



COLLEGE OF HEALTH SCIENCES

FIVE-YEAR TREND ANALYSIS OF TUBERCULOSIS BURDEN IN BAHIR DAR, NORTHWEST ETHIOPIA, 2015 - 2019

By

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ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
Center for Innovative Drug Development and Therapeutic Trial for Africa
(CDT-AFRICA)

Five-year trend analysis of tuberculosis burden in Bahir Dar, Northwest Ethiopia, 2015 -
2019

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This is to certify that the thesis prepared by Dagmawi Mengesha Mekonnen, titled “Five-year trend analysis of tuberculosis burden in Bahir Dar, Northwest Ethiopia, 2015 - 2019” and submitted to the Center for Innovative Drug Development and Therapeutic Trials for Africa (CDT-Africa), College of Health Sciences, Addis Ababa University; in partial fulfillment for the requirement of master of science degree in clinical trials, compiles with the regulations of the University and meets the accepted standards originality and quality.

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DECLARATION

I, the undersigned, declare that this thesis entitled “Five-year trend analysis of tuberculosis burden in Bahir Dar, Northwest Ethiopia, 2015 – 2019” is my original work, in partial fulfillment of the requirement for the Degree of Masters in Clinical Trials, and has not been presented for a degree in this or any other University. All sources of materials used for this thesis work have been duly acknowledged.

Declared by:

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Signature: -----

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LIST OF ABBREVIATIONS AND ACRONYMS

AIDS- Acquired immunodeficiency syndrome

ARI - Acute Respiratory Infection

CDC- Center for diseases prevention and control

DR- Drug-resistant

FMOH - Federal Ministry of Health

HIV- Human immunodeficiency virus

MDR – Multidrug-resistant

NTLC- National tuberculosis and leprosy control program

TB - Tuberculosis

TBL- Tuberculosis and leprosy

URTI - Upper Respiratory Tract Infection

WHO - World Health Organization

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ABSTRACT

Background: Tuberculosis (TB) remains a major cause of morbidity and mortality in Ethiopia despite the increased availability of effective treatments. Trend analysis of issues and priorities affecting TB programs across different regions of the country is critical to ensure equitable and sustainable TB outcomes.

Objective: The study aimed to determine the trends of TB burden in Bahir Dar, Northwest Ethiopia, for five years from 2015 to 2019.

Methods: An institution-based retrospective study was conducted. Five-year data and records of individual cases screened for TB were reviewed from all government- and private-led healthcare facilities that implemented DOTs programs in Bahir Dar (N = 47) from January 1, 2015 to December 30, 2019. Data were collected with a data collection format adopted from the standard checklist of World Health Organization. The checklist contains unique code, age, sex, residence, HIV status, and year of diagnosis of subjects. First we categorized participants data and records based on their age as (<15, 15-24, 25-34, 35-44, 45-65 and 65+), Sex (male/female), the type of TB infection (PTB+, PTB- and EPTB) and the years of diagnosis (2015, 2016, 2017, 2018 and 2019). A standard checklist was used to collect data relevant to screening, diagnosis, and treatment of TB. SPSS version 20 software was used for data analysis. Descriptive analysis, frequencies, and figures were used to explain the findings. Bivariate Logistic regression analysis was conducted primarily to check the association of each independent variable with the dependent variable. Multivariate logistic regression models were employed to analyze specific associations between variables. Odds ratio (OR) and 95% confidence interval (CIs) were calculated using logistic regression model to measure the strength of an association. Mean and standard deviation was used to summarize continuous variables. P-value <0.05 with corresponding 95% CI were taken significant values

Results: A total of 4,275 TB cases record (2015-2019) were reviewed. The detection rate of TB were 2,151 (50.3%) extra pulmonary TB cases, 929 (21.7%) bacteriologically confirmed pulmonary TB cases, and 1,195 (28.0%) clinically confirmed pulmonary TB cases. Female patients account for 55.5% of the total cases. Patients from ages of 15-34

years were the most affected age groups (51.5 %), and ages of 65 years the least affected age group (7.5%). For HIV status, 2, 804/4275 (65.6 %) were HIV co-infected, of whom 46.5% were male and 53.5% were female. From the total TB patients, 33.0% (929/2804) of PTB+, 42.6% (1195/2804) of PTB- and 76.7% (2151/2804) of the EPTB were co-infected with HIV. Among bacteriologically confirmed pulmonary TB cases, 577 (62.1%) were female within the five-year period from 2015 – 2019. The prevalence of all forms of TB were 922 (21.6%), 812 (19.0%), 843 (19.7%), 876 (20.5%), and 822 (19.2%), respectively. The variables sex, HIV co-infection and age<15 (AOR: 1.7, 1.9, 1.4, CI: 1.4 -2.2, 1.6 -2.3, 1.1-1.7), respectively, were factors associated with TB infection.

Conclusion:. Even though there was a declining trend of tuberculosis burden within the five-year study period, prevention and control strategies needs to be improved to achieve the stop TB strategies set by the WHO. For this successful achievement, a comprehensive TB diagnosis, care, treatment, and prevention approach is needed to improve TB programs continuously and accelerate the fight to End TB in this setting.

Keywords: Tuberculosis, trend analysis, Ethiopia

1. INTRODUCTION

1.1. Background

Tuberculosis (TB) is a communicable disease that is caused by *Mycobacterium* complex, mainly by *Mycobacterium tuberculosis* (1). It is one of the top ten causes of death worldwide (2). *Mycobacterium tuberculosis* bacilli are transmitted through coughing, sneezing, and singing (3). The disease is usually chronic with varying clinical manifestations (4). It can be either pulmonary or extra-pulmonary. Pulmonary TB affects the lungs (80%) but extra-pulmonary TB can affect sites such as bones, glands, the genito-urinary system, the nervous system (tuberculosis meningitis), and the intestine (5). The incubation period ranges from three to six weeks (6).

According to WHO 2020 report, globally, an estimated 10 million people fell ill with TB in 2019, a number that has been declining very slowly in recent years. There were an estimated 1.2 million TB deaths among HIV-negative people in 2019 (a reduction from 1.7 million in 2000), and an additional 208 000 deaths among HIV-positive people (a reduction from 678 000 in 2000). Men (aged ≥ 15 years) accounted for 56% of the people who developed TB in 2019; women accounted for 32% and children (aged < 15 years) for 12%. Among all those affected 8.2% were people living with HIV (7 12 25).

Geographically, most people who developed TB in 2019 were in the WHO regions of South-East Asia (44%), Africa (25%), and the Western Pacific (18%), with smaller percentages in the Eastern Mediterranean (8.2%), the Americas (2.9%) and Europe (2.5%). According to WHO 2009, tuberculosis is a major public health problem in the world, which is leading to 1.3 million deaths with the majority of cases and deaths being

in Sub-Saharan Africa (7). In many low-income and middle-income countries, TB continues to be a major cause of morbidity and mortality, and drug-resistant TB is a major concern in many countries (8).

Ethiopia remains to be among the 30 countries reported with a high burden of TB, TB/HIV, and MDR-TB for 2015 to 2020 (9).

TB related mortality is highlighted in the top ten reported causes of death among hospital admissions, with an annual estimated death rate of 26 per 100,000 populations in 2015, despite the 42% decline in the annual TB incidence from 369 cases per 100,000 populations in 1990 to 177 per 100,000 populations in 2016 in Ethiopia (9). In this study, we analyzed the prevalence of tuberculosis from 2015 to 2019 to determine the trends of the burden of the diseases based on sex, age, and types of TB infection.

1.2. Statement of the problem

According to WHO 2019 report Tuberculosis remains a major cause of ill health and is one of the top 10 causes of death worldwide.

Faster reductions in TB incidence and deaths require improvements in access to diagnosis and care within the context of progress towards universal health coverage, action on broader determinants of TB incidence (e.g. levels of under-nutrition, poverty, smoking, and diabetes), and a new treatment or vaccine to substantially lower the risk of developing TB in people who have a latent TB infection (10).

The burden of drug-resistant TB is of major interest and concern at global, regional, and country level. In 2018, there were approximately half a million (range, 417000–556000) new cases of rifampicin-resistant TB (of which 78% had multidrug-resistant TB) (11). TB is the most important cause of death throughout the world (12). 1.5 million People died from TB, including 360,000 among HIV-positive people, in 2013 (13). In the African region that has the highest TB/HIV burden; three out of four TB patients knew their HIV status (14). Globally, 70% of the TB patients known to be living with HIV in 2013 were started on antiretroviral therapy (15). The number of people diagnosed with Multi-Drug Resistant (MDR)-TB tripled between 2009 and 2013 and reached 136,000.

Progress in the detection of drug-resistant TB has been facilitated by the use of new rapid diagnostics (16). There were an estimated 210,000 deaths from MDR-TB in 2013 (17). The gap between diagnosis and treatment widened between 2012 and 2013 in several countries. Between 2000 and 2013, 37 million lives were saved through effective TB diagnosis and treatment. However, international travel, labor migration, and the influx of refugees from endemic countries pose a continued threat of importation of TB and spread within the community (18). In addition, resistance to effective drugs is an increasing problem, which complicates treatment and increases mortality and long-term morbidity (19).

Given that the alarming increasing rate of DR TB and the decline of overall TB (DST) cases indicate that further research is of paramount importance. Hence our study; trend analysis of TB, identified the burden of TB in the region in particular and in Ethiopia in general. Hence this study would be helpful to fight the spread of the diseases since research and innovations are needed to sharply bend the TB epidemic curve to meet the ambitious targets to end TB.

1.3. Significance of the study

The decline of TB (DST) is still sluggish which requires the improvements in access to diagnosis and treatment to further reduce the prevalence of tuberculosis. Studying the trend analysis of the burden of TB is essential to understand the magnitude of the disease. It can also help to give due attention for the most affected groups, By identifying the major challenges and opportunities of TB research in Ethiopia, the study is expected to help in informing policy-makers and implementing specific and efficient institutional and other relevant planning options towards developing enhanced research practice in both research and academic institutions that would benefit community health. It is also hoped that the study will give a good understanding and an insight about TB research for other researchers and policy-makers so that they can engage more in this issue in the future.

2. LITERATURE REVIEW

2.1. Overview of Tuberculosis

TB is a communicable, systemic disease caused by *Mycobacterium Tuberculosis* (21). Tuberculosis (TB) persists as a global public health problem of a serious magnitude requiring urgent attention (22). According to WHO 1994, current global efforts to control TB have three distinct dimensions: humanitarian, public health, and economic (23). Alleviating illness, suffering, and death of individuals caused by TB is a major humanitarian concern and calls for a patient-centered approach to TB control. The public health dimension concerns proper diagnosis and treatment of TB patients to decrease disease transmission within communities. This necessitates the development of well-organized TB control programs. TB is responsible for considerable direct and indirect costs to individuals and society. The economic dimension of TB control relates to a reduction of these costs, alleviation of poverty, and promotion of development. WHO declared TB a "global emergency" In 1993 (24).

2.2. Worldwide distribution of TB

In 2018, 1.7 billion people were infected by TB; roughly 23% of the world's population and it is the leading infectious disease killer in the world, claiming 1.5 million lives each year (25).

2.3. Tuberculosis epidemiology

More than 90% of global TB cases and deaths occur in the developing world, where 75% of cases are in the most economically productive age group (15-54 years) (28 29). Consequently, an adult with TB loses on average three to four months of work time. This results in the annual loss of 20-30% in household income and, if the patient dies of TB, an average of 15 years of lost income (30).

Co-infection with the human immunodeficiency virus (HIV) significantly increases the risk of developing TB (31). Countries with a high prevalence of HIV, particularly those in sub-Saharan Africa, have witnessed a profound increase in the number of TB cases,

with reported incidence rates increasing two or three-fold in the 1990s (32). At the same time, multi-drug resistance TB, which is caused by poorly managed TB treatment, is a growing problem of serious concern in many countries around the world (33)

Based on surveillance and survey data, WHO estimates that 9.27 million new cases of TB occurred in 2007 (139 per 100 000 population), compared with 9.24 million new cases (140 per 100 000 population) in 2006. Of these 9.27 million new cases, an estimated 44% or 4.1 million (61 per 100 000 population) were new smear-positive cases (34). India, China, Indonesia, Nigeria, and South Africa rank the first to fifth in terms of the total number of incident cases (35). Asia (the South-East Asia and Western Pacific regions) accounts for 55% of global cases and the African Region for 31%; the other three regions (the Americas, European, and Eastern Mediterranean regions) account for small fractions of global cases (36)

Among the 15 countries with the highest estimated TB incidence rates, 13 are in Africa, a phenomenon linked to high rates of HIV (37). Research conducted in South Africa shows that a strain of Extensively Drug-Resistant Tuberculosis (XDR-TB) has caused an outbreak in rural South Africa, with mortality reaching nearly 100 percent in patients with HIV (38)

2.4. Distribution of TB in Ethiopia

Tuberculosis is a major cause of morbidity and mortality in Ethiopia, in which Ethiopia belongs to the list of countries most affected (25 26 38).

The burden of TB in Ethiopia is estimated at 168 new smear-positive cases per 100,000 populations (39). Although several anti-TB interventions have been made in Ethiopia, the country continues to be the 7th country in TB incidence among the 22 high TB burden countries globally and 4th from Africa and is also among the top 20 countries with TB-HIV and drug resistance TB (MDRTB) from the 30 high TB-HIV and MDR-TB burden countries (40 41). According to the Ethiopian Federal Ministry of Health hospital statistics evidence, pulmonary TB was the third leading cause of hospital admission (7.8%) and the first leading cause of in-patient deaths (10.1%) (42). Even though the

Ethiopian government has expanded TB diagnosis and treatment services to both public and private healthcare facilities since 2004, TB is still a major public health concern. This may be due to the emergence of drug resistance TB, malnutrition, low community awareness, inaccessibility/quality of TB services, and high comorbidity rates (HIV AIDS, malaria, and diabetes mellitus) (43). Efforts made to identify and treat those cases are far below satisfactory. This will further worsen the situation until the trend is reversed. Successful fight against TB calls for the implementation of TB/HIV collaboration which is enabling all people living with HIV/AIDS to benefit from packages of TB diagnosis and care and enabling all TB suspects to benefit from packages of Provider Initiated HIV Counseling, Testing and subsequent services(44).

CONCEPTUAL FRAMEWORK

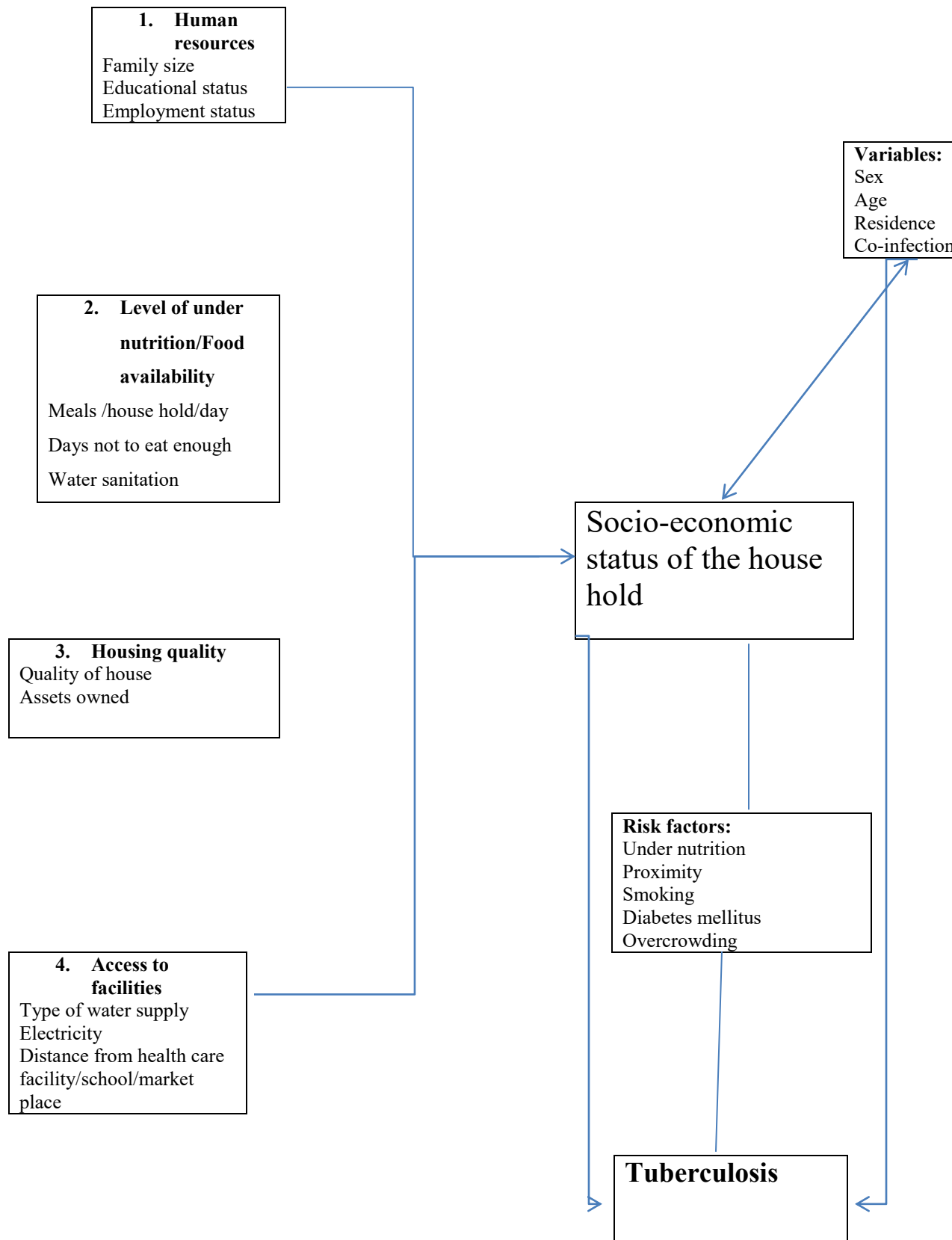




Fig 4: Conceptual framework showing the prevalence of TB burden and associated factors

3. OBJECTIVES

3.1. General objective

- To assess the trends of tuberculosis burden in Bahir Dar city

3.2. Specific objectives

- ❖ To determine the prevalence of TB in the study area
- ❖ To assess factors associated with TB in the study area

4. METHODS AND MATERIALS

4.1. Study area

The study was conducted in Bahir Dar, the capital city of the Amhara National Regional State located 563 km away from Addis Ababa, the capital city of Ethiopia. The city is located at an altitude of 1,820 metres (5,970 ft.) above sea level (fig1). Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), Bahir Dar has a total population of 221,991, of whom 108,456 are men and 113,535 women; 180,174 or 81.16% are urban inhabitants. There were 13 governmental health facilities in the city; three hospitals (Felege Hiwot comprehensive specialized Hospital, Addis Alem General Hospital and Tibebe Ghion specialized teaching hospital) and ten health centers (Abay Health center, Han health center, Shimbet health center, Dagmawi Minilik health center, Bahir Dar health center, Tis Abay health center, Zege health center, Meshenti health center, Zenzelema health center and Shumabo health center) including four private hospitals (Gambi, Aflagat, Afilas and Dream care) and more than twenty private clinics

including Family Guidance Association of Ethiopia(FGAE) and Marie Stopes international clinic during our study period..

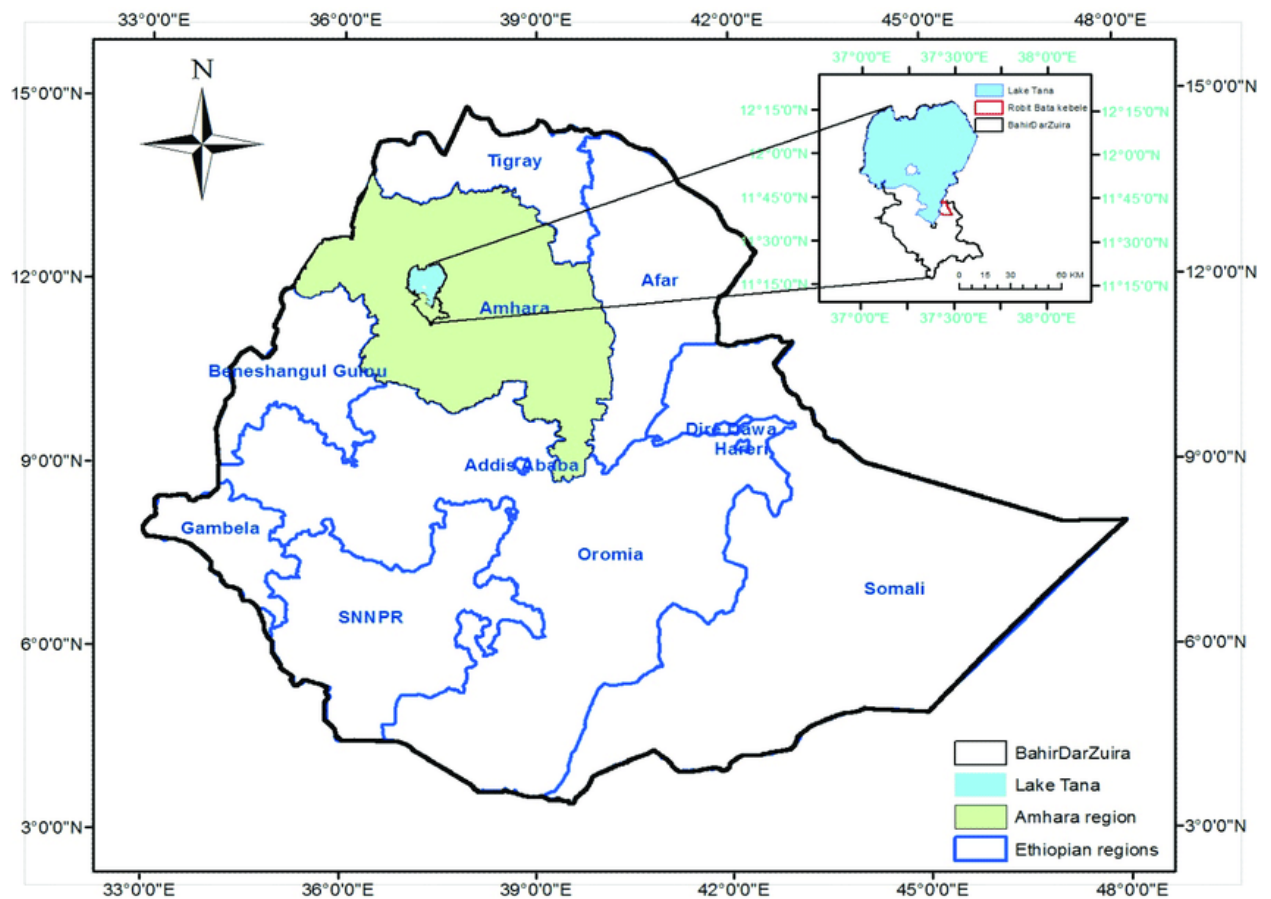


Fig1: Map of Ethiopia and Bahir Dar and its surroundings

4.2. Study sites, Study Design and Period

An institution-based retrospective cross-sectional study design was conducted to determine the trends of TB burden among patients diagnosed with TB by using data

recorded from Jan.1, 2015 to Dec.30, 2019 at governmental and nongovernmental health facilities that implemented DOTs program at Bahir Dar, Northwestern, Ethiopia. Data were collected from 47 health facilities but some of the health facilities were excluded due to their incomplete information for our analysis. All the governmental (public) health facilities (Felege Hiwot comprehensive specialized Hospital, Addis Alem primary Hospital, Abay Health center, Han health center, Shimbet health center, Dagmawi Minilik health center, Bahir Dar health center, Tis Abay health center, Zege health center, Meshenti health center, Zenzelema health center and Shumabo health center) and some nongovernmental(private) health facilities (Gambi general hospital, Adinas general hospital, Aflagat general hospital, Kidane Mihret higher clinic, Agmas higher clinic, Ethiopia medium clinic, St. John medium clinic and Eyasta internal medicine) were included in our study. Analysis was done after defining our objectives, data collection and data cleaning and clarification

Sample size determination and sampling technique

A total of 4,275 participants' data were collected and analyzed in our study.

Data were extracted from Bahir Dar Health Office TB/Leprosy Unit by using pre-structured questionnaire based on participant's sex, age and type of TB infection

4.3. Study population

The study population for this study was patients records collected from both the governmental and nongovernmental health facilities in Bahir Dar, Northwest Ethiopia.

4.4. Eligibility criteria

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4.4.1 Inclusion criteria

Participants' records with complete information were included in the study

4.4.2 Exclusion criteria

Participants' records recorded with:

Death within the first 15 days of treatment

Treatment default during the first 30 days of treatment initiation

Transfer to other health service facility and

Unknown treatment outcome were excluded

4.5. Data collection procedures and quality assurance

Data were collected with a data collection format adopted from the standard checklist of World Health Organization. The checklist contains unique code, age, sex, residence, HIV status, and year of diagnosis of subjects.

First we categorized participants based on their age as (<15, 15-24, 25-34, 35-44, 45-65 and 65+), Sex (male/female), the type of TB infection (PTB+, PTB- and EPTB) and the years of diagnosis (2015, 2016, 2017, 2018 and 2019). Residence was our missing data since residence in any of the health facilities were not recorded in the registration book. These data were collected from Bahir Dar health office department of TB/Leprosy Unit from 1st January 2015 to 30 December 2019. Trained data collectors collected the data. The principal investigator cleaned and edited the collected data using SPSS version 20 Software and check the completeness, consistency and clarity of the data

4.6. Study variables

The dependent variable is the results (PTB+, PTB-and EPTB) of TB infection and the independent variables are sex, age, year/period of infection and co-infections

4.7. Diagnosis of TB patients

The facilities use sputum smear examination, clinical diagnosis, radiological examination, culture examinations, and X-pert MTB/Rif assay for the diagnosis of TB. X-pert MTB/Rif assay was employed for MDR-TB diagnosis and only one health facility (Felege Hiwot Referral Hospital) was doing X-pert MTB/Rif assay.

4.8. HIV Screening

Both health facilities have counseling and testing rooms and trained professionals for HIV screening services. Hence HIV screening was performed according to FMOH HIV counseling and testing (VCT) guideline.

5. Statistical Analysis

Data obtained through the checklist was double entered into SPSS software version 20. Descriptive analysis, frequencies, and figures were used to explain the findings. Bivariate Logistic regression analysis was conducted primarily to check the association of each independent variable with the dependent variable. Multivariate logistic regression models were employed to analyze specific associations between variables. Odds ratio (OR) and 95% confidence interval (CIs) were calculated using logistic regression model to measure the strength of an association. Mean and standard deviation was used to summarize continuous variables. P-values less than 0.05 with corresponding 95% CI were considered as statistically significant. Data analysis was performed using SPSS version 20.

Operational Definitions

According to the standard definitions of the National Tuberculosis and Leprosy Control Program guideline (NLCP) adopted from WHO, the following clinical case definitions were used (FMOH):

Pulmonary TB, smear-positive: A patient with at least two sputum specimens which were positive for acid-fast bacilli (AFB) by microscopy, or a patient with only one sputum specimen which was positive for AFB by microscopy, and chest radiographic abnormalities consistent with active pulmonary TB

Pulmonary TB, smear-negative: A patient with symptoms suggestive of TB, with at least two sputum specimens which were negative for AFB by microscopy, and with chest radiographic abnormalities consistent with active pulmonary TB (including interstitial or miliary abnormal images), or a patient with two sets of at least two sputum specimens taken at least two weeks apart, and which were negative for AFB by microscopy, and radiographic abnormalities consistent with pulmonary TB and lack of clinical response to one week of broad spectrum antibiotic therapy.

Extra pulmonary TB (EPTB): This includes tuberculosis of organs other than the lungs, such as lymph nodes, abdomen, genitourinary tract, skin, joints, and bones, meninges,

etc. Diagnosis of EPTB will be based on fine needle aspiration cytology(FNAC) or biochemical analyses of cerebrospinal/pleural/ascetic fluid or histopathological examination or strong clinical evidence consistent with active extra-pulmonary tuberculosis, followed by a decision of a clinician to treat with a full course of anti-tuberculosis chemotherapy

Presumptive TB: An individual who presents with symptoms or signs suggestive of TB like sweating, coughing more than two weeks, loss of appetite, weight loss, and weakness

Ethical Considerations

Ethical clearance for the conduct of this study was obtained from the scientific and ethics committee of CDT-Africa. Permission was sought from Bahir Dar Health Office administration Unit of TB/Leprosy

5. RESULTS

5.1. Patient Demographic Characteristics

A total of 4275 participants' data were analyzed for TB within the five-year study period (2015-2019) (Fig 3). Among all participants screened for TB, 929(21.7%) were bacteriologically confirmed TB cases, 1195(28%) were clinically confirmed TB cases and 2151(50.3%) were extra pulmonary TB cases from which 62.1%, 58.3% and 51.0% of the participants were female participants of PTB+, PTB- and EPTB respectively, and 1903 (44.5%) of the participants were males (Table4).

Table1. Distribution of TB cases among governmental (public) and nongovernmental (private) health facilities in Bahir Dar, northwest, Ethiopian from January 1, 2015 – December 30, 2019

		TB status					
		EPTB		PTB-		PTB+	
Year	Sex	Governmental	Private	Governmental	Private	Governmental	Private
2015	Female	205	24	89	12	75	7
	Male	226	28	116	21	103	16
2016	Females	188	26	93	18	51	8
	Male	183	25	108	27	71	14
2017	Female	151	36	83	14	69	11
	Males	178	35	110	29	117	10
2018	Female	196	18	99	10	66	4
	Male	204	15	121	10	125	8
2019	Female	182	23	78	11	58	3
	Male	188	20	131	15	106	7

*EPTB, extra pulmonary TB *PTB-, clinically confirmed TB *PTB+, bacteriologically confirmed TB *private, nongovernmental health facilities

Majority 3770 (88.2%) of the participants data were collected from the Governmental health facilities and only 11.8% were from Nongovernmental (private) health facilities. This figure shows that private health facilities are also contributing their part in the fight to STOP TB.

Among the participants screened for HIV, 2804 participants were HIV positive of which 46.5% were males and 53.5% were females. And 1471 subjects were HIV negative from which 33.9% were male and 66.1% were female participants (Table3)

The majority of the cases (51.5%) were between the ages of 15-34 years followed by age groups less than 15 years (19.6%). The distribution among the different age groups were: 51.5% (15-34 years of age), 19% (less than 15 years of age), 11.8% (45-65 years of age), 9.6% (35-44 years of age) and 7.5% (≥ 65 years of age) in a decreasing order (Table 2).

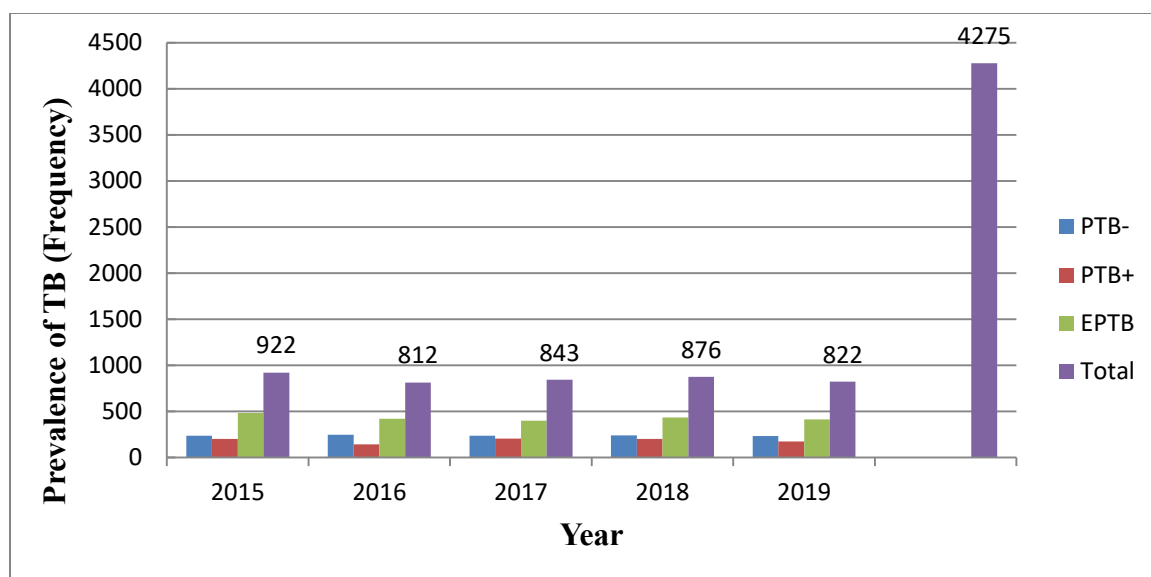


Fig 3: graph showing the prevalence of TB in Bahir Dar, northwest, Ethiopian from January 1, 2015 – December 30, 2019

5.2. Detection of tuberculosis

Within the five-year study period, the highest prevalence rate of TB was 21.6% in 2015 study period followed by 20.5% in 2019. Bacteriologically confirmed pulmonary TB was the lowest prevalence (21.7%) during our study period compared to clinically confirmed pulmonary TB (28%) and extra pulmonary TB (50.3%).

Table 2: Prevalence of TB among different age groups in Bahir Dar, northwest, Ethiopian from January 1, 2015 – December 30, 2019

Variables		PTB-	%	PTB+	%	EPTB	%	Total	%
Age group	<15	196	16.4	17	1.8	624	29.0	837	19.6
	15-34	601	50.3	634	68.2	966	44.9	2201	51.5
	35-44	162	13.6	138	14.9	111	5.2	411	9.6
	45-65	181	15.1	105	11.3	220	10.2	506	11.8
	>=65	55	4.6	35	3.8	230	10.7	320	7.5
	Total	1195	100	929	100	2151	100.0	4275	100.00

Table 3: Prevalence of HIV among Sex in Bahir Dar, northwest, Ethiopian from January 1, 2015 – December 30, 2019

Variables		Negative	%	Positive	%	Total	%
Sex	Male	498	33.9	1305	46.5	1803	42.2
	Female	973	66.1	1499	53.5	2472	57.8
	Total	1471	100	2804	100	4275	100.00

Table 4: Prevalence of TB cases among Sex in Bahir Dar, northwest, Ethiopian from January 1, 2015 – December 30, 2019

Variables		PTB-	%	PTB+	%	EPTB	%	Total	%
Sex	Male	498	41.7	352	37.9	1053	49.0	1903	44.5
	Female	697	58.3	577	62.1	1098	51.0	2372	55.5
	Total	1195	100	929	100	2151	110.9	4275	100.00

Among all forms of TB cases, 50.3% were extra pulmonary TB cases (Fig 3). From participants who were screened for HIV tests, 2804 (65.6%) were HIV positive and 1471(34.4%) were HIV negative of which 1803 (42.2%) were male and 2472 (57.8%) were female participants (Table3).

Our study also showed that the prevalence of HIV was higher in females (53.5%) compared to males (46.5%)

Among bacteriologically confirmed pulmonary TB cases 577(62.1%) were females. In general prevalence of TB was more prevalent in female Sex in all forms of TB infections (62.1%, 58.3% and 51.0% for PTB+, PTB- and EPTB respectively) than males.

The prevalence of TB was higher in subjects whose ages were between 15 and 34 years (51.5%) and the lowest prevalence (7.5%) was between the ages of 65+ years. The second most prevalent age (19.6%) was between age groups of subjects less than 15 years

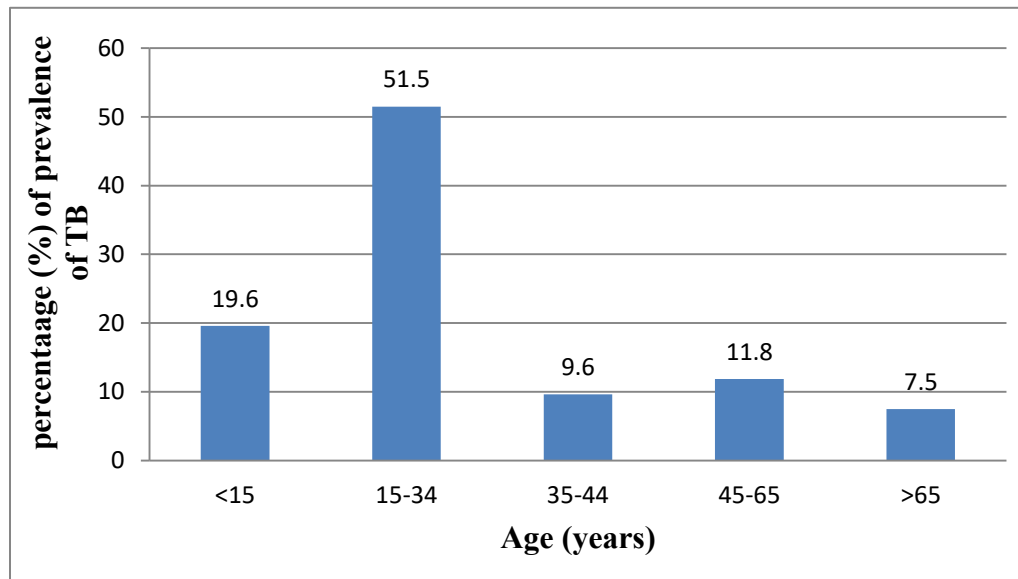


Fig 2: Distribution of TB among different age groups in Bahir Dar, northwest, Ethiopian from January 1, 2015 – December 30, 2019

5.3. Trends of TB prevalence

The prevalence of TB during the five-year study period was fluctuating and inconsistent. The highest prevalence period being 2015 (21.6%) followed by the lowest prevalence in 2016 (19%) a reduction by 2.6%. A significant elevated prevalence was observed during the 2016-2018 (19%, 19.7% and 20.5%) study periods respectively. In 2019 the prevalence was decreased from 2018 (20.5% in 2018 to 19.2% in 2019) (Fig 3)

5.4. Distribution of TB by Sex and age groups

High prevalence of TB was observed between the ages of 15-34 years (51.5%) and lowest prevalence was among the age groups greater than or equal to 65 years (7.5%) (Fig2) The distribution of TB among female participants is slightly elevated (51%) than males. The ratio of female to male (2372/1903) prevalence is 1.25 (Table 2).

5.5. Associated factors for TB prevalence

The variables sex, HIV infection and age<15 (AOR: 1.7, 1.9, 1.4, CI: 1.4 -2.2, 1.6 -2.3, 1.1-1.7: P: 0.01) respectively were factors associated with TB infection (Table 5).

Table 5: Regression table for associated factors with TB/HIV infection in Bahir Dar, northwest, Ethiopian from January 1, 2015 – December 30, 2019

Variables		TB status		P- value	(95 % C.I)			P-value	(95 % C.I)		
		PTB	EPTB								
		Count	Count		COR				AOR		
HIV	Negative	1166	1596		1				1		
	Positive	305	1201	0.01	2.9	2.5	3.4	0.01	1.9	1.6	2.3
Sex	Female	973	1499		1				1		
	Male	498	1305	0.01	1.7	1.5	1.9	0.01	1.7	1.4	2.2
Age	<15	196	641	0.01	1.4	1.2	1.7	0.01	1.4	1.1	1.7
	15-34	656	1545		1				1		
	35-44	162	249	0.01	0.7	0.5	0.8	0.01	0.4	0.3	0.5
	45-65	192	314	0.01	0.7	0.6	0.9	0.01	0.6	0.4	0.8
	>65	265	55	0.01	0.09	0.1	0.1	0.01	0.1	0.1	0.2

6. DISCUSSION

Our study showed that the prevalence of TB burden was higher among people of productive age groups (15-34 years). It was also revealed that records of female participants showed that the prevalence of TB burden was higher among females than males. HIV infection, female sex and age less than 15 years were associated factors for the development of TB infection

TB related mortality is highlighted in the top ten reported causes of death among hospital admissions in Ethiopia (44). Five-year data were collected to analyze the trends of TB burden in Bahir Dar Northwest Ethiopia.

A total of 4275 patient records were collected. The detection rate of TB were; 929 (21.7%) bacteriologically confirmed pulmonary positive TB cases, 1195 (28.0%) clinically confirmed pulmonary negative TB cases and 2151(50.3%) were extra pulmonary tuberculosis cases. This finding is consistent with detection rate of Ethiopia (6%) (45). But this rate is lower than a study conducted in Addis Ababa, Ethiopia (15.11%) and Harar, Ethiopia (15.7%) and the difference may be explained by larger sample size (45-47).

This proportion is also in line with a study conducted in Bahir Dar northwest Ethiopian (48) which is (11.6%, 31.1% and 57.2%) respectively and a study conducted in Mekelle (49) However results different from this study was recorded in a study conducted in Gambella (50) (31.8%,75.7% and 24.3%) and Sierra Leone (51). This variation may be due to the advancement of imaging and pathologic evidences. And the higher prevalence in EPTB and PTB- in our study might be due to the higher prevalence of TB, TB/HIV co-infections in the country (52).

Higher prevalence of TB was reported among individuals aged 15–34 years (51.5%) followed by age groups of less than 15(19.6%) years, being age groups greater than or equal to 65 years old are the lowest prevalence age groups (7.5%). This difference was statistically significant ($p=0.01$). The higher prevalence in the 15-34 years is consistent with many countries (53-55). And this is explained by active sexual age which is risk factor for TB/HIV co-infection We also observed that more females (57.8%) were

infected with HIV than male participants (42.2%) which is statistically significant ($p=0.000$) (Fig2) (56). This result is consistent with a study conducted in Gondar northwest Ethiopia (54). But it is different from studies from studies of different countries like Sierra Leone Zimbabwe and Ethiopia (Harar) (27 51 53 57). The possible explanation to this variation might be poverty, gender inequality and HIV infection. TB and HIV Co-Infections were higher in 2019 at (22.2 %). The lowest prevalence is seen in 2016(16.9%). The prevalence of HIV in females (53.5) was more than males. This is statistically significant with (AOR: 1.875 $p=0.000$). Our study revealed that the trends of TB prevalence was decreased from 2015(21.6%) to 2016(19%). And the prevalence in the study periods, 2017 and 2018 showed an increased (19.7%. to 20.5%) prevalence respectively. And decreased prevalence from 2018(20.5%) to 2019(19.2%). This fluctuating result was consistent with a study in Nigeria, Gambella and Tigray, Ethiopia (50 58 59) This difference may be explained by storage of samples and reagents, clinicians experience to identify presumptive TB and patients awareness and knowledge about tuberculosis.

In this study, participants who had been infected with HIV were more likely (AOR: 1.9, CI: 1.6 -2.3) to be infected with TB than those who were not infected with HIV (Table4) (59). The study also revealed that the prevalence of EPTB (50.3%) was higher than PTB (both PTB+ and PTB- 28.0% and 21.7% respectively). This result was consistent with a study conducted in the Prevalence and diagnosis of extra pulmonary tuberculosis in Assuit Chest Hospital in Cairo, Egypt and study conducted on the prevalence of extra pulmonary TB among people living with HIV in sub-Saharan Africa in Haremaya University, Harar, Ethiopia (60 61). The possible explanation for this is the increased prevalence of HIV infection.

The average decline of TB in this study during the five-year period was 4.34% (21.7/5) per year which is consistent with the national decline level (4%) per year. The declining trend may be explained by the expansion of DOTS program at the national level in the country (41).

7. STRENGTHS AND LIMITATIONS OF THE STUDY

This study may provide a compelling insight on the prevalence of TB which can be used for the formulation of strategies and policies to the END TB goal set by WHO.

7.1. Strengths of the study

One of the advantages of using structured questionnaire is that it is used to contact large number of people quickly, easily, and efficiently. It is also less time consuming, provide quantitative data, easy to conduct and covers broader area. The other strength of this study includes the involvement of experts from different disciplines. The data collected has enabled a comprehensive insight of the trends of the burden of TB that could guide researchers to overcome the challenges faced to the control of tuberculosis

7.2. Limitation of the Study

Since this is retrospective data, we encountered missing data (residence of the participants were missed), incomplete data and limited associated factors for the Variables included. We also faced disorganized data management systems which took longer time to clean the data

8. CONCLUSION

The overall decline of TB for the five-year study period showed a sluggish progress in the study area. HIV infection, Sex and age under 15 were statistically associated factors with TB infection. The prevalence of TB was higher among people of the productive age groups (15-34 years) which could affect the socioeconomic status of an individual and a country as a whole. This study also showed a significant increase in the trends of TB burden in females (55.5%) than males. These findings are a point of concern highlighting the importance of strengthening health care services towards these groups. This study highlights the need for more targeted interventions to accelerate the decline of TB in the country. Hence, national health system policy and federal ministry of health should consider introducing regular screening strategy for TB for early diagnosis and treatment to enhance the prevention and control strategies of TB

RECOMMENDATION

Considering participants records and other relevant literatures the trends of TB burden were higher among females, adults (15-34 years) and people with HIV infection. Hence we recommend research institutes to incorporate topics concerning trends of TB burden among these groups of people within their research. Developing a plan and creating platforms to engage inter-sectorial communication to bring the different researchers together to conduct a research based on trends of TB prevalence is also another mechanism to combat the prevalence of the disease. Conducting further research to investigate the existing gaps in the current efforts and recommending strategies to fill the gaps which are barriers for the control of TB.

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10. APPENDICES

Annex1: Information sheet and consent form

Study title: Trend analysis of tuberculosis among TB patients in Bahir Dar Northwest Ethiopia.

Name of organization: Addis Ababa University College of health sciences

Name of principal investigator: Dagmawi Mengesha (BSc, MSc candidate)

1. Purpose of the research project: the aim of this study is to determine the trends of tuberculosis during the study period. In line with this the findings will also provide baseline information for health sector administrators and other concerned bodies to plan and manage the mortality and morbidity associated with tuberculosis
2. Procedures: In order to perform this study data related to patient's socio demography, type of TB and other relevant information will be collected using the checklist

3. Risk associated with the study: we will work to the benefit of the patient and try to avoid any risks that we can face during the study period
 4. Benefits of the study: the result of this study will be valuable to the prevention and control of tuberculosis. It can serve as baseline for the end TB strategy
 5. Confidentiality of information: All information gathered will remain confidential. Information will never be transmitted to any unauthorized person or organization.
- Person to contact: This research project will be reviewed and approved by ethical clearance committee of Addis Ababa University College of health sciences.

Annex2: Consent form

Study Title: Trend analysis of tuberculosis among TB patients in Bahir Dar, Northwest Ethiopia

Name of Principal Investigator: Dagmawi Mengesha

I voluntarily agree to take part in this study. I have been well informed about the study plan and the procedures that I will undergo as part of this study. The possible harms and discomforts and the possible benefits of this study have been explained to me. All my questions have been answered. I am aware that I can withdraw at any time and for any reason from this study.

Name of Participant

Signature

Date

Name of person obtaining consent

Name of principal investigator

For further information you may ask:

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Annex3: Data collection tool

1. Questionnaire: Trend analysis of tuberculosis among TB patients in Bahir Dar city, Northwest Ethiopia.

Questionnaire code	
Card number	
Date of data collection	
Name of health institution	

2. Socio demographic information

	Questions	Coding categories
Q1	Age (in years)	-----
Q2	Sex/Gender/	1. Male 2. Female
Q3	Current residence	1. Urban 2. Rural

Q4	Type of TB	1. Smear Positive TB 2. Smear Negative TB 3. Extra pulmonary TB
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