TREND OF ALL TYPES OF TUBERCULOSIS AT HEALTH FACILITIES IN HARARI REGION, EASTERN ETHIOPIA: A 10 YEAR TIME SERIES ANALYSIS

MPH THESIS

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APPROVAL SHEET

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BIOGRAPHICAL SKETCH

My name is Hana Million Merine and I was born in September 21, 1997 G.C in Harar, eastern Ethiopia. I attended my elementary school at Ras Mekonnen primary and secondary school and after I finished primary school and take 8th class national exam I moved to Harar senior secondary school to attend my high school class then after taking 10th grade national exam I moved to Harar preparatory school to attend my preparatory class for university. After I finished 12th grade I attend my BSc class in Harar Health Science College and I get my BSc degree in public health from Harar Health Science College in 2019 in G.C. I started my employment at the time of covid19 pandemic as front-line worker in Ras mekonnen isolation center then I moved to Harari regional health bureau then until now I am working at Harari regional health bureau as a public health professional about 5 years. Currently I am MPH student in Haramaya University College of Health and Medical Science.

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ACRONYMS AND ABBREVIATIONS

AFB	Acid Fast Bacilli
ARIMA	Auto-Regressive Integrated Moving Average
ART	Anti-Retroviral Therapy
AIC	Akaike information criteria
BCTB	Bacteriologically Confirmed Tuberculosis
BIC	Bayesian Information Criteria
CCTB	Clinically Diagnosed Tuberculosis
CHF	Congestive Heart Failure
CNS	Central Nervous System
COPD	Chronic Obstructive Pulmonary Disease
CPT	Cotrimoxazole Preventive Treatment
CRF	Chronic Renal Failure
CSA	Central Statistical Agency
DM	Diabetes Mellitus
DHIS	Demographic Health
EFY	Ethiopian Fiscal Year
EPTB	Extra pulmonary Tuberculosis
HIV	Human Immunodeficiency Virus
HSTP	Health Sector Transformation Plan
HTN	Hypertension
MDR TB	Multi-drug Resistance Tuberculosis
MOH	Ministry of Health
OPD	Outpatient Department
PPMDOTS	Public-Private/Public-Public Mix Directly Observe Treatment, Short-Course
PTB	Pulmonary Tuberculosis
TB-HIV	Tuberculosis-Human Immune Virus Co-infection
TB	Tuberculosis
TBM	Tuberculosis Meningitis
UN	United Nation
WHO	World Health Organization

ABSTRACT

Introduction: Tuberculosis is among the leading causes of death globally. Every year more than 10 million peoples are suffering from tuberculosis. United nation and world health organization stated that urgent action is required to end the global tuberculosis epidemic in 2030. In Ethiopia, there is a scarcity of information on trend of tuberculosis particularly in this study setting. As a result, significant numbers of the total case load are outside of the conventional tuberculosis control programme and threaten the control strategy. There is limited study on trend and forecasted information of all types of tuberculosis analysed using time series analysis in Harar governmental and private health facilities.

Objective: To assess and forecast the trend of all types of tuberculosis in government and private health facilities in Harar, Eastern Ethiopia from 2007EFY - 2016EFY (July 08, 2014G.C-July 07, 2024G.C). Data extraction was conducted from July 10-20, 2024.

Method: In this study all type of tuberculosis cases reported to Harari regional health bureau was included quarterly in the last 10 years and data were extracted from District health information system of Harari regional health bureau. Routine surveillance-based time series analysis was conducted to assess the trend of all types of tuberculosis. Autoregressive integrated moving average model have been used to forecast all types of Tuberculosis cases. STATA software version 17 and Time series analysis have been used for analyzing the data.

Results: Based on this research finding, number of all forms of tuberculosis cases in the last ten years (2007-2016EFY) have been increased significantly. The forecasting result of this research also shows that the number of all forms of tuberculosis will be increased in the next six years in the same increasing range of in the past ten years. In addition to that in the last ten years treatment outcome of all forms of tuberculosis cases were good but still there is death, failed to treatment, loss of treatment and moved to MDR-TB list cases were increased in the past ten years.

Conclusion: The number of tuberculosis cases over the past ten years in Harari region has increased year to year among young adults and the number of forecasted or predicted tuberculosis cases to be detected in the next six years will also increase in the same number of TB cases in the past ten years.

Key word: Trend, Tuberculosis, extra pulmonary tuberculosis, pulmonary tuberculosis, Eastern Ethiopia, Harar

1. INTRODUCTION

1.1. Background

Tuberculosis (TB), preventable and curable infectious disease, is one of the leading causes of death in our world. A goal that has been adopted from members of united nation (UN) and world health organization (WHO) stated that urgent action is required to end the global TB epidemic in 2030 (WHO, 2023). TB is caused by bacteria called Mycobacterium tuberculosis. TB commonly affected lung. TB is highly infectious disease because it spreads in the air when infected person (a person with active TB) sneezes, coughs (Swalehe and Obeagu, 2024).

We classified Mycobacterium tuberculosis as a group of M. tuberculosis complex it is an alcohol, rod shaped and acid-fast bacillus. Other members of M. tuberculosis complex are Mycobacterium africanum, Mycobacterium bovis, and Mycobacterium microti (Zaman, 2010). Utmost, other mycobacteria organisms are classified as non-tuberculosis or atypical mycobacterial organisms. The organism is neither gram-positive nor gram-negative because of a veritably poor response with the Gram stain. Weakly positive cells can occasionally be demonstrated on Gram stain, a miracle known as" ghost cells (Adigun and Singh, 2024).

There are three stages of TB, the first stage is primary infection the second stage is latent TB infection, and the last stage is active TB disease. When TB is in the first stage a person has been exposed to another person who has TB or a person have contact with TB infected person but the exposed person has no any sign and symptoms, skin test will be negative and chest x-ray will be normal. When TB infection is in the second stage, a person has TB bacteria in his/her body, positive skin test and normal chest x-ray but does not have symptoms of disease. If the infected person has high/good immune system for TB organisms TB remains in active throughout life. When TB infection is in the last stage a person have sign and symptoms of active TB infection their skin test and chest x-ray become positive (Haulman *et al.*, 2008).

When TB infection occurs outside the lung we call it extra pulmonary tuberculosis (EPTB). EPTB includes tuberculosis meningitis, skeletal tuberculosis, abdominal tuberculosis, genitourinary tuberculosis (renal TB), spine tuberculosis (Pott’s disease) and lymphadenitis. From all cause of TB 15-25% of TB accounts for extra pulmonary tuberculosis (Haulman et al., 2008).

It is difficult to diagnose EPTB than pulmonary TB because clinical samples obtained from relatively inaccessible sites may be pauci bacillary, thus decreasing the sensitivity of diagnostic tests (Lee, 2015).

Sign and symptoms of EPTB specially related to the affected organ system Lymphatic tuberculosis most often affect those of the neck and supraclavicular regions (scrofula). Tuberculosis of the bone and joints usually causes extreme and persistent localized pain and swelling. An exception may be Pott's disease of the spine, which can progress insidiously and become advanced before diagnosis (Haulman et al., 2008).

1.2 Statement of the Problem

Every year more than 10 million peoples are suffering TB Worldwide (WHO, 2023). In 2019 an estimated 10 million people have got TB infection and it takes the lives of 1.2 million people (WHO, 2020). Globally around 3.3% of new cases and 17.7% previously treated cases have rifampicin resistance TB or multi drug resistance TB (MOH, 2021).

Ethiopia is one of the high TB and TB-HIV burden countries with an estimated TB incidence rate of 140/100000 (157000 persons annually) and 19/100000 (21000) population TB death in 2018. In the last decades Ethiopia experienced a decline in TB mortality. In 2020 TB treatment coverage to be 71% among estimated incident TB cases with total of 108,196 persons with all form of TB notified to the national programme. Among notified cases in 2020, bacteriologically confirmed cases were 41%, clinically confirmed cases were 27% and 31% were extra pulmonary TB cases (MOH, 2021).

In Ethiopia, there is a scarcity of information on the trends of TB. A report from Harari Regional Health Bureau indicated that there is an increasing trend in TB caseload in the last few years (MOH, 2021). As a result, significant numbers of the total case load are outside of the conventional TB control programme and threaten the control strategy. Failure to diagnose, treat and monitor the treatment outcomes of TB can have serious health consequences.

Therefore, the current study is proposed to generate valid data on the circumstances of TB in order to further strengthen the existing TB control programme in Harar, eastern Ethiopia. Unfortunately, besides there are a few studies done in Ethiopia (Dememew *et al.*, 2016, Zewudie *et al.*, 2021, Nigatu and Abraha, 2010, Mengesha *et al.*, 2021, Fisseha, 2018, Fiseha *et al.*, 2015, Dangisso *et al.*, 2014, Alemu and Gutema, 2019), especially to the best of investigator knowledge in this study setting there is no study on trend of tuberculosis analysed using time series analysis.

In addition to that there was no any forecasted information about TB trends, therefore this study was filling this gap through analysing trend of TB by time series analysis and forecasting it for the next six years based on the 10 years trend analyses.

1.3. Significance of the study

The findings from this research will inform Health sector transformational plan department of Harari regional health bureau through filling the information gap on trends of tuberculosis and predicting the trends of TB in the next six years and giving clues how could achieve the Sustainable development goals and build up treatment system of TB.

The findings of this study provided information supporting policy makers and healthcare planners at various levels for developing appropriate interventions. Lastly, the findings contributed to the existing literature on trend of tuberculosis by employing time series analysis approach.

1.4 Objectives of the Study

1.4.1 General Objective

- To assess and forecast the trend of tuberculosis in Harar Region, Eastern Ethiopia from 2007EFY-2016EFY. Data extraction was conducted from June 10 - 20, 2024.

1.4.2 Specific Objectives

1. To determine the trend of tuberculosis in Harar, Eastern Ethiopia
2. To forecasting the trend of tuberculosis for the next six years

2. LITERATURE REVIEW

2.1. Trends of Tuberculosis

2.1.1. Magnitude of tuberculosis

According to global TB report 2021, in most of the high TB burden countries monthly and quarterly notifications of newly diagnosed people with TB in 2020 and first half of 2021 were substantially below the average for 2019. In annual notifications between 2019 and 2020 the largest relative reduction were seen in Gabon (80%), the Philippines (37%), Lesotho (35%), Indonesia (31%) and India (25%) (WHO, 2021).

As WHO stated, in 2022 deaths that related to TB was 1.30 million, it is down from best estimates of 1.4 million in 2020 and 2021. The estimated number of deaths that related to TB was relatively stable between 2021 and 2022 in south East Asia and western pacific regions but in America the estimated number of death by TB continued to rise in the same year (WHO, 2023).

As a study conducted in Rio de Janeiro, Brazil, ‘’death due to TB was significantly higher among patients with EPTB than those with PTB which is EPTB 5(33.3%) and PTB 4(3.6%). The most frequent unfavourable outcome in EPTB is 4(80%) patients died due to TBM which is one death in those under five children’s, two in those aged 10-14years and one in those aged 15-18 years. Among these patients none were TB-HIV co-infected, ¾ (75%) were male and one was malnourished’’ (De Oliveira *et al.*, 2021) .

A study conducted in Africa concludes that, since the early 2000s in four African countries (Burundi, Benin, Burkina Faso and Botswana) there was decline in their infected population. Botswana’s decline has been especially sharp since 2005, and despite a slight rise during the COVID-19 pandemic. Burkina Faso and Benin are projected to maintain their historical rates of decline, while Burundi is likely to accelerate its reduction of cases. Angola, on the other hand, had a rapid increase in infections from 2000 to 2010, followed by a decrease until 2020. (Ojo *et al.*, 2023).

Among 22 high burden countries Ethiopia ranked 7th in the world and in Africa Ethiopia is in the second stage. In Ethiopia the second top cause of mortality and the third cause of hospital admission is tuberculosis (Hasen Badeso *et al.*, 2022).

A study conducted in Ethiopia stated that, annual rate of change in age standardised incidence of multi drug resistant tuberculosis among HIV negative individuals was increased by 1.3% from 2016 to 2019 at national level, its much lower than from 1990 to 2015 (12.86%), but annual mortality rate decreased by 3.1% from 2016 to 2019 great improvement from 1990 to 2015 (9.18%). Based on this we can estimate that the burden of extensively drug resistant TB had increased globally. Beside that annualized age standardized rate change in the incidence of extensively drug resistant TB was increased by 4.24% from 2016 to 2019 which is higher rate of change than in 1990 to 2015 (22.03%), but mortality rate was decreased by 0.23%, still higher rate of change in 1990 to 2015 (+16.85%) (Wolde *et al.*, 2023).

2.1.2. Demographic characteristic

A study conducted in Mahatma Gandhi Mission medical college, Aurangabad, stated that the study recorded and analysed 400 patients with pulmonary and extra pulmonary tuberculosis those who attending the respiratory medicine OPD, Mahatma Gandhi Mission medical college, Aurangabad. This study divided the study participants as EPTB patients and PTB patients. From those patients 80(64%) and 107(61%) were male with EPTB and PTB, respectively (Mani *et al.*, 2023). As a study conducted in Iran stated, proportion of TB cases were 53.7% in female study participants (Shirzad-Aski *et al.*, 2020).

A study conducted in Malatya, Turkey, includes 397 TB patients whose TB diagnoses were confirmed by mycobacterial culture. From those 397 TB cases 103 of them were EPTB cases and women and men each accounted for half of the cases. The male to female ratio for PTB was higher than that for EPTB (Gunal *et al.*, 2011). In study conducted in Tepi public health centre, Ethiopia, among 1651 TB patients registered at the time period between June 2011 and May 2018 who were included in the study 924(56%) patients were males (Zewudie et al., 2021). A study conducted in Harar town, in Hiwot Fana Specialized University Hospital and Jugal Hospital stated the socio-demographic characteristic as follows, in the study 1236 TB patients document were reviewed, from those 59.8% of TB patients were male(Tola *et al.*, 2019).

A study conducted in Mahatma Gandhi Mission medical college, Aurangabad, stated that, the mean age of the patients with EPTB were 46.2±8.4 and for patients with PTB were 43.7±7.3 years (Mani *et al.*, 2023). Study conducted in Iran stated that, the mean age of the patients was 40.55 (±16) years and the youngest patient were 2 years old female and the

oldest patient were 90 years old male (Shirzad-Aski *et al.*, 2020). A study conducted in Malatya, Turkey stated that, the median age for PTB was 30 years the age range is between 2 to 89 and the median age for EPTB was 33 years and the age range is between 1 to 80 (Gunal *et al.*, 2011). In study conducted in Tepi public health centre, Ethiopia, 1053(63.8%) of patients were in the age range of 15 to 35 years and the median age was 25 with an interquartile range of 14. At the time of ignition of treatment, the mean and median weight is 44.51 and 46.68kgs (Zewudie et al., 2021).

A study conducted in Harar town, in Hiwot Fana Specialized University Hospital and Jugal Hospital stated, 363(29.4%) study participant were in the age range of 25-34 years and 355(28.7%) were in the age range of 15-24 years. In addition to that weight range of the study participant were between 6 to 89kg with mean weight of 48.9kg 59.7% of the participants weighted 38-54kg (Tola *et al.*, 2019).

According to a study conducted in Egypt, ‘’all sites that affected by TB whether it is PTB or EPTB were more common in school-aged children except for tuberculosis CNS affection, that was more in pre-school children. This finding is consistent with other studies were CNS TB was more common in early childhood especially between 6 month and 5 years of age. This is possibly due to this age being more vulnerable to malnutrition and viral infection, which renders pre-school children more vulnerable for CNS TB’’ (Basanti *et al.*, 2021).

2.1.3. Clinical characteristic

The study conducted in Mahatma Gandhi Mission medical college, Aurangabad showed in the result that, the most common sites of infection were lymph nodes (40%), pleura (28%), peritoneum (15%) and bone (7%). From the study participants the most common systemic disorders accompanying with EPTB were DM (8.8%), CRF (6.4%), COPD (3.2%), HTN (5.6%), CHF (2.4%), Lymphoma (3.2%) and HIV (1.6%) and accompanying with PTB were DM (9.1%), CRF (6.9%), COPD (5.7%), HTN (7.4%), CHF (5.1%), Lymphoma (4.0%) and HIV (2.3%) (Mani et al., 2023).

A study conducted in Iran shows that, from the study participant’s total of 9.7% and 6.9% had a TB history in the past and co-infection with HIV. Based on their lifestyle and past medical history, 39.57% were diabetic and 42.36% were drug addicted so this study shows that diabetes and drug addiction were other important factors related to EPTB. This study

also figures out the two main and frequent forms of EPTB which is 31.7% (193/609) were lymphatic TB and 25.9% (158/609) were plural TB. Additionally this study categorised rare infection sites as 'other group' as follows bone and joint 16.74% (102/609), breast 11% (67/609), urogenital system 6.89% (42/609), gastrointestinal system 1.97% (12/609) and meninges 1.31% (8/609) (Shirzad-Aski et al., 2020).

As a study took place in Tepi public health centre, from the study participants 457(27.7%) were EPTB and 1194(72.3%) were PTB. From those who were PTB patients 683(41.4%) were smear negative PTB. About 632 patients from the study participants were known HIV positive patients with 443(26.8%) non-reactive and 187(11.4%) were reactive status. From all types of TB cases about 1469(90%) of the cases were new TB cases while 158(9.6%) were transferred from other TB clinics and 23(1.4%) were previously treated or relapsed cases (Zewudie et al., 2021).

According to a study conducted in kality federal prison Addis Ababa, Ethiopia, during 2009-2017 proportion of EPTB was lower among those with a previous TB diagnosed patients compared to newly diagnosed beside that among TB HIV co-infected individuals EPTB was 27% lower compared to HIV sero-negative TB patients. Having microbiologically confirmed PTB was similar among previously and newly diagnosed TB patients. The likelihood of microbiologically confirmed PTB was 22% which is lower among HIV sero-positive PTB patients compared to HIV sero-negative PTB patients. ''The likelihood of TB-HIV co-infection among those with a previous history of TB was 37% higher than newly diagnosed. The likelihood of co-infection among clinically diagnosed pulmonary TB cases was 1.32 times the likelihood of co-infected among microbiologically confirmed pulmonary TB cases (Amirkhani *et al.*, 2021).

According to a study conducted in Harar town, in Hiwot Fana Specialized University Hospital and Jugal Hospital, the reviewed TB patient's document shows that 97% of the attendants were new TB cases. Pulmonary TB accounts about 61.2% whom 52.9% were smear positive, 282(22.8%) were HIV positive whom 250(88.7%) and 258(91.5%) were on ART and cotrimoxazole preventive treatment (CPT). Extra pulmonary TB slightly increased in the time 2011 to 2015 from 31.1% to 43.3% in proportion to al forms of TB cases. However, the proportion of smear positive pulmonary TB decreased from 40.1% to 21.3% in the first three years of the study period (Tola et al., 2019).

2.1.4. Treatment Outcome

In the study conducted in Mahatma Gandhi Mission medical college, Aurangabad, the distribution of treatment and outcome stated as follows, from the study participants with EPTB 91(72.8%) were completed their treatment, 34(27.2%) were defaulters, 86(68.8%) were recovered and the rest of 8(6.4%) were died and from the study participant with PTB 117(66.9%) were completed their treatment, 58(33.1%) were defaulter, 93(53.1%) were recovered and 17(9.7%) were died (Mani et al., 2023).

A study conducted in Addis Ababa to determine the treatment outcome of Directly Observed Treatment Short Course in all government owned health centers result showed that, from 6450 analysed Tb patients 1167(18%) were cured, 4164(64.6%) were completed their treatment, 2.36(3.7%) were died, 26(0.4%) were treatment failure, 328(5.1%) were defaulted and the rest 351(5.4%) were transferred out (Getahun *et al.*, 2013).

According to Tepi public health centre study, from the study participants 952(57.7%) were completed their treatment, 415(25.1%) were cured, 238(14.4%) were transferred out and the rest of 39(2.4%) were died during the follow up. In this study the overall treatment success rate was 80.4% that had shown an increasing trend in the first four years (from 2010 to 2014) and decreasing in the following four years (from 2015 to 2018) (Zewudie et al., 2021).

As a result of the study conducted in Harar town, in Hiwot Fana Specialized University Hospital and Jugal Hospital, among TB patients those who participate in the study ‘’376(30.4%) were cured, 767(62.1) had completed their treatment, 48(3.9%) were dead, 30(2.4%) were defaulted and 15(1.2%) were failed treatment’’. Concerning trend of treatment outcome of TB patients, ‘’the cure rate was high in the year 2011(38.1%) and low in the year 2013(19.8%). The default rate showed slight increment during the review period 1.3% in the year 2011 to 3.4% in the year 2015. The death rate showed a reduction in the first three years (2011-2013) from 6.1% to 2.0% and then started to increase in the last two years of the study period (Tola et al., 2019).

2.2 Forecasting trends of tuberculosis

A study conducted in Benin, analysis's tuberculosis cases in time period of 15 years from 2000 up to 2014 and it concludes that in Benin number of TB cases were decreased among males and young adults. Based on this finding the study was forecasted that the number of TB cases will be decreased in the next five year (Ade *et al.*, 2016).

The study conducted in north-eastern Brazil stated that, the trend of tuberculosis were decreasing, even before the covid-19 pandemic for both sex and age. So based on this evidence (result) the study forecasted that the disease would have achieved a level of stability in the city in the next years of after this study conducted, However it might have been aggravated by the pandemic (De Andrade *et al.*, 2021).

A study conducted in Africa concludes that, since the early 2000s in four African countries (Burundi, Benin, Burkina Faso and Botswana) trend of tuberculosis expected to continue dropping until 2030, though at a slower pace. The model predicts a modest rise in cases for Angola in the next decade. The Central African Republic has shown no significant change in its infection rate for the past 20 years, and the model does not anticipate any changes by 2030 (Ojo *et al.*, 2023).

3. MATERIALS AND METHODS

3.1. Study Area and period

This study was conducted in Harar which is one of Regional States of the Federal Democratic Republic of Ethiopia with projected population 283,000.Of these, 143,000 (50.53%) and 140,000 (49.47%) are males and females, respectively (CSA, 2023). The region is found in the eastern part at a distance of 526 km away from Addis Ababa, the capital city of Ethiopia.

Tuberculosis diagnosis and treatment are provided in four hospitals (two public, one private and one government non-public) and nine health Centre. In addition to that there is a Tuberculosis treatment Centre in the region which host and provide the large number of TB diagnosis treatment and cares. In line with this national linkage and referral system their system for the transfer in and out of the patient based on the different assumption of the patients. In regards to the AFB Microscopy Centre, there are three Public hospital hospitals and three public health Centre which provide the services. On the other aspect, three hospital and two clinics which are in PPM-DOTS health facilities provide the AFB Microscopic examination (MOH, 2021).

Data collected from 2007EFY-2016EFY (July 08, 2014G.C-July 07, 2024G.C) and was extracted from July 10-20, 2024.

3.2. Study Design

In this study routine surveillance-based time series analysis was conducted.

3.3 Population

3.3.1 Source population

All type of tuberculosis diagnosed and confirmed cases registered in all government and private health facilities in Harar and reported to Harari regional health bureau.

3.3.2. Study population

All type of tuberculosis diagnosed and confirmed cases registered in all government and private health facilities in Harar and reported to Harari regional health bureau from 2007EFY-2016EFY (July 08, 2014G.C-July 07, 2024G.C).

3.4 Inclusion and Exclusion Criteria

3.4.1 Inclusion criteria

All type of tuberculosis cases reported to Harari regional health bureau from 2007EFY-2016EFY (July 08, 2014G.C-July 07, 2024G.C).

3.4.2 Exclusion criteria

Cases with incomplete data such as unknown treatment outcome and unknown age group were excluded.

3.5 Sample Size Determination

All types of TB cases those reported to Harari regional health bureau in the context of EHMIS and DHIS reporting format in the past ten years (2007EFY and 2016EFY (July 08, 2014G.C-July 07, 2024G.C)) have been chosen. In addition, all government and private health facilities reports their data to Harari regional health bureau quarterly according to electronic health management information system (EHMIS) and district health information system (DHIS) reporting formats of TB.

3.6 Sampling Procedure and Techniques

Census type sampling procedure was employed

3.7 Data Collection Methods

3.7.1 Data collection instrument

The checklist that was adapted from different literature (Hasen Badeso et al., 2022, Negash *et al.*, 2020, De Andrade et al., 2021) and designed in English to extract information from EHMIS and DHIS report**.** The checklists consist of variables such as year of diagnosis, quarter of diagnosis, sex, treatment outcome and age.

3.7.2 Data collector and supervisor

There was one data collector who are BSc degree holder involved in this study and extract data from EHMIS and DHIS based on the prepared adapted checklists while maintaining the privacy and confidentiality of the data obtained from the records. Finally, the principal investigator has been reviewed each record to ensure its accuracy, consistency, and completeness before exporting data from STATA for analysis.

3.7.3 Data collection procedure

After approval letter obtained from institutional health research ethics review committee (IHRERC) of college of health and medical sciences of Haramaya University the official letter was written to Harari regional health bureau head office. Then after explaining the purpose of the study the permission was obtained from Harari regional health bureau to access the reported data of confirmed tuberculosis cases from 2007EFY-2016EFY (July 08, 2014G.C-July 07, 2024G.C) in Microsoft excel format and extracted relevant information based on adapted checklist from it.

3.8 Variables

3.8.1 Dependent variable

Trend of all types of Tuberculosis
Forecasted trend of Tuberculosis

3.8.2 Independent variables

Socio-demographic characteristics: age, sex, residence and weight
Types of TB: Extra pulmonary tuberculosis, pulmonary tuberculosis, lymphadenitis
Treatment outcome: cured, died, defaulter, complete their treatment, lost to follow up
Comorbidities: Diabetes mellitus, Hypertension, HIV, Cancer, congestive heart failure

3.9 Operational Definition

Pulmonary Tuberculosis (PTB): A persistent and progressive cough, often accompanied by specific systemic symptoms such as fever, night sweats or loss of weight is the commonest presentation of pulmonary tuberculosis (MOH, 2021).

Smear Positive Pulmonary TB (PTB+): A patient with at least two initial sputum smear examination positive for AFB by direct microscopy or a patient with one initial smear examination positive for AFB by direct microscopy and culture positive or a patient with one initial smear positive for AFB by direct microscopy and radiographic abnormalities consistent with active TB as determined by a clinician (MOH, 2021).

Smear Negative Pulmonary TB (PTB-): A patient having symptoms suggestive of TB with at least three initial examinations negative for AFB by direct microscopy or no response to a course of broad-spectrum antibiotics or three negative smear examination by direct microscopy or radiological abnormalities consistent with pulmonary tuberculosis or

decision by a clinician to treat with a full course of anti-tuberculosis or a patient whose diagnosis Is based on culture positive for M. tuberculosis but three initial smear examinations negative by direct microscopy (MOH, 2021).

Extra-pulmonary Tuberculosis (EPTB): Patients may present with non-specific symptoms such as unintentional weight loss, night sweats and fever for more than 2 weeks. Other symptoms depend on the site or organ affected (MOH, 2021).

New Case: A patient who never had treatment for TB or has not been on anti-TB treatment for less than four weeks (MOH, 2021).

Treatment Failure: A patient who while on treatment is smear positive at the end of the fifth month or later after commencing. Treatment failure also include a patient who was initially sputum smear negative but who becomes smear-positive during treatment (MOH, 2021).

Cured: Initially smear-positive patient who is sputum smear-negative at or one month prior to the completion of treatment and on at least one previous occasion (usually at the end of the second or fifth month) (MOH, 2021).

Treatment Completed: A patient who completed treatment but for whom smear result are not available at seventh month or one month prior to the completion of treatment (MOH, 2021).

Died: A patient who dies for any reason during the course of treatment (MOH, 2021).

Transfer Out: A patient who started treatment and has been transferred to another reporting unit and for whom the treatment outcome is not known at the time of evaluation of treatment results (MOH, 2021).

Defaulter: A patient who has been on treatment for at least four weeks and whose treatment was interrupted for eight or more consecutive weeks (MOH, 2021).

Trend of Tuberculosis: indicate trends of all types of tuberculosis.

3.10 Data Quality Control

To ensure the quality of data, each data that was obtained from reported cases to Harari health bureau database in Microsoft excel format has been checked one by one for completeness and accuracy of entered information in each quarter from each health facility in each year, then if any incomplete and inaccurate data per checklist, the data was excluded and only those data that fulfil the requirement of checklist have been transferred to STATA version 17 for analysis and forecasting of the TB trend.

3.11 Data Processing and Analysis

After the data was obtained and organized in the form of the checklist with excel format then the data was imported to STATA version 17 and checked for incompleteness and inconsistencies of data before analysis. After managing the data, the notified bacteriologically confirmed tuberculosis, clinically diagnosed tuberculosis and extra pulmonary tuberculosis were described. For time series analysis data was declared to be time series data and the stationarity of the data was checked by dfuller test. To make data stationary differencing operator was applied. The autocorrelation and partial autocorrelation plot were applied to visualize periodicities and to identify parameters of ARIMA model. ARIMA model was fitted and forecasting trend of all form of tuberculosis cases in the next six years was done. Due to model selection process the investigator uses the AIC, BIC criteria which is the smallest AIC, BIC was the best fitting model so based on that the investigator chooses the best fitting model.

3.12 Ethical Consideration

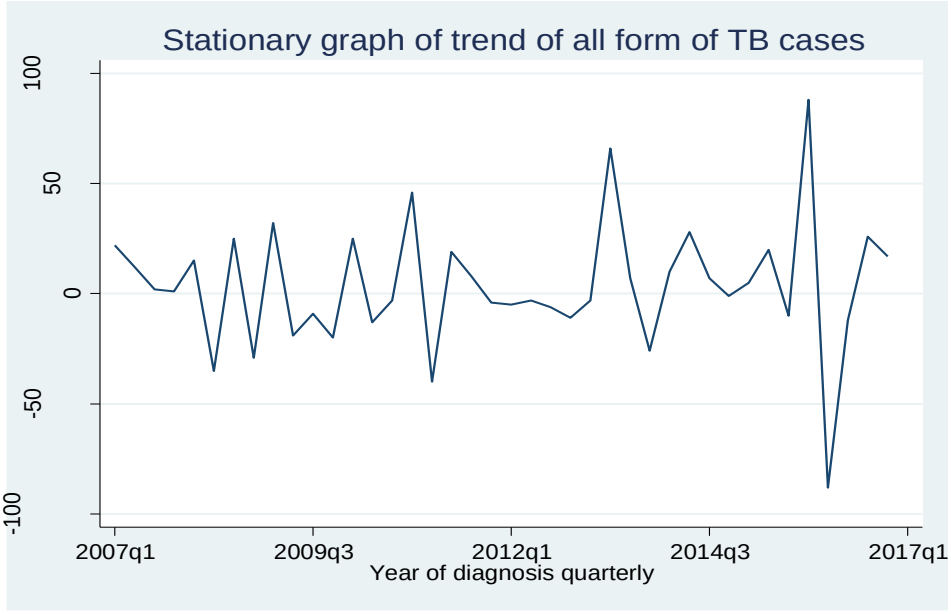
The ethical approval letter for study was obtained from the Institutional Health Research Ethics Review Committee (IHRERC) of Haramaya University College of Health and Medical Science with reference number of IHRERC/128/2024. An official letter of agreement and an informed, voluntary, written and signed consent was obtained from Harari regional health bureau after the nature of the study is fully explained to them. Confidentiality of data have been maintained throughout the research process by giving code of records.

4. RESULTS

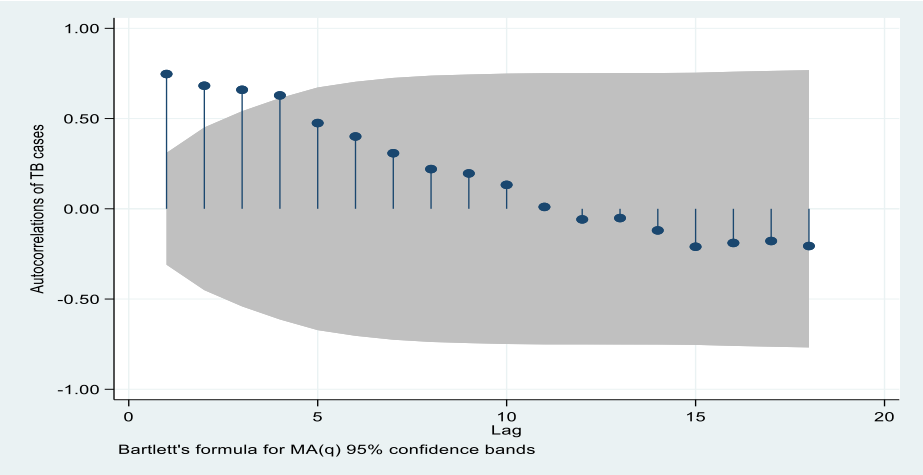
4.1. Trend of All Form of Tuberculosis

The number of notified TB cases in the time period of 2007 up to 2016 (EFY) was 6101. The trend of diagnosed TB patients seen consecutively in **(**Error! Reference source not found.**).** Tuberculosis cases were increased between year 2013EFY and 2016EFY. The maximum number of diagnosed TB cases were reported in year of 2014, 2015 and 2016(EFY). In year 2014(EFY), 2015(EFY) and 2016(EFY), 755, 939 and 896 newly diagnosed TB cases were reported respectively. Furthermore, after covid 19 pandemic there was some increment in newly diagnosed TB cases.

Figure 1(A) represents trend of all form of tuberculosis cases in the last 10 years after the data become stationary, figure 1(B) shows the autocorrelation of stationary tuberculosis data, figure 1(C) represents the partial autocorrelation of stationary tuberculosis data and figure 1(D) represents the actual and predicted trend of all form of tuberculosis cases in the last 10 years at Harari region, eastern Ethiopia **(**Error! Reference source not found.**).**



2(A)



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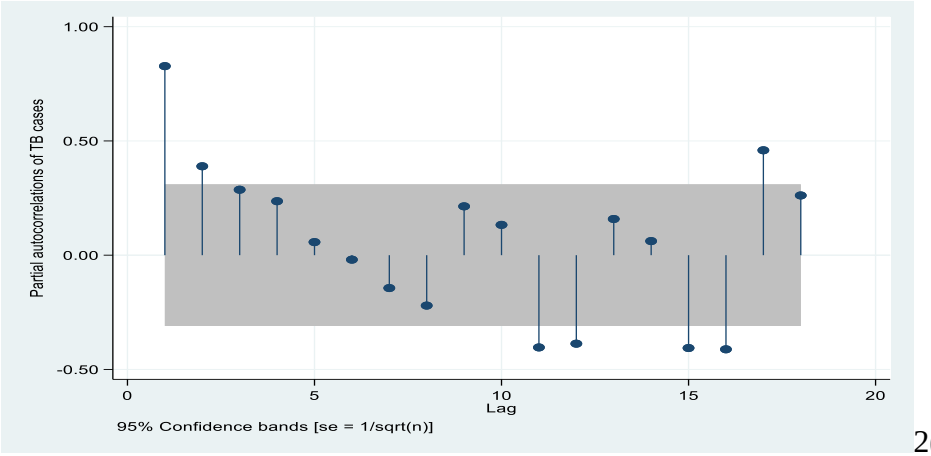

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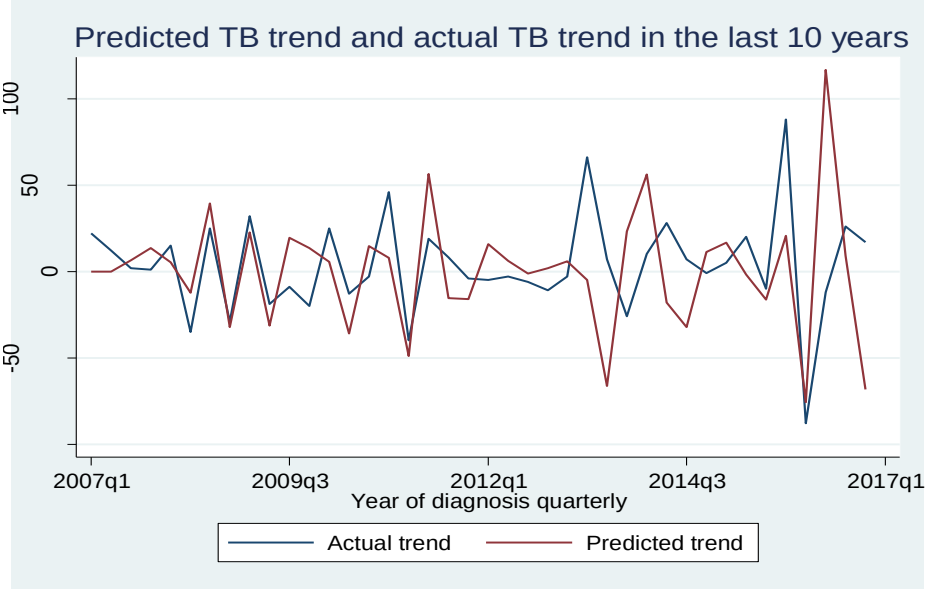

2(D)

Figure 1: Trend of all forms of notified TB cases in the last 10 years at health facilities in Harari region, eastern Ethiopia.

4.2. Trend of Three Types of Tuberculosis

Based on this study finding number of bacteriologically confirmed tuberculosis cases were high in year of 2010(EFY) and it becomes lower in the next two years then after two year again number of bacteriologically confirmed tuberculosis cases increased gradually starting from year 2013(EFY) up to 2016(EFY). The highest number of bacteriologically confirmed tuberculosis cases recorded were in year of 2016(EFY).

Again, clinically diagnosed tuberculosis cases were high in year of 2008(EFY) and it fluctuates in the range of 115 and 155 in the year between 2009 and 2013(EFY) then after year of 2013(EFY) the number of clinically diagnosed tuberculosis cases gradually increased and in year of 2015(EFY) the higher number of clinically diagnosed tuberculosis cases were recorded.

Number of clinically diagnosed and bacteriologically confirmed extra-pulmonary tuberculosis were ranges between 104 and 184 in the first seven years (2007EFY-2013EFY) then in the next three years (2014EFY-2016EFY) number of clinically diagnosed and bacteriologically confirmed tuberculosis cases were increased gradually. The maximum number of clinically diagnosed and bacteriologically confirmed extra pulmonary tuberculosis cases were recorded in the year of 2016(EFY). Figure 2 represents trend of three types of tuberculosis cases in the last 10 years at Harari region, eastern Ethiopia **(Figure 2).**

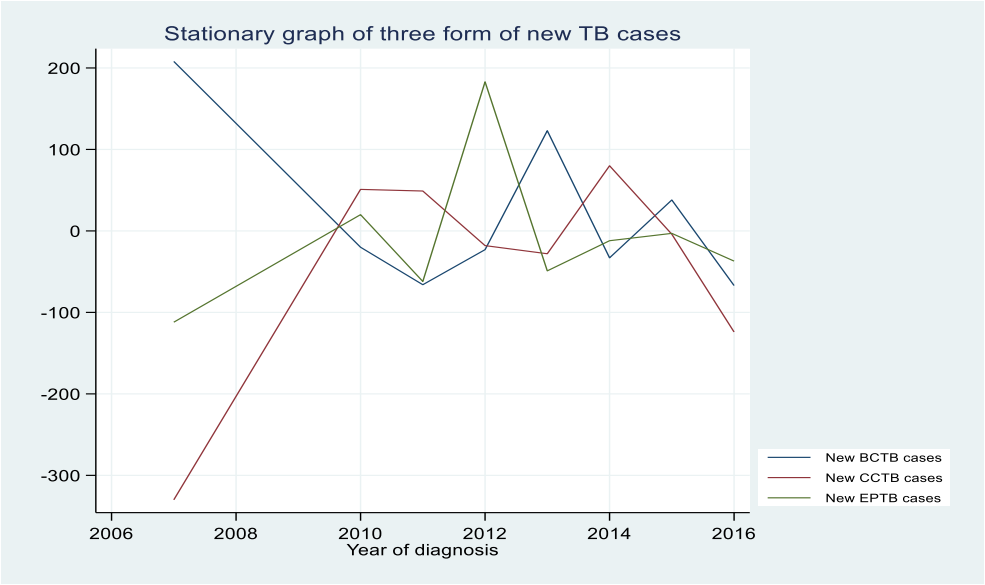

Figure 2: Trend of confirmed TB cases that classified in three types of TB cases in the last 10 years at health facilities in Harari region, eastern Ethiopia.

4.3. Trend of All Form of Tuberculosis by Age Classification

From total number of all forms of tuberculosis cases in the last 10 years the highest number of tuberculosis cases were registered in the age group of 25-34. However, in year of 2011, 2013, 2015 and 2016(EFY) the highest number of tuberculosis cases were registered in the age group of 15-24. The maximum number of tuberculosis cases from the age group of 25-34 were recorded in the year of 2015(EFY) which is 236 and the maximum number of tuberculosis cases that was registered in the age group of 15-24 were recorded in the year of 2015(EFY) which is 264. Figure 3 shows the trend of all forms of tuberculosis by age category in the past 10 years at Harari region, eastern Ethiopia **(Figure *3*).**

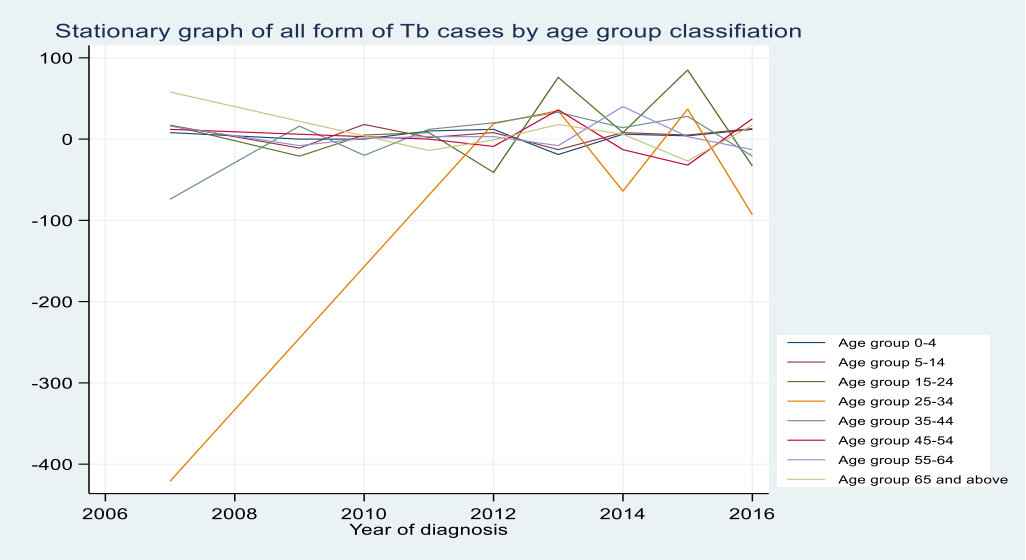

Figure 3: Trend of confirmed TB cases that classified in age group in the last 10 years at health facilities in Harari region, eastern Ethiopia.

4.4. Trend of All Forms of Tuberculosis by Sex Classification

From total number of all form of tuberculosis cases that was registered in the last 10 years 3515 were male and the rest 2586 were female. From those male patients' high number of patients were reported in the first two years (2006EFY and 2007EFY) and in the last four years (2013EFY – 2016EFY) besides from those female patients' high number of cases were reported in the last three years (2014EFY – 2016EFY). The maximum number of male patients were reported in 2015EFY which was 550 and the maximum number of female patients were reported in 2016EFY which was 398.

Figure 4 represents trend of all form of tuberculosis cases in both sex category in the last 10 years at Harari region, eastern Ethiopia (**Figure *4***).

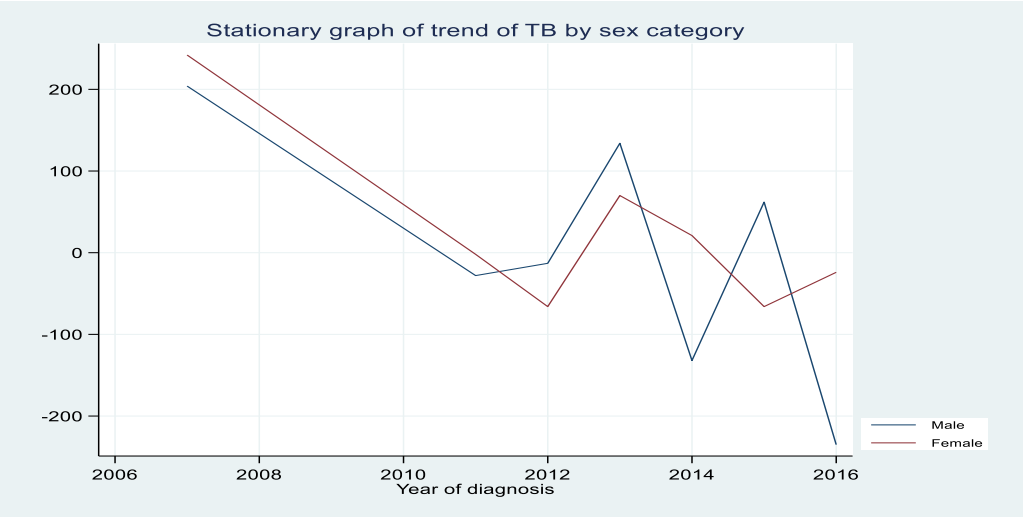

Figure 4: Trend of confirmed TB cases that classified in sex category in the last 10 years at health facilities in Harari region, eastern Ethiopia.

4.5. Trend of Treatment Outcome of Bacteriologically Confirmed Tuberculosis

From total number of bacteriologically confirmed tuberculosis cases that was reported in the last 10 years which is from 2007-2016EFY almost all of the cases were cured. 62 cases were complete their treatment, 9 cases were lost their follow up, 25 cases were dead. Those whose treatment outcome was failed were 10 and finally those who were moved to MDR-TB registries were 5. Figure 5 shows that treatment outcome of bacteriologically confirmed tuberculosis in the past 10 years Harari region, eastern Ethiopia **(Figure *5*).**

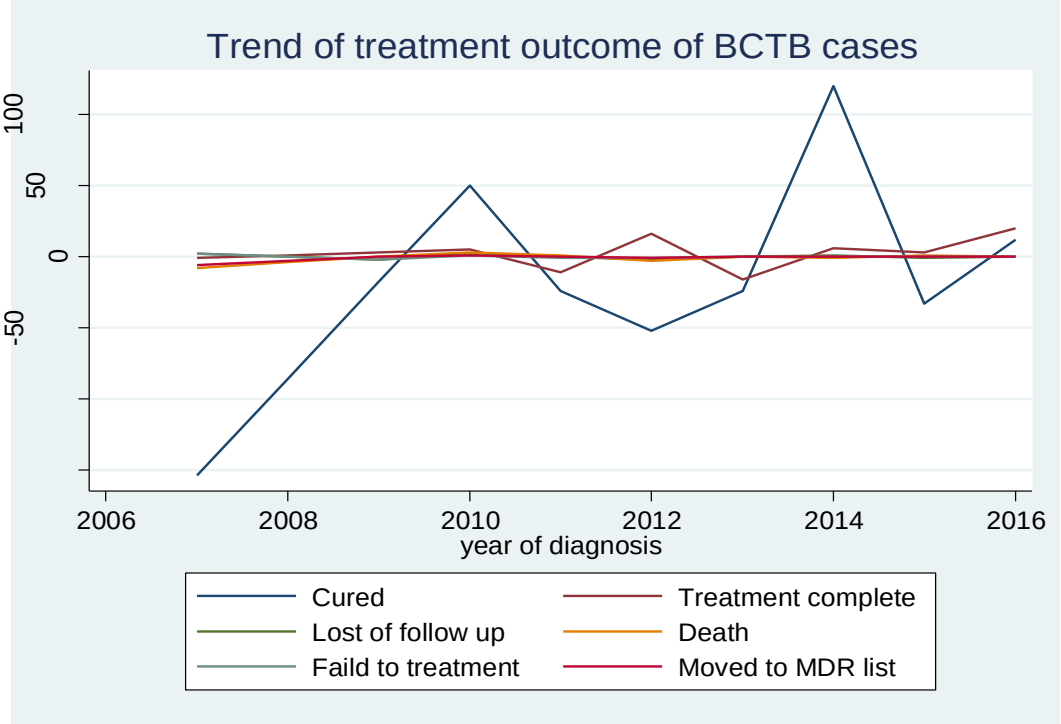

Figure 5: Trend of treatment outcome of bacteriologically confirmed tuberculosis (BCTB) cases in the last 10 years at health facilities in Harari region, eastern Ethiopia.

4.6. Trend of Treatment Outcome of Clinically Diagnosed Tuberculosis

From total number of clinically diagnosed tuberculosis cases that was reported in the last 10 years which is from 2007-2016EFY almost all of the reported cases were complete their treatment. However, 12 of clinically diagnosed tuberculosis cases were lost their follow up 16 cases reported as death 1 case was failed to treatment 6 cases were reported as not evaluated and finally there was no case that was moved to MDR-TB registries. Figure 6 shows trend of treatment outcome of clinically confirmed (diagnosed) tuberculosis cases in the last 10 years at Harari region, eastern Ethiopia **(Figure *6*).**

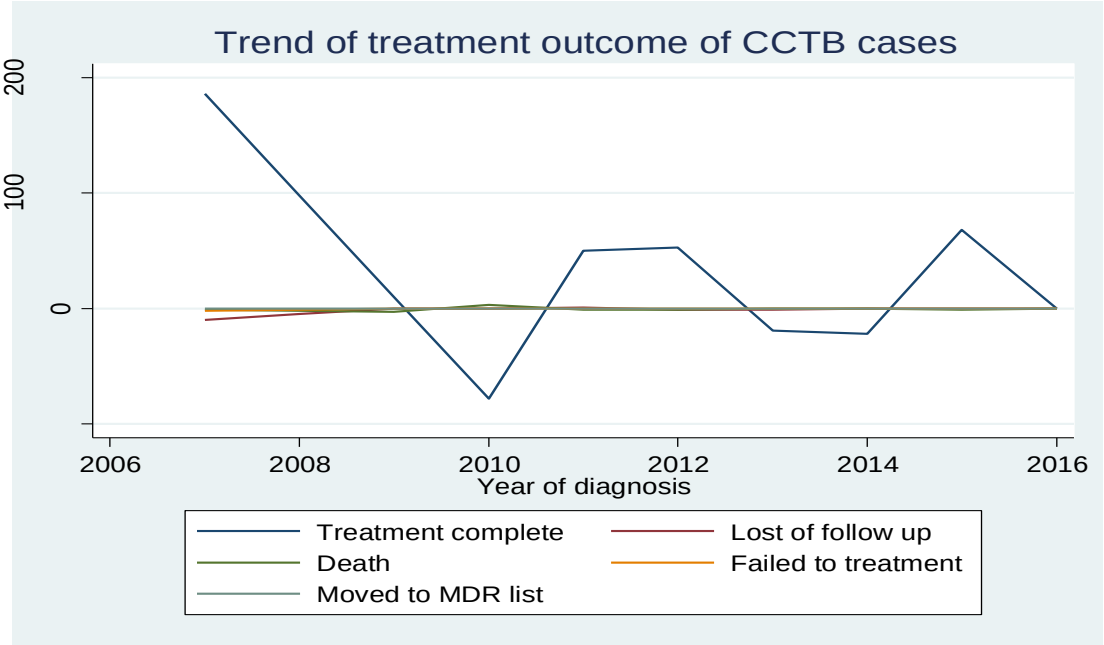

Figure 6: Trend of treatment outcome of clinically diagnosed tuberculosis (CCTB) cases in the last 10 years at health facilities in Harari region, eastern Ethiopia.

4.7. Trend of Treatment Outcome of Clinically Diagnosed Bacteriologically Confirmed extra-pulmonary Tuberculosis

From total number of clinically diagnosed and bacteriologically confirmed extra pulmonary tuberculosis cases that was reported in the las 10 years which is 2007-2016EFY almost all of the cases were complete their treatments number of loss of follow up were 6 cases that reported as death were 15 failed to treatment were 1 case with not evaluated treatment outcome were 3 and finally there was no cases which was moved to MDR-TB registries. Figure 7 shows trend of treatment outcome of extra pulmonary tuberculosis cases in the past 10 years at Harari region, eastern Ethiopia **(Figure *7*).**

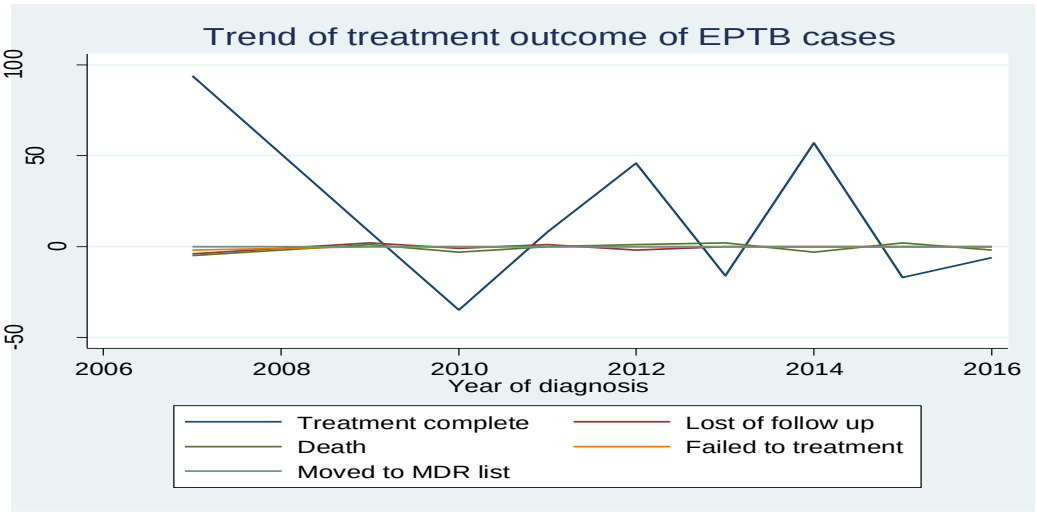

Figure 7: Trend of treatment outcome of extra-pulmonary tuberculosis (EPTB) cases in the last 10 years at health facilities in Harari region, eastern Ethiopia.

4.8. Forecasted Trend of All Form of Tuberculosis for the Next Six Years

Based on the forecasted trend of all form of tuberculosis for the next six years the number of newly detected tuberculosis will be increased in the same range of increased number in the past ten years. Table 1 represents the result of dfuller test for both non-stationary and stationary data **(Table 1).** Table 2 shows the ARIMA regression that was used to forecast for the next six years **(*Table 2*)**. Table 3 represents the AIC BIC results that was used to model specification (***Table 3***). Figure 8 shows the actual trend of all forms of tuberculosis and the forecasted trend of all form of tuberculosis for the next six years at health facilities in Harari region, eastern Ethiopia **(Figure *8*).**

Dfuller test result

Augmented Dickey-Fuller (ADF) test is used to check the stationarity of time series. Dfuller test has three key components the first one is Test Statistics which is used to compare against critical values (1%, 5%, 10% critical values) to determine whether the time series has a unit root or not and the second key component is P-Value which is associated with the test statistics which helps to decide whether to reject or not to reject the null hypothesis a small p-value (less than 0.05) suggests rejecting the null hypothesis which indicates the series is stationary and the last key component of dfuller test is critical values it has different significant levels which is 1% critical value, 5% critical value and 10% critical value provide to assess the test statistic if the test statistics is less than the critical value at the chosen significance level reject the null hypothesis.

Table 1: Dfuller test result of non-stationary and stationary data of tuberculosis in the last ten years in Harari region, eastern Ethiopia.

Dfuller test result for non-stationary data of tuberculosis cases.

	Test Statistic	**1% Critical Value**	**5% Critical Value**	**10% Critical Value**
Z(t)	-1.647	-3.655	-2.961	-2.613

MacKinnon approximate p-value for Z (t) = 0.4588

Dfuller test result for stationary data of tuberculosis cases.

	Test Statistic	**1% Critical Value**	**5% Critical Value**	**10% Critical Value**
Z(t)	-9.311	-3.662	-2.964	-2.614

MacKinnon approximate p-value for Z (t) = 0.0000

ARIMA regression

Table 2: ARIMA regression result used to forecasting.

		OPG				
D.Tuberculosis	**Coefficient**	**Standard error**	**Z**	**P-value**	**[95% conf. interval]**	
Tuberculosis						
_cons	2.805182	1.976232	1.42	0.156	-1.068161	6.678525
ARMA						
Ar						
L1.	-.0342631	.2067599	-0.17	0.868	-.4395049	.3709788
Ma						
L1.	-.5702062	.1793597	-3.18	0.001	-.9217448	-.2186675
/sigma	24.70097	2.359271	10.47	0.000	20.07689	29.32506

ARIMA model specification

Table 3: ARIMA model specification (model selection) procedure used to select the fitting model for the forecasting processes.

ARIMA (p,d,q)	**AIC**	**BIC**
arima tuberculosis, arima (1,1,1)	369.2443	375.8985
arima tuberculosis, arima(2,1,1)	370.9065	379.2243

ARIMA model fitting

By using the Maximum Likelihood Estimation the model was fitted. The estimated coefficients for the AR and MA components were:

AR (1): 0.03

MA (1): 0.57

ARIMA model results summary

An ARIMA (1, 1, 1) model was fitted to forecast trend of tuberculosis cases in the next six years. The models parameter were chosen based on AIC minimization, resulting in AR coefficients of 0.03 and an MA coefficient of 0.57. The diagnostic tests indicated that the residuals were uncorrelated and normally distributed. The models AIC was 369.24. Forecasts for the next six years indicates increases in trend of tuberculosis with 95% confidence intervals showing moderate uncertainty.

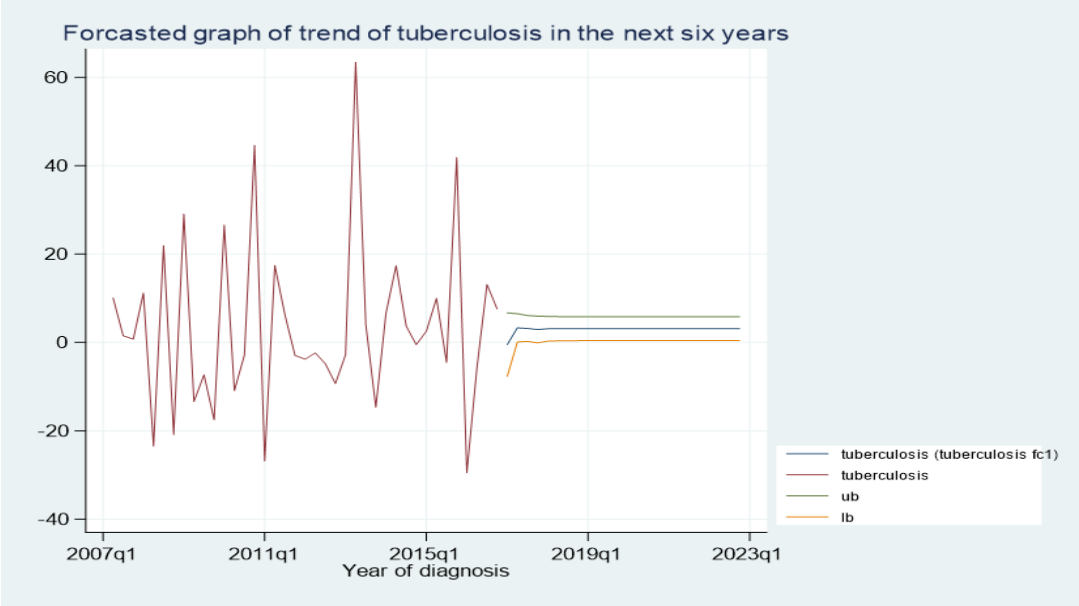

Figure 8: Trend of all form of tuberculosis in the past ten years (2007-2016 EFY) and Forecasted trend of all form of tuberculosis for the next six years (2017-2022 EFY) at health facilities in Harari region, eastern Ethiopia.

5. DISCUSSION

This study aimed to describe how trend of tuberculosis goes in the previous ten years and forecast for the next six years. In this study the investigator found that between 2007EFY and 2016EFY the number of new tuberculosis cases increased in the region. The main reason for tuberculosis cases increased in the past ten years was the strategic change of global strategy of stop TB to End TB program in 2015G.C (2007E.C), the number of new TB cases was increased. The second reason for increased TB case was associated to strategic change new technologies (gene expert machines) were come and applied in to health facilities.

The other reason behind the increased number of TB cases was after gene expert applied all health facilities starts to give TB inclusive health services and gene expert applied there were additional health facilities that gave TB detection and treatment service in the region such as Yemaj General Hospital and Harar general hospital started TB inclusive treatment from year 2008 and from year 2009 federal police hospital has started to give TB inclusive treatment and finally in 2014 shenkor woreda health center has started to give TB inclusive treatment.

In addition, after covid-19 pandemic, number of tuberculosis cases was very high. The major reason behind that was people with sign and symptom of tuberculosis mainly with cough might be fear to go to hospitals because of social stigma at that time and the society thought that when someone cough or sneezes it was covid-19 that might be one reason for not get treated. After covid-19, even though people with sign and symptom of TB feel free to go to health facilities and get treatment, there was economic crises which had a big impact in the increased number of TB cases because when the price of goods increased people cannot afford them that means they didn’t get balanced diet and not getting balanced diet prone someone vulnerable to TB infection.

In this study finding 28.8% study participants were registered with the cases of extra pulmonary tuberculosis while the remain were registered as pulmonary tuberculosis. This finding was supported by study finding in of Tepi public health center which revealed that 27.7% of the study participants were diagnosed with extra pulmonary tuberculosis and 72.3% were diagnosed with pulmonary tuberculosis (Zewudie et al., 2021).

In this study finding the 60% of bacteriologically confirmed tuberculosis and 57.4% of clinically diagnosed tuberculosis cases were male respectively. This finding was similar with study finding in Aurangabad that shows from the study participants 64% were male diagnosed with extra pulmonary tuberculosis and 61% male were diagnosed with pulmonary tuberculosis (Mani *et al.*, 2023).

In this study finding from the total participant of the study 57.6% cases were male. This finding was similar to that if Tepi public health center finding which report that from the study participants 59.8% were male (Zewudie et al., 2021).

The finding of the study conducted in Harari region from the study participants 29.4% cases were registered in the age group of 25-34 and 28.7% cases were registered in the age group of 15-24 (Tola *et al.*, 2019). As the finding of this study from the participants of the study 26.7% cases were registered in the age group of 15-24 and 26.6% cases were registered in the age group of 25-34. It was very difficult to achieve the WHO End TB strategies by 2030. Because if the young society of the region affected by tuberculosis in wide range it's difficult to eliminate the spread of tuberculosis due to the nature of the young age group of the society. This age group is very movable due to different reasons like work.

Associated to increased number of tuberculosis cases the treatment outcome of the patients also changed over time in the last ten years. In bacteriologically confirmed tuberculosis cases almost all of the cases were cured and complete their treatments but still there is significant number of tuberculosis cases in death, loss of follow up, failed to treatment and moved to MDR-TB list same to this in clinically diagnosed tuberculosis and clinically diagnosed and bacteriologically confirmed extra-pulmonary tuberculosis cases also have high number of patients have complete their treatment. However, there is still significant number of tuberculosis cases that have been loss their follow ups, died, failed to their treatment and moved to MDR-TB list.

The forecasted trend of four African countries (Burundi, Benin, Burkina Faso and Botswana) shows the trend of tuberculosis will continue dropping until 2030 (Ojo *et al.*, 2023). Other study conducted in Benin forecasts that the number of tuberculosis will decreases in the next year five years starting from the study period (Ade *et al.*, 2016).

However, in this study finding the forecasted trend shows that the number of tuberculosis cases will increase in the next six years in Harari region.

STRENGTH AND LIMITATION OF STUDY

The strength of this study was that it involved all forms of TB cases those who reported to Harari regional health bureau at Harari region. Therefore, there was no need for any sampling framework. The data used for this study also previously validated during regular quarterly supervision which contributed to minimizing errors.

Regarding limitation of study, due to nature of secondary data it is difficult to get full information.

6. CONCLUSSION AND RECCOMENDATIONS

6.1. Conclusion

The number of tuberculosis cases over the past ten years in Harari region has increased year to year among young adults. The number of forecasted or predicted tuberculosis cases to be detected in the next six years will have increasing trend. In addition to that in the last ten years treatment outcome of all forms of tuberculosis cases were good but still there is death, failed to treatment, loss of treatment and moved to MDR-TB list cases and number of this cases were very significant and enough to contaminate the community.

Highly affected community in the region were in the age group of 15-24 and 25-34 this means young age group of the community were highly vulnerable for tuberculosis. This affects the regions productivity.

6.2. Recommendations

Based on this study result and forecasted result for the next six years I recommend that Harari regional health bureau have to think about TB reduction mechanism carefully. Finally, I recommend that to Harari regional health bureau to check the TB detection capacity and TB management ways. Even if the tuberculosis treatment outcome is good but still Harari regional health bureau have to think about because there is still significant number of deaths associated to tuberculosis there were patients who lost their follow up, failed for their treatment and moved to MDR-TB list this means this patients have high potential to affect the community besides the number in the death list have to become zero to achieve the sustainable development goal of end TB by 2030 in Ethiopia.

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8. APPENDICES

Appendix I. Information Sheet and Informed Voluntary Consent Form for the Head of Institution.

1. Introduction:

My name is **Hana Million Merine**, and I am the Principal Investigator of the study to be conducted in Harari regional health bureau. I am studying for my master's degree in General Public Health at Haramaya University, College of Health and Medical Sciences. I kindly request you to lend me your attention to explain you about the study and your institution being selected as the study setting.

2. The study/project title:

Trend of all types of Tuberculosis in Government and private Health Facilities in Harar, Eastern Ethiopia: A 10 Year Time Series Analysis.

3. Purpose/aim of the study:

The findings of this study can be of a paramount importance for the region help them to develop effective preventive strategical programmes for the community about tuberculosis. It will also be used by health care providers to provide information about the trends of all types of TB and to improve service by providing evidence-based care.

Moreover, the aim of this study is to write a thesis as a partial requirement for the fulfilment of a master's Program in General public health for the principal investigator.

4. Procedure and duration:

I will be collecting data from the data set of Harari regional health bureau that reported from all government health facilities to Harari regional health bureau quarterly using a checklist to provide me with pertinent data that is helpful for the study. There are 3 sections of checklist with total of 14 questions to answer trend of all types of TB in the region.

5. Risks and benefits:

The risk of taking secondary data from the data base is minimal, but the findings from this research may reveal important information for the health facility, providers and for the region.

6. Confidentiality:

The information that we will be provided will be kept confidential. There will be no information that will identify the participants. The findings of the study will be general for the study community and will not reflect anything particular of individual persons. The checklist will be coded to exclude showing names.

7. Rights:

The Harari regional health bureau management have the right to terminate the study at any time if he/she consider something related to the study is wrong.

8. Contact address:

If there are any questions or enquires any time about the study or the procedures, please contact: Hana Million (principal investigator) Phone numbers +251937843908 Email address- **hanamillion7@gmail.com**; as well as contact address of the responsible Institutional Health Research Ethics Review Committee (IHRERC) at office phone 0254662011 or P.O. Box 235, Harar, Ethiopia].

9. Declaration of informed voluntary consent:

I have read the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the rights of participating and the contact address for any queries. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that participants have the right to withdraw from the study at any time or not to answer any question that they do not want. I am also informed that the office has the right to stop this study from being conducted if any misdeeds and unethical procedures are observed during the data collection process in the office's premises. Therefore, I declare my voluntary consent on behalf of Harari regional health bureau management to allow this study to be conducted in the organization with my initials (signature).

Name and Signature of Head of the Institution: _____Date _____

Name and Signature of the PI: _____ Date _____

Appendix II. Data collection checklist

HARAMAYA UNIVERSITY

COLLEGE OF HEALTH AND MEDICAL SCIENCES

SCHOOL OF GRADUATE STUDIES

This is data collection check list to asses a 10-year trend analysis of all types of tuberculosis in all government and private health facilities in Harar, eastern Ethiopia.

Part I: Sociodemographic characteristics		
1.	Age of the patient	0-14 15-24 25-34 35-44 45-54 55-64 ≥65
2.	Sex	Male Female
3.	Number of Tuberculosis case diagnosed	
4.	Quarter of diagnosis	1st quarter 2nd quarter 3rd quarter 4th quarter
Part II: Patient characteristics		
6.	TB type	1. Bacteriologically confirmed new pulmonary TB case 2. Clinically diagnosed new pulmonary TB case 3. Clinically diagnosed and bacteriologically confirmed new EPTB case

6.1	Number of Bacteriologically confirmed new pulmonary TB case	
6.2	Number of Clinically diagnosed new pulmonary TB case	
6.3	Number of Clinically diagnosed and bacteriologically confirmed new EPTB case	
Part III: Treatment Outcome of the patient		
7.	Treatment outcome of the patient	1. Completed 2. Lost to follow up 3. Death 4. Failed 5. Move to DRTB registries 6. Not evaluated

Appendix III. Curriculum Vitae

Personal Information

Name: Hana Million Merine

Sex: Female

Date of birth: 21/09/1998 G.C

Place of birth: Harar

Address: Harar

Phone No: +251937843908

Email: hanamillion7@gmail.com

Educational Background

Qualification: Bachelor of Science (B.Sc.) Degree in Public Health at Harar Health Science College with a final CGPA of 2.91 (2015 – 2019) Harar, eastern Ethiopia.

Institute of attainment	**Year of study (G.C)**	**Field of study**	**Certification**
Aboker preparatory school	2014 – 2015	Natural science	University Entrance Examination Certificate
Harar senior secondary school	2013 – 2014	General science	General Secondary Education Certificate
Ras - mekonnen primary school	2007 – 2013	General science	8th Grade National Examination Certificate

Experience

I have almost 4 years of working experience at Harari regional health bureau as a public health professional.

Computer Skill

I have good knowledge of Microsoft Word, Power Point and Excel, and also in email and internet. Additionally, I have basic knowledge in SPSS and STATA software application.

Soft Skills

Team working, Customer service, Problem solving, Communication skills, Leadership, Hardworking, Familiar with health care system, Ability to work under pressure, adaptability, and stress tolerance.

Language

Amharic: Mother tongue

English: Excellent in writing, Reading and listening and very good in speaking.

Reference

1. Redwan Mohammed - Harari Regional Health Bureau communication directorate, phone no: +251910146159 Email: redwanmohammed25@gmail.com
2. Assefa Tufa – USAID/PMI/PATH-S2ME Project Eastern Cluster Surveillance Technical Assistant, phone no: +251911901908, Email: atufa@path.org