteria transmitted? 1. Airborne transmission (from coughing and sneezing) □ 2. Through overcrowding □ 3.Other specify____

14. MDR TB bacteria is influences by the factors: 1.Nutritional status □ 2.Poor living □ 3. Drug use □ 4. other

15. Do you feed properly without missing (Breakfast, lunch and dinner) on the time? 1. Yes□ 2. No □

APPEENDIKSII II

YUNVERSIITII JIMMAATTI

KOLLEEJJII SAAYINSII UUMAMAA

MUUMMEE BAYOLOOJII

1. **Gaaffilee**

Faayidaan Gaaffilee kanaaodeeffannoowaa'eedhukkubadaranyoosombaaqorichaanwalbaree (MDR TB bacteria) argachuufwaanta'eefqorannookanaafga'eenkeessanol'aanaadha.Kanaafuu, Gaaffilee armaangadiiakkaguuttankabajaanisingaafadha. Galatoomaa!

I. Haalawalii gala deebiikennitootaa

1. Saaladhiira□ dhalaa□

2. Umurii≤15□ 16-30 □ 31-45 □ 46-60 □ >61□

3. Sadarkaabarnootaadhukkubsattootaa M/barumsaKanhingaliin □ dubbisuu fi barreessuu □ sadarka1^{ffaa} (1-4) □ Sadarkaa1ffaamarsaalammaffaa(5-8) □ Sadarkaa2ffaa(9-10) □ Qophaa'ina(11-12) □ dippiloomaakolleejjii fi isaaol □

4. HaalahojiidhukkubsattootaaMindeffamaadhaabbataamiti-mootummaa□ Miindeffamaamootummaa□ HojjetaaGuyyaa□ Hojiidhuunfaakanhojjetu □ Kanbiraa_____

5. Maddagaliidhukkubsattootaa ≤ 1000 □ 1001-2000 □ 2001-3000 □ 3001-4000 □ 4001-5000 □ ≥5001□

6. Iddoojireenyadhukkubsattootaamagaalaa □ Baadiyyaa□

7. Haalafuudhaa fi heerumaaKanhinfuudhiin /heerumiin □ Kanfuudhe/heerumte□ Kanaddaba'an/walhiikan□ Kanabbaanmanaayknhatimanaairraadu' e/duute□ Deebiinhinjiru□

8. Amantiidhukkubsataa1.Pirootestaantii 2.Ortoodoksii 3. Musilima 4.Kanbiraa

9. Sabummaadhukkubsattootaa 1. Oromoo2.Amaara 3.Kanbiraa

10. Ijoolleemeeqaqabda? Hinqabu □ 1-3 □ 4-6 □ 7 ol □

11. Tamboonixuuxxaa, caatiiniqamtaa, akkasumautuuyaaliindhibeedaranyoosombaasiif Godhamualkooliinidhugdaa? Eeyyee□Lakkii □

II.Beekumsawaa'eeyaalii MDR TBbacteria (Daranyoosombaaqorichaanwalbaree)

1. DhukkubniTB (dhukkubaDaranyoosombaa) irraafayyuunnidanda'ama?

Eeyyee □Lakkii □

2. DhukkubaDaranyoosombaairraafayyuufqorichaaadaafudhatteejirta?

Eeyyee □Lakkii □

3.DhukkubsataaDaranyoosombaamanakeekeessaaniqabdaa?Eeyyee □Lakkii □

4.DhukkubsataaDaranyoosombaafirriikeeyknoollaankeeKandhukkubsatujiraa?

Eeyyee □Lakkii □

5.Dhukkubni MDR TB(dhukkubaDaranyoosombaaqorichaanwalbaree) nibeektaa?

Eeyyee □Lakkii □

6.DhukkubniMDR TB(DhukkubniDaranyoosombaaqorichaanwalbaree) irraayaalame

Fayyuun nidanda'amaa?Eeyyee □Lakkii □ hinbeeku □

7. DhukkubaDaranyoosombaairraafayyuufyaaliinisaahangamiakkata'eehubannooni

qabdaa? 1. Ji'a4 2. Ji'a 8 3.Ji'a 12 4.Ji'a18 5. Ji'a24

8. KaraaTeleviziyoonaayknRaadiyoobarumsa (leenjii) waa'ee MDR TBbaakteriyaa(daranyoo SombaaQorichaanwalbaree) yeroobarsiifamunidhaggeeffattaa? Eeyyee□Lakkii □

9. Maddi/ka'umsi/ dhukkuba MDR TB baakteriyaa (daranyoosombaaqorichaanwalbaree) Maali?Baakteriyaa □HIV□yaaliindhukkubadaranyoosombaa□Kan biro_____

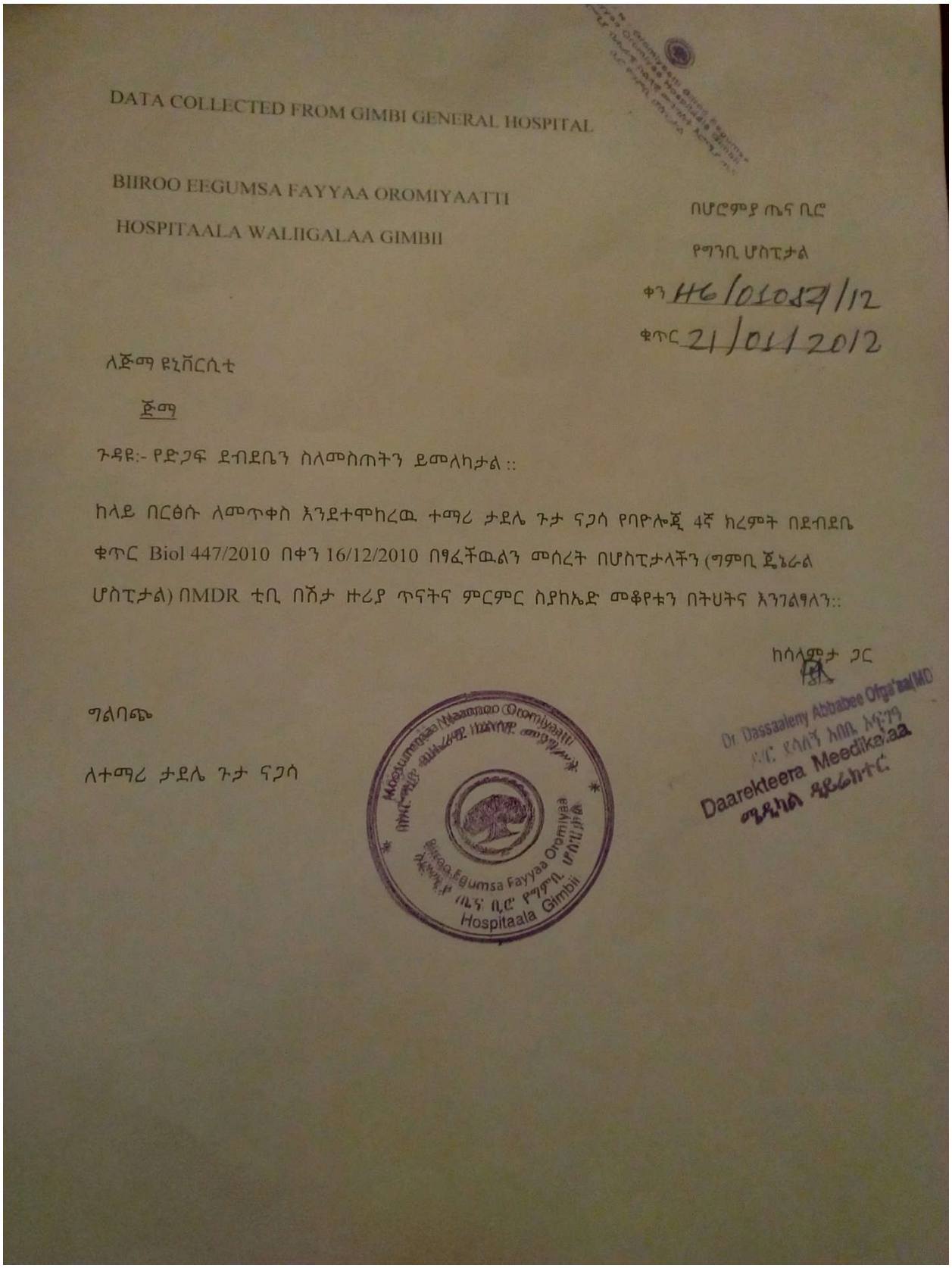
10. MallattoondhukkubaMDRTBbaakteriyaa (daranyoosombaaqorichaanwalbaree) maal fa'i?Qufaayeroodheeraa (turban lamaa fi isaaol) □ Ulfaatinniqaamaahir'achuu□ Halkan Dafqisiisuu□ Dhukkubbiilaphee □ fedhiinnyaataahir'achuu □ Ho'aqaamaa □ Hinbeeku□ kanbiraa_____

11. DhukkubaMDRTBbaakteriyaa (daranyoosombaaqorichaanwalbaree) ittisuun/to'achuun Ni danda'ama?Eeyyee□Lakkii □

12. Dhukkubsataan MDR TB baakteriyaa (daranyoosombaaqorichaanwalbaree) dhukkubichi Kanbiraattiakkahindaddarbineegochuuattamittidanda'a?Namairrattiqufa'uuyookiin Axxiffachuudhiisuu□Tufaa (akkitaa) bilqaaxiittitufuuykniddooargamettitufuudhiisuu □ Iddoojiraatankeessaqilleensiga'aanakkaseenugochuu/foddaabanaagochuu □ Dhukkubsataaqophaattibaasuu□Kanbiraa_____

13. Dhukkubni MDR TB baakteriyaa (daranyoosombaaqorichaanwalbaree) attamittidaddarba? Karaacophaqilleensaan□ Yeroonamoonniwalittibaay'ataniddotokkotti □ Kanbiraa_____

APPEENDIKSII III



DATA COLLECTED FROM GIMBI GENERAL HOSPITAL

BIIROO EEGUMSA FAYYAA OROMIYAATTI

HOSPITAALA WALIIGALAA GIMBII

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ቀን 16/04/12

ቁጥር 21/011/2012

ለጅማ ዩኒቨርሲቲ

ጅማ

ጉዳዩ:- የድጋፍ ደብደቤን ስለመስጠትን ይመለካታል ::

ከላይ በርዕሱ ለመጥቀስ እንደተሞከረዉ ተማሪ ታደሌ ጉታ ናጋሳ የባዮሎጂ 4ኛ ክረምት በደብደቤ ቁጥር Biol 447/2010 በቀን 16/12/2010 በፃፈችዉልን መሰረት በሆስፒታላችን (ግምቢ ጄኔራል ሆስፒታል) በMDR ቲቢ በሽታ ዙሪያ ጥናትና ምርምር ስያከኤድ መቆየቱን በትህትና እንገልፃለን::

ከሰላምታ ጋር

ግልባጭ

ለተማሪ ታደሌ ጉታ ናጋሳ

Dr. Dassaaleny Abbabee Ofga'aa(MD)

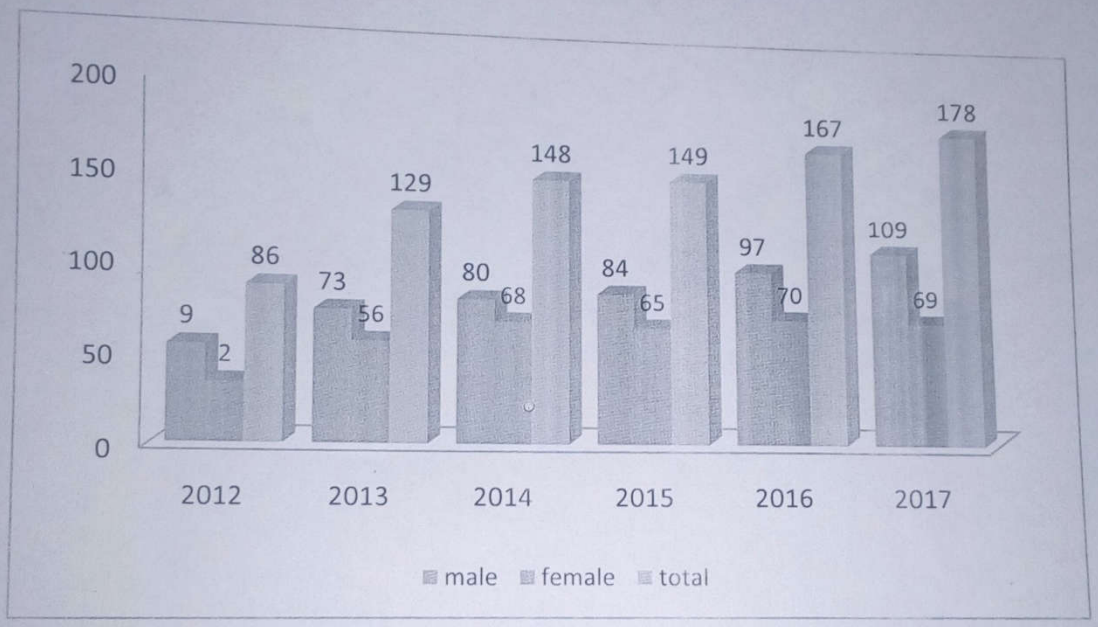
ዶ/ር ደሳለኝ አበቤ አፍጋ

Daarekteera Meedikaalaa

ሜዲካል ዳይሬክተር

TB & MDR TB Patientsfrom 2012-2018 Summarized in sex andage.

Year	Age group	TB infection						MDR TB		
		Male		Female		Total		Male	Female	Total
		No of Exam	No of +ve (%)	No of Exam	No of +ve (%)	No of Exam	No of +ve (%)	No of +ve (%)	No of +ve (%)	No of +ve(%)
2012 -2017	≤ 15	1689	33(1.95)	1732	24(1.38)	3421	57(1.66)	1(0.05)	0	1(0.02)
	16-30	5411	267(4.9)	6916	195(2.8)	12327	462(3.7)	8(0.14)	7(0.10)	15(0.1)
	31-45	4631	118(2.5)	5311	94(1.76)	9942	212(2.13)	5(0.10)	6(0.11)	11(0.1)
	46-60	3146	58(1.8)	3396	35(1.03)	6542	93(1.4)	4(0.12)	2(0.05)	6(0.09)
	≥61	1627	20(1.2)	2112	13(0.6)	3739	33(0.88)	2(0.12)	0	2(0.05)
	Total	16504	496(3.0)	19467	361(1.85)	35971	857(2.4)	20(0.12)	15(0.07)	35(0.1)
2017/ 2018	≤ 15	248	8(3.22)	156	8(5.12)	404	16(3.96)			
	16-30	369	61(16.5)	200	50(25)	569	111(19.5)	11(2.98)	2(1)	13(1.9)
	31-45	402	30(7.5)	215	19(8.83)	617	49(7.94)	4(0.99)	3(1.39)	7(1.13)
	46-60	310	23(7.4)	97	6(6.18)	407	29(7.12)			
	≥61	112	5(4.5)	56	0(0.00)	168	5(2.97)	1(0.89)	2(3.57)	3(1.78)
	Total	1441	127(8.8)	724	83(11.46)	2165	210(9.69)	16(1.11)	7(0.96)	23(1.1)



TB patients with year and sex of patient are at Gimbi General Hospital from January 2012 t
September, 2017.