Trends in the Occurrence and Treatment Outcomes of Tuberculosis in North Shewa Zone of Ethiopia: A 5-Year Retrospective Analysis of Cases at Tarmaber District Health Centers

Seble Teklesilassia
Addis Ababa University
Tegenu Gelana
Addis Ababa University
Tilahun Alelign (tilaalelign@gmail.com)
Debre Berhan University https://orcid.org/0000-0001-8384-2593

Research

Keywords: Ethiopia, Retrospective, Trend, Tuberculosis, TB/HIV Co-infection

Posted Date: November 2nd, 2021

DOI: https://doi.org/10.21203/rs.3.rs-1024562/v1

Abstract

Background: Tuberculosis (TB) remain a key global public health concern in Ethiopia.

The study aimed at assessing prevalence and treatment outcomes of tuberculosis in the past five years.

Methods: A retrospective data were collected from TB registry unit at Debre-Sina and Aremanya health centers from 2014-2018. A total of 221 TB patients who were registered and attended the direct observed treatment (DOTs) service in the health centers included in the study. Data were analyzed using SPSS version 20.

Results: Among 221 TB patients, the prevalence of pulmonary TB was 175 (79.2%) of which 35.7% were smear positive, 43.4% were smear negative, 19.9% were with extra pulmonary TB and 0.9% were multidrug resistant. TB was found to be higher in males (52.5%) than females (47.5%). The highest TB cases (62%) occurred in the age group of 15 to 44 years (c^2 =26.110, p= 0.002). The occurrence of all forms of TB was higher in urban (56.6%) than in rural settings (43.4%). The incidence of TB/HIV co-infection in the study area was 19% (c^2=9.534, p= 0.023). Treatment success was increased from 2014 to 2018 in both health centers; however, TB detection rate was low (45.8%) in the study area.

Conclusions: This retrospective study showed a decreasing trend of TB in the last five years. However, the study implies the need to give emphasis on pulmonary TB case detection for its elimination program.

Background

Tuberculosis (TB) causes mortality and morbidity, particularly in developing countries [1]. It is caused by *Mycobacterium tuberculosis* (MTB) and occasionally caused by other species of MTB complex such as *M. bovine, M. africanum* and *M. canetti* [2]. Globally, TB is the second leading cause of death from an infectious disease next to HIV [3,4]. TB spreads when people with pulmonary TB discharges the bacilli while coughing and sneezing [5]. There are two types of tuberculosis including pulmonary tuberculosis (PTB) and extra pulmonary tuberculosis (EPTB). Clinically, it has been reported that pulmonary tuberculosis and extra-pulmonary tuberculosis, contributes to 80% and 20% of TB infection, respectively [6].

Globally, it is estimated that 10 million people develop TB disease in 2017 of which 5.8 million were men, 3.2 million were women and 1 million were children. The majority of TB occurred among people living in low and middle income countries.Thus, poverty is a risk factor for developing TB, which places Ethiopia as high-risk environment. TB epidemic has further been exacerbated by HIV/AIDS pandemic. There were cases in all countries and age groups, but overall 90% were adults (aged ≥15 years), 9% were people living with HIV (72%) in Africa) and two thirds were in eight countries: India 27%, China 9%, Indonesia 8% Philippines 6%, Pakistan 5%, Nigeria 4%, Bangladesh 4% south Africa 3% [7]. In developing countries, the annual infection rate of TB reached 2%, and 0.5% in developed countries [8].

Ethiopia ranks 3rd in Africa and 8th among the 22 highest tuberculosis burdened countries in the world [9]. The prevalence of all forms of TB is estimated at 261 per 100,000 populations, leading to an annual mortality rate of 64 per 100,000 populations. The incidence rate of all forms of TB is estimated at 359 per 100,000 populations, while the incidence rate of smear-positive TB is 108 per 100,000 populations. The TB case detection rate, the treatment success rate and TB cure rate are 74%, 82.5% and 67%, respectively [7]. In the year 2009/10 Ethiopia registered 146,172 cases of TB. Among these, 139,261 were new cases; 46,132 new smear-positive (33.1%); 49,037 new smear-negative (35.2%); 44,092 new extra-pulmonary TB (31.6%). TB is affecting all sex and age groups [10]. Despite several interventions including providing TB detection and treatment services in both public and private healthcare facilities [11], TB continues as a major public health concern in Ethiopia [12].

The prevalence of TB was reported from different parts of Ethiopia as: 1.8% in Afar [17], 7.3% in Arsi zone [13], 9.2% from south East Ethiopia [14], 19.4% in Gamo Gofa [15], 14.2% in Metehara hospital [16], and 21% in Eastern Ethiopia [18]. In Ethiopia, TB is a major public health problem in Amhara region [4]: 155-203 per 100,000 in West Gojjam [19], 2.6% in Debre Berhan [20], 4.5% in Dabat [21] and 6.2% in Dessie hospital [22]. The presence of high TB prevalence among TB suspected patients were also reported in Debre Berhan hospital [23]. The actual magnitude of TB has not been accurately determined due to low health service coverage and poorly developed health information systems. In addition, a wide variations exist among the different localities of a country in TB/HIV co-infection, and the treatment success rate. However, the assessment of the prevalence and treatment outcomes of TB would help to generate information on the achievement of DOTs service.

In all governmental health centers including Tarmaber district health centers, the treatment outcome services of TB was based on the direct observed treatment (DOTS) programs. No study has described the prevalence and treatment outcome of TB at Debre-Sina and Aremanya health centers. Therefore, the present study was assessed the prevalence and treatment outcomes of TB at Debre-Sina and Aremanya health centers from 2014 to 2018 years.

Methods

Description of the Study Area

Debre Sina is the capital town of Tarmaber District, which is one of the 27 District in North Shewa administrative zone of Amhara regional state. It is 60 kilometers away from Debre Birhan town, and 190 kilometers away from Addis Ababa.Tarmaber District is bordered from north-east Kewet, south Ankober, North-west Menz Mama-Midr, South-West Bassona-Werena and West Mojana District, and Afar regional state in the Southeast. According to the Tarmaber District's population count (2018), the total people lived in this District was 106,731 of which 54,884 were males and 51,847 were females.

There are four health centers in Tarmaber District of which Debre-Sina and Armanya health centers were selected purposefully. The majority of TB directly observed treatment (DOTs) service takes place in these

health centers that made high inflow of TB patients to the centers. In the district, the health centers have microscopic TB diagnostic laboratory. The smear-confirmed TB cases get treatment service by DOTs short-course.

Research Design and Data collection

Retrospective study design was conducted from January 1, 2014 to December 30, 2018 (five years) among TB patients attending DOTS services. Patients in all age groups who had started and completed TB therapy, or transferred out during the study period were included in the study. Medical records were reviewed to extract socio-demographic information of TB patient and treatment outcomes. Patients with complete demographic and laboratory informations were included; whereas patient records with chronic illnesses like diabetes were excluded.

The data sources were all TB patients collected after communicating TB focal person. The variables in the medical record including patient type (new, relapsed), HIV status, form of TB (pulmonary TB and extra pulmonary TB), drug resistance TB, treatment outcome (completed, lost to follow up, cured and died), and socio-demographic characters (sex, age, residence) were collected from the DOTs registration book and from the total TB suspected examinees. Data were checked for completeness, clarity and consistency before analyzing to ensure quality.

Ethical considerations

The research protocol was approved by the Addis Ababa University, Department of Zoological Sciences and the letter was submitted to the concerned administrators head office in the study area. After discussing the purpose of the study with them, Debre-Sina and Armanya health centers permitted the study. Finally, permission letter was obtained to conduct the research in Tarmaber District at these governmental health centers.

Data analysis

Data analysis was performed using SPSS version 20 software. Descriptive statistics were used to present the prevalence and treatment outcomes of TB. The associations of various risk factors with different TB forms was analysed using chi-square at 95% CI, where $p\text{-value} < 0.05$.

Results

Prevalence of Tuberculosis among Health Centers

A total of 1, 291 TB suspected examinees were registered for all forms of TB cases. Out of these, 226 patients were enrolled in the study and 221 had complete data. Among a total 221 of TB cases, 79(35.7%) were smear positive, 96 (43.4%) smear negative, 44 (19.9%) EPTB, and 2 (0.9%) were MDR-TB. Out of 221 TB patients, 141 (63.8%) were from Debre-Sina 80 (36.2%) were from Armanya (**Table 1**).

A total of 221 TB patients were attended DOTs service at Debere-Sina and Aremanya health centers from 2014-2018 years, of which 116 (52.5%) were males and 105 (47.5%) were females. Among males, 45(38.8%) were smear positive, 53 (45.7%) were smear negative, 17 (14.7%) were with extra pulmonary TB and 1 (0.86%) were with MDR-TB. Likewise, among females 47.5% TB patients, 34 (32.4%) were smear positive, 43 (40.9%) were smear negative, 27 (25.7%) were EPTB and 1 (0.95%) were MDR-TB (**Table 2**).

Prevalence of Tuberculosis in relation to Age

Tuberculosis most frequently affected the age group between 15- 44 and in both forms of TB (PTB and EPTB). The highest prevalence of TB cases 137 (62%) were occurred in the age group of 15-44 years in both sexes, of which 55 (40.1%) were SPPTB and 52 (38%) SNPTB, 29 (21.2%) EPTB and (0.7%) were MDR-TB (**Table 3**).

Prevalence of TB in relation to Residency

Among the study subjects, 125 (56.6%) TB patients were living in urban areas; whereas 96 (43.4%) of TB patients were living in rural areas. Among urban residents, 49 (39.2%) were smear positive, and 30 (31.3%) of rural residents were smear positive (**Table 4**).

Trends in the prevalence of TB cases from 2014-2018

The prevalence of TB cases from 2014-2018 were 53 (24%), 43 (19.5%), 40 (18 %), 46 (20.8%) and 39 (17.6%) respectively. The highest TB records were in 2014 (24%). Regarding pulmonary TB, the highest cases were registered in 2014 (41 cases) and the lowest cases were in 2017(31 cases) (**Table 5**).

Prevalence of TB/HIV Co-infection

The overall prevalence of TB/HIV co-infection in the two health centers was 42 (19%). The pattern of co-infection was slightly higher in males 22 (52.4%) than females 20 (47.6%) (Table 6).

Detection rate of smear positive pulmonary TB cases

Among the total of 175 PTB patients, 79 cases were SPPTB during the past five years, among these the smear positive were 57% in males and 43% in females. In addition, the rest cases 44 (19.9%) were postive for extra pulmonary TB. The trend in year-specific case detection rate of SPPTB was 15 (36.6%), 16 (47%), 10 (28.6%), 17 (54.9%) and 21 (61.8%) from 2014-2018 respectively. This result showed slightly an increase in trends of case detection rate. The average case detection rate (CDR) of the study site was 45.8% (**Table 7**).

Treatment outcomes of TB patients from 2014-2018

About 191(86.5%) TB patients who were completed treatment and get cured successfully, of which of these, 66 (29.9%) were cured and 125 (56.5%) were completed the treatment. Aomng these, 97 (50.8%)

were males and 94 (49.2%) were females. The year specific treatment success of the health centers were 83%, 86%, 85%, 91.3% and 87.1% from 2014 to 2018, respectively. The higher ranges were (91%) in 2017 and lower range were (83%) in 2014. Treatment failure were only for 1(0.45%), deaths were 16 (7.2%), and those who transferred out were 9 (4%) and 4 (1.8%) were lost to follow up (**Table 8**).

Types of TB cases at Health Centers from 2014-2018

Among a total of 221 TB cases, 205 (92.8%) were new cases, whereas 16 (7.2%) were relapsed cases. The highest relapsed case (31.2%) were recorded in 2018 (**Table 9**). Some risk factors associated with different TB cases were mentioned as shown in **Table 10.**

Discussion

Tuberculosis causes mortality and morbidity particularly in developing countries(1). The retrospective data analysis showed that TB cases were higher in males compared to females. This was consistent with previous studies conducted in different part of Ethiopia such as Gambella (24; 25), Sidama (26), Gonder (27) and the reports of the World Health Organization (3). According to Neyrolles (28) various factors possibly contributed to the sex bias in TB such as sociocultural component (income and stigmatization awareness), behavioral components (smoking, drinking of alcohol and drug abuse), traveling more frequently and exposure to toxic dusts at the working places.

The higher prevalence of PTB cases than EPTB was in agreement with clinically diagnosed pulmonary tuberculosis (PTB) and extra-pulmonary tuberculosis (EPTB), contributing to 80% and 20% of the TB infections (6). This was similar with other retrospective studies conducted at Ataye, Debre Berhan, and Mehal-Meda public hospitals (29). The present study showed the overall proportion of EPTB (19.9%) was in agreement with the proportion of three public hospitals 17.5% (29), but lower than the proportion of EPTB in Nekemte 45.2% (30).

Tuberculosis most frequently affected the age group 15- 44 years in both sexes and both forms of TB, which wass similar to various studies at Gambella (24), Nekemte (30), Bahir Dar (31), Gonder (27), and Metehara (16) hospitals. This was also inline with the study reported that TB cases predominantly occur among young adults (15-49 years), who are the most productive ages (32). The possible reason might be due to the fact that these age groups are sexually active and may be co-infected with HIV, are highly movable (high chance of getting contact with PTB cases), and exposed to drinking alcohol, chewing khat, and cigarette smoking. The prevalence of TB cases in children age group (0-14) was very low. This is in agreement with other reports in Nekemte (30, 33) and Ruwanda (34). It might indicate BCG vaccination provides a certain degree of protection against serious forms of TB (35).

In the present study, the prevalence of TB was higher in urban than rural settings, which was in agreement with the study conducted at Gambella regional state hospital indicating that about 1798 patients were from urban and 721 were from rural areas (24). Similarly, a study from Debre Berhan referral hospital reported that 72.7% TB patients were from urban and 27.3% were from rural areas (23). This was

disagree with the reports of Hamid (36). The higher risk of having TB in urban than rural areas was possiblly due to overcrowding living styles, which increase the likelihood of MTB transmission (37,38). Several environmental factors including crowded shelters lacking ventilation system can influence the likelihood that someone acquire TB infections (38).

In the present study, trends in TB prevalence was decreased in the last five years (2014-2018), which was similar to the report WHO (7), Yirga Chafe Health Center (39), and Nekemte (30). The probable reason for the falling down of the annual prevalence of all forms of TB might be due to the availability of health facilities, the continuous health service delivery including the implementation of DOTs, and public awareness about TB disease.

The overall prevalence of TB/HIV co-infection was found to be 19%, which was significantly associated with Tuberculosis ($p = 0.023$). This was consistent with the studies reported from Gambella region as 24% (24), 18.7% (30), and 21% from Oromia region (40), but it was less than the studies reported from Debre Brehan (28.9%) (23) and WHO estimates (36%) in Africa (7). This was also higher than the national rate of TB/HIV co-infection (11%) in Ethiopia (9). Smear negative diagnosis in TB/HIV co-infected patients (59.5%) was probablly due to patients with HIV associated TB have less bacilli in their sputum than do HIV uninfected patients with PTB (41). This may be one reason for proportion of low smear positive PTB record.

In the presest study, the average case detection rate (CDR) at Debere Sina and Armanya health centers was low (45.8%) compared to the global target of 70% by 2015. This result supports the study that was reported in Nekemte (30), and Ethiopia (9). However, the present case detection rate was higher than that of Tigray (26%), Amhara (23%), Somali and Benshangul region (19%) (2), but lower than the CDR in Harrar (95%), Dire-Dawa (81%), and Addis Ababa (63%) (2). This low case detection rate in the present study area could be attributed due to non-adherence to the national diagnostic algorithms, which is a common problem in hospitals contributing to over-diagnosis of smear-negative PTB (42). Poor quality examinations of a sub-optimal number of sputum smears could partly be contributing to the high diagnosis of smear negative PTB diagnosis (43). Therefore, improving the diagnostic problems can increase the case detection rate, which serves to fight TB transmission.

According to the current study, there was an increment of treatment success rate (TSR) from the end of 2014 to 2018 in the two health centers. The average treatment success rate of all forms of tuberculosis was found to be 86.5%. This was consistent with the trends of TSR in Ethiopia that showed 80% in 2000, 78% in 2005, 77% in 2010, 89% in 2011, and 91% in 2012 (9). Similarly, the TSR achievement was not similar in all regions of the country, and it was 85.5% in Nekemte, Oromia region (30), 85% in Somalia region, 79.4% in Debre Brehan (23), 84% in Amhara region (44), and 89% in Sidama (26). The treatment success rate in Ethiopia was increased from 80% in 2000 to 91% in 2012 showing that Ethiopia has achieved the global target of the treatment success rate before the deadline (85% by 2015). Although death rate registered in the study area was 7.2% in the last 5 years, it was consistent with Nekemte (8.1%) (30), and Gondar Hospital (10.1%) (45). However, it was higher than the death rates registered in in Addis

Ababa (3.7%) (46), and 1.8% in Debre Brehan (23). The success of treatment outcomes could have played by the measures taken in the implementation of DOTs and an increasing efforts to encourage HIV screening and initiating antiretroviral therapy for TB/HIV co-infected patients. Other possible reasons for the improvement of TSR might be the increased awareness of people about the disease transmission and treatments through health information dissemination by health extension workers.

The present study indicated that the higher prevalence of new TB cases than relapsing cases (p= 0.009), which were associated with all forms of TB. Presently, DOTs program was implemented in the study area, but the prevalence of relapsed and death cases were generally shown increment towards the end of 2018. This finding was in agreement with research conducted in Nekemte (33) and North Western Shoa (47). An increament in the prevalence of TB relapse and deaths of the TB patients may be an indication for the increasing of TB/HIV co-infection (2).

Conclusions

The retrospective study indicated that the prevalence of TB was gradually declining, while the relapsing and death cases were rising in association with HIV in the last five years. TB disease was predominant among the productive ages (15-44 years), and common in males than females. About 79.2% of new infections were pulmonary tuberculosis. The prevalence of TB/HIV co-infections were increased from 2014 to 2017. Treatment outcomes of 86.5% TB patients were successful, but the average case detection rate was low (45.8%).

Abbreviations

TB:Tuberculosis; MTB: *Mycobacterium tuberculosis*; PTB: Pulmonary tuberculosis; EPTB: Extra pulmonary tuberculosis; DOTs: Directly observed treatment; TB/HIV: Tuberculosis/Human Immundeficiency Virus co-infection; HIV/AIDS: Human Immundeficiency Virus/Aquired Immunodeficiency syndrome

Declarations

Acknowledgments

The authors would like to thank the staff of Armanya and Debre-Sina health center's for their support during data collection. Furthermore, we would like to thank laboratory technicians and TB focal persons of the two health centers for their kind co-operation. Also, we acknowledged Addis Ababa University for sponsoring this study.

Authors' contributions

ST and **TG** was involved in study conception, data collection and data analysis. **TG** and **TA** were involved in the data analysis, and drafting the manuscript. **TA** was critically reviewing the manuscript. All

authors have read and approved the final manuscript.

Funding
This research work was not funded.

Availability of data and materials
Data is available upon request.
Ethics approval and consent to participate
Not applicabe.
Consent for publication
Not applicable.

Conflict of Interest

The authors declare that they have no competing interests.

References

1. Pal M, Zenebe N, Rahman, MT. The Growing significance of *Mycobacterium bovis* in human health. Microbes and Health. 2014; 3: 21-34.

2. FMOH.
National comprehensive tuberculosis, leprosy and TB/HIV training manual for health care worker in Ethiopia. Addis Ababa, 2016.

3. WHO. World tuberculosis Report: World Health Organization, Geneva, Switzerland, 2013.

4. WHO. World tuberculosis Report: World Health Organization, Geneva, Switzerland, 2014.

5. Admasu K, Kebede A. Tuberculosis prevalence survey in Addis Ababa.American Journal of Epidemiology and Infectious Disease, 2011;13-15.

6. Randal R, Sahil A. A Report of the CSIS global health policy center. Washington, DC 20036, 2016.

7. WHO. TB detection and diagnosis https://www.who.int/tb/areas-of-work/laboratory/en/,2018.

8. Getahun H, Gunneberg C, Granich R, Nunn P. HIV infection associated tuberculosis: The epidemiology and the response .Clin infect Dis. 2010; 50(3): 201-207.

9. Global TB report. Tuberculosis epidemiology, prevention and control, economics, MDR and Annual report, 2014.

10. FMOH . 1st Ethiopian national population based TB prevalence Survey. Ethiopian health nutritional research institute, Addis Ababa, 2011.

11. FMOH. Guideline for program and clinical management of drug resistant tuberculosis, Addis Ababa, Ethiopia, 5th edition. Incidence and their determinants in 134 countries. Bulletin of World Health Organization, 2009.

12. WHO Global Tuberculosis Report, 2017. http://apps.who.int/iris/bitstream/10665/259366/1/9789241565516-eng.pdf?ua=1.

13. Hamusse SO, Demissie M, Teshome D, Hassen MS, Lindtjørn B. Prevalence and incidence of Smear-Positive Pulmonary tuberculosis in the Hetosa District of Arsi Zone, Oromia Regional State of Central Ethiopia. BMC Infectious Diseases,2017;17: 214.

14. Tulu B, Dida N, Kassa Y, Taye B. Smear positive pulmonary tuberculosis and its risk factors among tuberculosis suspect in South East Ethiopia: A hospital based cross-sectional study. BMC Research Notes, 2014; 7.

15. Zerdo Z, Medhin G, Worku A, Ameni G. Prevalence of Pulmonary tuberculosis and associated risk factors in Prisons of Gamo Goffa Zone, south Ethiopia: A cross-sectional study. American Journal of Health Research, 2014; 2: 291-297.

16. Yohans A, Abera S, Ali S. Smear positive pulmonary tuberculosis among suspected patients attending Metehara sugar factory hospital; eastern Ethiopia. African Health Sciences, 2012; 12: 325-330.

17. Legesse M, Mamo G, Ameni G, Medhin G, Bjune G, Abebe F. Community-based prevalence of undiagnosed mycobacterial diseases in the Afar Region, north-east Ethiopia. International journal of Mycobacteriology, 2013; 2: 94-102.

18. Mekonnen A. Smear-positive pulmonary tuberculosis and AFB examination practices according to the standard checklist of WHO tuberculosis laboratory assessment tool in three governmental hospitals, Eastern Ethiopia. BMC Research Notes, 2014; 7.

19. Gebreegziabher S, Yimer SA, Bjune GA. Tuberculosis case notification and treatment outcomes in West Gojjam Zone, Northwest Ethiopia: A five-year retrospective study, *Journal* of Tuberculosis Research, 2016; 4: 23-33.

20. Semunigus T, Tessema B, Eshetie S, Moges F. Smear positive pulmonary, 2016.

21. Tadesse T, Demissie M, Berhane Y, Kebede Y, Abebe M. Two-thirds of smear-positive tuberculosis cases in the community were undiagnosed in Northwest Ethiopia: Population based cross-sectional study. PLoS ONE, 2011; 6.

22. Amare H, Gelaw A, Anagaw B, Gelaw B. Smear positive pulmonary tuberculosis among diabetic patients at the Dessie referral hospital, Northeast Ethiopia. Infectious Diseases of poverty, 2013; 2(6).

23. Firdie T, Tariku D, Tsegaye T. Treatment out comes of tuberculosis patients at Debre Berhan hosipital. Ethiopian Journal health sci, 2016; 26(1): DOI:http://dx.doi.org/10.4314/ejhs.

24. Jemberu A, Gezahegne M, Venkataramana K, Mahendra P. Prevalence of tuberculosis in Gambella Regional Hospital, Southwest Ethiopia: A retrospective study to assess the progress towards Millennium Development Goals for tuberculosis(2006-2015). American Journal of Public Health Research, 2017; 5(1): 6-11. doi: 10.12691/ajphr-5-1-2.

25. Demeke D, Legesse M, Jango B. Trends of tuberculosis and treatment outcome in Gambella Region with special emphasis on Gambella regional Hospital, West Ethiopia (2006-2010). Journal Mycobac Dis, 2013; 3(130): doi: 10.4172/2161-1068.1000103.

26. Dangisso M, Datico D, Linditjurn B. Trends of tuberculosis notification and treatment out come in the Sidama Zone, Southern Ethiopia (2003-2012). PLoS ONE, 2014; 10(4):e0125135. Doi:10.1371/journal.

27. Kassu A, Mengistu G, Ayele B, Diro E, Mekonnen F, Ketema D, Moges F, Mesfine T, Getachew A, Ergicho B, Elis D, Aseffa A, Wondmikun Y, Ota F. Co-infection and clinical manifestation of tuberculosis in human immunodeficiency virus. infected and uninfected adults at s teaching hospital, North West Ethiopia. Journal Microbiol Immunol Infect. 2007; 40: 116-122.

28. Neyrolles O, Quintana-Murci L. Sexual Inequality in Tuberculosis. PLoS Med, 2009; 6(12): e1000199. doi:10.1371/journal.pmed.

29. Solomon H, Osman Y, Abdurahman M. Retrospective assessment of the status and determinants of tuberculosis treatment outcome among patients treated in government hospitals. Dovepress, Journal Research and Report inTropical medicine, 2017.

30. Ajema L. Evaluation of millennium development goals for control of tuberculosis in Nekemte town. Addis Ababa University, 2015; 1-37.

31. Biadglegne F, Anagaw B, Debebe T, Anagaw B, Tesfaye W, Tessema B, Rodloff AC, Sack U.. A retrospective study on the outcomes of tuberculosis treatment in Felege Hiwot Referral Hospital, Northwest Ethiopia. International Jurnal Medicine and Med Sci. 2013; 5: 85-91.

32. Johnson JL, Ellner JJ. Adult tuberculosis overview: African versus Western perspectives. Curr Opin Pulm Medmay, 2000; 6(3): 180-6.

33. Eyasu E, Mengistu L, Gobena A. Preliminary study on the epidemiology of tuberculosis in Nekemte and its surroundings -Western Ethiopia. STAR: Science, Technology and Arts Research Journal, 2012; 1(1): 18-25.

34. Muvunyi C, Masaisa F, Bayingana C, Musemakweri A, Mutesa L, Hernade Z. Prevalence and diagnostic aspects of sputum smear positive tuberculosis cases at a tertiary care institution in Ruwanda. Afr Jurnal Microbiol Res. 2010;4: 088-091.

35. Cole E, Cook C. Characterization of infectious aerosols in health care facilities an aid to effective engineering controls and preventive strategies. Int Journal Tuberc lung Dis, 1998; 8(3): 323-332.

36. Hamid J. Current and past 10-year trend of pulmonary tuberculosis and intervention practices in Amba-Giorgis health center, 2016.

37. Cambanis A, Yassin MA, Ramsay A, Bertel S, quire S, Arbide I, Cuevas LE. Rural poverty and delayed presentation to tuberculosis services in Ethiopia. TropMed Int health, 2005; 10(4): 330-5.

38. CDC. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings. MMWR weekly, 2005; 54: 1-141.

39. Fekadu A. Assessment of the prevalence of pulmonary tuberculosis patients at Yirga Cheffe Health Center from 2008-2013, Ethiopia. Clinical Medicine Research, 2015; l4(2):38-42.

40. Deribew A, Robert C. Tuberculosis and HIV co-infection: its impaction quality of life. Health and Quality of Life Outcomes. 2009; 7(105): doi:10.1186/1477-7525-7-105.

41. FMOH. Tuberculosis, leprosy and TB/HIV prevention and control programme manual. fourth edition, Addis Ababa, 2008.

42. Mengiste M., Tesfaye W T, Madeley J, Richard J. The quality of tuberculosis diagnosis in district of Tigray Region North Ethiopia. University of Nottingham, Division of Epidemiology and Public Health, United kingdom, 2005.

43. Hawken MP, Muhindi DW, Chakaya JM, Bhatt SM, Ng'ang'a LW, Porter JD. Under diagnosis of smear positive pulmonary tuberculosis in Nairobi, Kenya. Int J Tuberc Lung Dis, 2001; 5(4): 360-3.

44. FMOH. Evaluating the national tuberculosis control program: Challenges and ways forward, 2014.

45. Belay T, Abebe M., Assegedech B, Dieter R, Frank E, Ulrich S. Treatment outcome of tuberculosis patients at Gondar University Teaching Hospital, Northwest Ethiopia: A five-year retrospective study. BMC Public Health, 2009; 371(9): 1471-2458.

46. Belete G, Gobena A, Girmay M, Sibhatu B. Treatment outcome of tuberculosis patients under directly observed treatment in Addis Ababa, Ethiopia. Braz Journal Infect Dis. 2013; 17(5): 521-528.

47. Seyoum T S. Study on tuberculosis in North Western Shewa, Central Ethiopia, M.Sc thesis, Aklilue Lemma Institute of Path biology, Addis Ababa University, Ethiopia, 2007.

Tables

Table 1. All forms of TB cases count at health centers from 2014-2018.

Years	Suspected Examinees	Total TB Patients	Sex		Form of TB			
			M(n)	F(n)	SPPTB	SNPTB	EPTB	MDR-TB
2014	183	53	32	21	15	26	11	**1**
2015	223	43	25	18	16	18	8	**1**
2016	207	40	20	20	10	25	5	**0**
2017	310	46	16	30	17	14	15	**0**
2018	368	39	23	16	21	13	5	**0**
Total	1,291	221	116	105	79	96	44	**2**

Note: M=Male, F=Female, SPPTB=Smear positive pulmonary TB, SNPTB=Smear negative pulmonary TB, MDR-TB =Multidrug resistant TB and EPTB=Extra pulmonary

Table 2. Prevalence of all forms of TB by sex at health centers.

Form of TB	Sex		Total n(%)
	Male n(%)	Female n(%)	
Smear positive	45 (38.8%)	34 (32.4%)	79 (35.7%)
Smear negative	53 (45.7%)	43 (40.9%)	96 (43.4%)
Extra pulmonary TB	17 (14.7%)	27 (25.7%)	44 (19.9%)
MDR-TB	1(0.86%)	1(0.95%)	2 (0.9%)
Total	116 (52.5%)	105 (47.5%)	221 (100%)

Table 3. Prevalence of all forms of TB in different age categories in Debre-Sina and Aremanya health centers.

Age category	SPPTB n(%)	SNPTB n(%)	EPTB n(%)	MDR-TB n(%)	Total n(%)
0-14	1 (11.1)	2 (22.2)	5 (55.6)	1 (11.1)	9 (4.10)
15-44	55 (40.1)	52 (38)	29 (21.2)	1 (0.7)	137 (62)
45-65	17 (30.4)	31 (55.4)	8 (14.3)	0(0.0)	56 (25.3)
>65	6 (31.6)	11 (57.9)	2 (10.5)	0(0.0)	19 (8.60)
Total	79 (35.7)	96 (43.4)	44 (19.9)	2 (0.9)	221(100)

Note: SPPTB=Smear positive pulmonary TB, SNPTB=Smear-negative pulmonary TB, EPTB=Extra Pulmonary TB, MDR= Multidrug resistant TB

Table 4. Prevalence of TB cases among the residence in the study sites.

Form of TB	Residency		Total
	Urban	Rural	
Smear positive	49 (39.2%)	30 (31.25%)	79 (35.7%)
Smear negative	54 (43.2%)	42 (43.8%)	96 (43.4%)
EPTB	20 (16%)	24 (25%)	44 (19.9%)
MDR-TB	2 (1.6%)	0	2 (0.9%)
Total	125 (56.6%)	96 (43.4%)	221 (100%)

Table 5. Trends in year-specific prevalence of TB cases at the study sites.

Years	Form of TB					Total (TB %)
	Total PTB%	SPPTB%	SNPTB%	EPTB%	MDR-TB%	
2014	41 (77.4)	15 (28.3)	26 (49)	11 (20.8)	1(1.9)	53 (24)
2015	34 (79.1)	16 (37.2)	18 (41.9)	8 (18.6)	1(2.3)	43 (19.5)
2016	35 (87.5)	10 (25)	25 (62.5)	5 (12.5)	0(0.0)	40 (18)
2017	31 (67.4)	17 (37)	14 (30.4)	15 (32.6)	0(0.0)	46 (20.8)
2018	34 (87.2)	21 (53.8)	13 (33.3)	5 (12.8)	0(0.0)	39 (17.6)
Total	175(79.2)	79 (35.7)	96 (43.4)	44 (19.9)	2 (0.9)	221 (100)

Note: PTB=pulmonary TB, SPPTB=Smear positive pulmonary TB, SNPTB=Smear-negative pulmonary TB, EPTB=Extra Pulmonary TB, MDR-TB =Multidrug resistant TB

Table 6. Prevalence of TB/ HIV co-infection among TB patients from 2014-2018.

ear	HIV Status								
	Reactive				Non-reactive				
	SPPT-B.	SNPTB	EPTB	Total n(%)	SPPTB	SNPT	EPTB	MDR	Total n(/%)
014	3	5	1	9 (17)	12	21	10	1	44 (83)
015	4	5	0	9 (21)	12	13	8	1	34 (79)
016	2	7	0	9 (22.5)	8	18	5	0	31 (77.5
017	4	6	1	11(24)	13	8	14	0	35 (76)
018	2	2	0	4 (10.3)	19	11	5	0	35 (89.7)
otal(%)	15(35.7)	25 (59.5)	2(4.8)	42(19)	64 (35.8)	71(39.7)	42(23.5)	2(1.1)	179 (80.9)

Note: PTB=Pulmonary TB, SPPTB=Smear positive pulmonary TB, SNPTB=Smear-negative pulmonary TB, EPTB=Extra Pulmonary TB, MDR-TB= Multidrug resistant TB, M=Male, F =Female

Table 7. Detection Rates of smear positive PTB from 2014-2018.

Years	PTB						
	SPPTB %	M	F	SNPTB %	M	F	Total %
2014	15 (36.6)	9	6	26(63.4)	19	7	41 (23.4)
2015	16 (47)	7	9	18 (52.9)	13	5	34 (19.4)
2016	10 (28.6)	7	3	25 (71.4)	10	15	35 (20)
2017	17 (54.9)	6	11	14 (45.2)	5	9	31 (17.8)
2018	21 (61.8)	16	5	13 (38.2)	6	7	34 (19.4)
Total	79 (45.8)	45(57)	34(43)	96 (54.2)	53 (55.2)	43(44.8)	175 (79.2)

Note: PTB=Pulmonary TB, SPPTB=Smear positive pulmonary TB, SNPTB=Smear-negative pulmonary TB, M= Male, F= Female

Table 8. Treatment outcomes of TB patients attending DOTs at the study sites.

Year	Successful treatment			Sex		Unsuccessful treatment			
	C %	Com %	C+ Com %	M	F	Died %	L %	T %	F %
2014	11(16.7)	33(26.8)	44 (83)	24	20	3 (18.7)	2	3 (37.5)	1
2015	14(21.2)	23(18.3)	37(86)	23	14	2 (12.5)	0	4 (50)	0
2016	6 (9)	28 (22)	34 (85)	16	18	3 (18.7)	2	1(12.5	0
2017	17(25.7)	25 (20)	42(91 3)	15	27	4 (25)	0	0	0
2018	18(27.3)	16(12.8)	34(87.1)	19	15	4 (25)	0	1	0
Total	66(29.9)	125(56.5)	191(86.5	97(50.8)	94(49.2)	16(7.2	4(1.8)	9 (4)	1(.45)

Note: C= Cured, Com= Completed, L=Lost to follow up, T=Transfer out, F=Failure, N =New, R=Relapsed, Freq= Frequency

Table 9. Prevalence of TB cases during five years retrospective study.

Type of cases	Years					Total
	2014	2015	2016	2017	2018	
New	50 (24.4)	42 (20.5)	36 (17.5)	43 (21)	34 (16.5)	205 (92.8)
Relapsed	3 (18.8)	1 (6.25)	4 (25)	3 (18.8)	5 (31.2)	16 (7.2)

Table 10: Risk factors associated with different TB forms.

Variables	No.(%)	PTB (No.)	EPTB (No.)	MDR-TB (No.)	c^2	P-value
Sex						
Male	116 (52.5)	98	17	1	4.309	0.230
Female	105 (47.5)	77	27	1		
Total	221	175	44	2		
Age category						
0-14	9 (4.1)	3	5	1		
15-44	137 (62)	107	29	1	26.110	0.002
45-65	55 (25.3)	48	8	0		
>65	19 (8.6)	17	2	0		
HIV status						
Reactive	42 (19)	40	2	0	9.534	0.023
Non-reactive	179 (81%)	135	42	2		
Patient type						
New	205 (92.8)	159	44	2	11.628	0.009
Relapsed	16 (7.2)	16	0	0		
Resident						
Urban	125 (56.6)	103	20	2	4.709	0.194
Rural	96 (43.4)	72	24	0		

Note: c^2=Chi-square, P- value and No.= Number