

Trends and prevalence of HIV infection among tuberculosis patients in two public hospitals in Bale Zone, Southeast Ethiopia: five-year retrospective study

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Abstract

Introduction: Human immunodeficiency virus (HIV) increases epidemiology of tuberculosis (TB) cases worldwide, particularly in sub-Saharan Africa, with a significant increase in TB incidence. In many countries, HIV prevalence in TB patients is a sensitive indicator of the spread of HIV into general population. Therefore, the objective of this study was to determine trends and HIV prevalence among TB patients in two public hospitals in Bale Zone, Southeast Ethiopia.

Material and methods: A five-year retrospective data (from July 2013 to June 2018) of TB patients registered in TB clinics of two randomly selected public hospitals in Bale Zone were retrieved. HIV testing and tuberculosis diagnosis were performed according to national HIV/TB co-infection control program guidelines. Data were extracted from a registry of TB patients and analyzed using SPSS version 23. Bivariable and multivariable logistic regression analysis were used to identify factors associated with HIV infection among TB patients.

Results: Among 1,281 TB patients, 98.1% (1,257) have been tested for HIV, of whom 246 (19.6%) were HIV co-infected. A slightly declining trend of HIV infection among TB patients was observed during the study period, from 3.1% in 2013 to 2.5% in 2018 ($\chi^2 = 13.4$, $p = 0.02$). Females (AOR = 1.47, 95% CI: 1.09-1.97%), previously treated TB patients, and age between 25 and 44 were found to have a statistically significant association with HIV infection among TB patients.

Conclusions: In this study, around one-fifth of TB patients who followed treatment in the past five years was found HIV co-infected.

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Key words: HIV, Ethiopia, co-infection, Bale Zone, TB patients.

Introduction

Tuberculosis (TB) is the most common opportunistic infection affecting human immunodeficiency virus (HIV) seropositive individuals. HIV infection prevalence among TB patients is a sensitive indicator of the spread of HIV

to the general population. People infected with HIV have an annual risk of five to fifteen percent in developing active form of TB, and the course of HIV-related immunodeficiency worsens by active TB infection. Similarly, HIV infection was contributed to a significant increase in the worldwide

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incidence of TB, especially in developing countries, where HIV and TB infection are endemic diseases. Thus, the interaction of HIV and TB in co-infected individuals is bidirectional and synergistic [1-3].

According to the World Health Organization (WHO), there were 9.6 million new TB cases and 1.5 million TB deaths globally, of these, 5.4 million were men, 3.2 million were women, and 1 million were children. Four million people infected with HIV worldwide have TB disease, which makes TB the major killer among patients infected with HIV. On the other hand, forty-eight percent of TB patients globally had a documented HIV test result, of which 12% had a HIV infection [4-6]. A large dual TB-HIV epidemic still exists in sub-Saharan Africa, accounting for about 80% of estimated global burden, which is major challenge to socio-economic development, public health, and healthcare delivery systems [7, 8].

Despite many efforts undertaken to control and prevent dual occurrences of the diseases, HIV fuels the TB epidemic worldwide, especially in sub-Saharan Africa where TB is the commonest cause of death among people living with HIV [9, 10]. From infectious diseases statistics, TB and HIV kill more than 5,000 and 8,000 people every day, respectively. An estimated total of 1.4 million deaths due to TB occurred in 2015, making TB one of the top 10 causes of death worldwide, ranking above HIV and AIDS. Out of 1.2 million estimated deaths due to HIV, TB accounted for 0.4 million deaths among HIV-positive individuals. The global TB report showed that an estimated 3,600 TB-HIV co-infected patients on treatment have died in Ethiopia [11-13].

Previous studies finding and reports from Ethiopia and several other African countries had shown that the prevalence of HIV infection among TB patients ranged from 20% to 60% and from 6.1% to 40.4%, respectively [14-16]. Certain TB-infected people develop HIV, while others do not. This occurrence reaffirms having TB as not the only factor for being infected with HIV, indicating several factors, such as age, marital status, smoking, alcohol intake, TB treatment outcomes, and homeownership as associated with TB/HIV co-infection [17-22].

According to Ethiopia's TB/HIV national guidelines, all HIV-positive patients should be evaluated for TB before starting antiretroviral therapy (ART) and then at every visit. Similarly, all TB patients should be offered HIV testing services in TB clinics. As TB and HIV are known to enhance and worsen the effects of each other, to successfully mitigate the dual burden of TB/HIV in at risk populations, a combination of measures, including priority in effective research and collaborative activities involving intensified case finding, and preventive and curative therapy are crucial [23, 24].

Retrospective studies allow to understand how interventions develop in real world of clinical medicine and public health as well as to express ideas on possible associations. Up to our knowledge, despite huge secondary data available regarding HIV/TB co-infection, there is limited literature in Ethiopia and particularly, no retrospective study in Bale Zone that emphasize trends and prevalence of HIV infec-

tion among TB patients. Therefore, this study was designed to determine trends and prevalence of HIV infection among TB patients in two public hospitals in Bale Zone, Southeast Ethiopia. It was expected that findings from this study would influence the body of data (TB/HIV program planners, decision-makers, and project implementers).

Material and methods

Study setting

Bale Zone, after Borena Zone, is the second largest zone in Oromia National Regional State, with a total area of 63,555 km². It shares about 17.5% of the total area of Oromia region. It has 18 districts, 3 urban administrative centers, 20 urban, and 351 rural kebeles.

In Bale Zone, there are 84 health centers and five hospitals (one primary, one referral hospital, and three general hospitals). Of the five hospitals, two hospitals were selected randomly for the present study. In the past five years, the number of TB patients have ranged from 41 to 92 and 115 to 187 per year in referral and general hospital, respectively. The study was conducted between July 2013 and June 2019.

Study design and population

A five-year retrospective study among TB patients registered at direct observation treatment short-course strategy (DOTS) clinic of two public hospitals in Bale Zone was conducted. All types of TB patients registered between 2013 and 2019 were eligible for the study, who were followed-up in Goba referral and Robe general hospitals' TB clinics, with complete socio-demographic and treatment outcomes data. TB patients with incomplete data were excluded from the study. Patients were registered, tested for HIV, diagnosed, treated, and referred to other DOTS clinics, which follow national tuberculosis and TB/HIV prevention and control programs guidelines [21].

Ethical clearance was obtained from institutional ethical review board of Goba referral hospital, Madda Walabu University. Data access permission was acquired from two public hospitals within the Bale Zone. There was no personal involvement of participants in the study; we simply extracted anonymized data from the records of patients.

Data collection tool

Data were extracted from a registry of TB cases treated under direct observation treatment short-course strategy (DOTS) from July 2013 to June 2018, using a data extraction checklist.

Data processing and analysis

The data were checked for completeness, coded, and entered into SPSS version 23. Descriptive statistics frequency

Table 1. HIV status and demographic and clinical characteristics of two public hospitals of Bale Zone tuberculosis patients from July 2013 to June 2018, Ethiopia ($N = 1,257$)

Variables	Frequency (%)	HIV status/test result		Overall HIV infection, %	χ^2 , p -value
		Positive, n (%)	Negative, n (%)		
Level of hospital					
Referral hospital	414 (32.9)	92 (22.2)	322 (77.8)	7.32	2.8, 0.057
General hospital	843 (67.1)	154 (18.3)	689 (81.7)	12.25	
Patients' residences					
Urban	911 (72.5)	188 (20.6)	723 (79.4)	14.96	
Rural	299 (23.8)	50 (16.7)	249 (83.3)	4.00	
Prison	47 (3.7)	8 (17.0)	39 (83.0)	0.64	
Sex of patients					
Male	726 (57.8)	124 (17.1)	602 (82.9)	9.90	6.78, 0.009
Female	531 (42.2)	122 (23.0)	409 (77.0)	9.71	
Age group of patients					
0-14	100 (8.0)	18 (18.0)	82 (82.0)	1.43	116, < 0.001
15-24	418 (33.3)	29 (6.9)	389 (93.1)	2.31	
25-34	329 (26.2)	83 (25.2)	246 (74.8)	6.60	
35-44	166 (13.2)	66 (39.8)	100 (60.2)	5.25	
45-54	119 (9.5)	38 (31.9)	81 (68.1)	3.02	
55-64	62 (4.9)	11 (17.7)	51 (82.3)	0.88	
> 65	63 (5.0)	1 (1.6)	62 (98.4)		
Type of TB					
Pulmonary positive	446 (35.5)	89 (20.0)	357 (80.0)	7.08	22.4, 0.003
Pulmonary negative	462 (36.8)	94 (20.3)	368 (79.7)	7.48	
Extra-pulmonary	349 (27.8)	63 (18.1)	286 (81.9)	5.01	
TB patient category					
New	1,131 (90.0)	221 (19.5)	910 (80.5)	17.58	16.22, 0.001
Previously treated	47 (3.7)	18 (38.3)	29 (61.7)	1.43	
Transferred	79 (6.3)	7 (8.9)	72 (91.1)	0.56	
Year of treatment					
2013	170 (13.5)	39 (22.9)	131 (77.1)	3.10	13.22, 0.02
2014	226 (18.0)	45 (19.9)	181 (80.1)	3.58	
2015	252 (20.0)	31 (12.3)	221 (87.7)	2.47	
2016	224 (17.8)	50 (22.3)	174 (77.7)	3.98	
2017	206 (16.4)	49 (23.8)	157 (76.2)	3.90	
2018	179 (14.2)	32 (17.9)	147 (82.1)	2.55	
Treatment outcome of TB patients					
Cure	383 (30.5)	75 (19.6)	308 (80.4)	6.00	
Complete	743 (59.1)	136 (18.3)	607 (81.7)	10.82	
Failure	8 (0.6)	0 (0.0)	8 (100.0)	0.00	
Death	66 (5.3)	29 (43.9)	37 (56.1)	2.31	
Not evaluated	38 (3.0)	3 (7.9)	35 (92.1)	0.24	
Loss to follow-up	14 (1.1)	3 (21.4)	11 (78.6)	0.24	
Moved to MDR TB treatment	5 (0.4)	0 (0.0)	5 (100.0)	0.00	

MDR – multidrug resistant, TB – tuberculosis

tables and graphs were computed to describe trends and HIV prevalence among TB patients. Bivariable logistic regression analysis was used to identify possible variables for multivariable logistic regression using a p -value less than 0.2. Adjusted odds ratio with 95% confidence interval was calculated to determine the strength of association, and variables with p -value < 0.05 in the final model were considered as statistically significant.

Results

Demographic and clinical characteristics of the patients

Among 1,281 TB patients registered for DOTS program, 1,257 with full information on treatment outcome and data were included, and 24 were excluded due to unknown treatment outcomes and data. Of the total TB patients included for further analysis, 726 (57.8%) were males, and 911 (72.5%) were urban residents. Regarding HIV test status, 246 (19.6%) of TB patients were recorded to be HIV-positive and 1,011 (80.4%) were HIV-negative. The median age of participants was 26 years (range, 1-95 years), and the majority of participants were within the 15-24 age category. Concerning types of TB, about 446 (35.5%) of TB patients were pulmonary positive and 90% of them were in new treatment category (Table 1).

Trends of HIV infection and treatment outcomes of tuberculosis patients

Among 1,281 TB patients, 1,257 (98.1%) were tested for HIV, of whom 246 (19.6%) were recorded to be HIV-positive. Of these, about 14.90% of TB patients infected with HIV were urban residents. Regarding treatment outcomes among HIV-positive patients, 75 (30.5%), 29 (11.8%), and

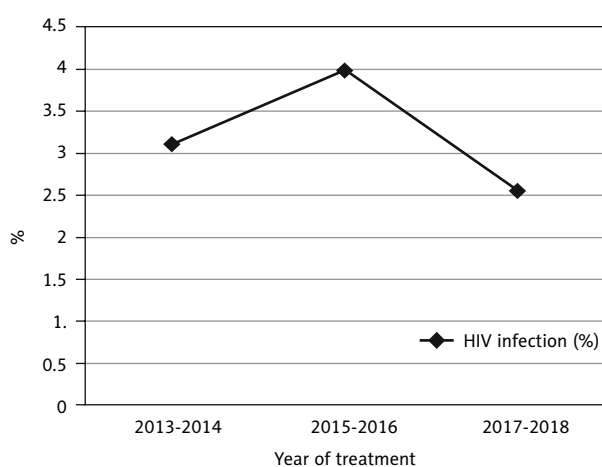


Figure 1. Trends of HIV infection prevalence among tuberculosis patients in two public hospitals in Bale Zone, Southeast Ethiopia (2013-2018)

3 (1.2%) of them were cured, died, and lost to follow-up, respectively. HIV infection prevalence among pulmonary and extra-pulmonary TB patients was 20% and 18%, respectively. A declining trend of HIV/ TB co-infection was observed during the study period, from 3.1% in 2013 to 2.5% in 2018 ($\chi^2 = 13.4, p = 0.02$) (Table 1 and Figure 1).

Factors related to HIV infection prevalence

In multivariable logistic regression analysis, sex, age, TB patient category, and duration of treatment were found to have a statistically significant association with HIV infection. Accordingly, female TB patients had a 1.47 times higher risk of HIV infection than males (AOR = 1.47; 95% CI: 1.09-1.97%). The odds of having HIV infection were nearly four times higher among TB patients within the 25-44 age category of TB patients than the under 24 age category (AOR = 4.13; 95% CI: 2.88-5.92%). Regarding TB patient category, the odds of having HIV infection among previously treated TB patients presented 5.5 times higher risk than transferred TB patients (AOR = 5.49; 95% CI: 2.00-15.03%). TB patients who followed a treatment for 6 to 12 months were 52% less likely to have HIV infection than patients in 0 to 2 TB treatment regimen (AOR = 0.48; 95% CI: 0.25-0.94%) (Table 2).

Discussion

HIV/TB co-infection is well recognized as a major public health problem worldwide, and the interaction between TB and HIV is a bidirectional or dual public health concern [24]. This study was designed to assess the trends of HIV infection prevalence among TB patients in two public hospitals of Bale Zone, Southeast Ethiopia. In our study, 98.1% of the TB patients knew their HIV status. This finding was comparable with studies in Metema hospital (95.7%) [25], Hawasa referral hospital (95%) [26], Arsi Negele health center (94.7%) [27], and Oromia region (98%) [28]. This finding was higher than that reported in a study from Ethiopia (71%) [29], national TB/HIV sentinel surveillance report (86%) [30], and a study from Addis Abebe (87.1%) [31]. This discrepancy might be due to different duration of a study, sample size, and health service provider characteristics. In the present research, HIV prevalence was 19.6%, which is comparable to that reported from India (18.86%) [32], Brazil (19%) [33], Metema hospital (20.1%) [25], and Gondar (18.5%) [34]. On the other hand, this finding was higher than that reported from Arsi Negele health center (10%) [27] and Hawasa referral hospital (13.9%) [26]. Thus far, the prevalence of HIV infection determined in this study was lower compared to similar studies conducted in Gondar (67%) [34], Mizan hospital (67%) [35], and Debre Markos (44%) [36] as well as pooled prevalence of TB/HIV co-infection of 25.59% in Ethiopia and 31% in Oromia region, Ethiopia [37]. Similarly, this finding was lower than study findings in Nigeria, sub-Saharan

Table 2. Factors associated with HIV infection among tuberculosis patients in two public hospitals of Bale Zone, Southeast Ethiopia, from July 2013 to June 2018 ($N = 1,257$)

Variables	HIV status		p-value	Crude OR (95% CI)	Adjusted OR (95% CI)	p-value
	Positive, n (%)	Negative, n (%)				
Hospital level						
Referral	92 (22.2)	322 (77.8)	0.09	1.27 (0.96, 1.71)		
General	154 (18.3)	689(81.7)		1.00		
Place of residency						
Urban	196 (20.5)	762 (79.5)	0.16	1.28 (0.91, 1.80)		
Rural	50 (16.7)	249 (83.3)		1.00		
Sex						
Male	124 (17.1)	602 (82.9)	0.01	1.00	1.00	0.010
Female	122 (23)	409 (77)		1.45 (1.10, 1.92)*	1.47 (1.09, 1.97)**	
Age						
≤ 24	47 (9.1)	471 (90.9)		1.00	1.00	
25-44	149 (30.1)	346 (69.9)	0.01	4.32 (3.02, 6.16)*	4.13 (2.88, 5.92)**	0.001
≥ 45	50 (20.5)	194 (79.5)	0.01	2.58 (1.68, 3.98)*	2.32 (1.49, 3.60)**	0.001
Type of TB						
Pulmonary positive	89 (20.0)	357 (80)	0.21	1.13 (0.79, 1.62)		
Pulmonary negative	94 (20.3)	368 (79.7)	0.19	1.16 (0.81, 1.65)		
Extra-pulmonary	63 (18.1)	286 (81.9)		1.00		
TB patients' category						
New	221 (19.5)	910 (80.5)	0.02	2.50 (1.13, 5.50)*	2.36 (1.05, 5.33)**	0.04
Retreated	18 (38.3)	29 (61.7)	0.01	6.38 (2.41, 16.90)*	5.49 (2.00, 15.03)**	0.001
Transferred	7 (8.9)	72 (91.1)		1.00	1.00	
Period of treatment						
2013-2014	84 (21.2)	312 (78.8)		1.00		
2015-2016	81 (17.0)	395 (83)	0.12	0.76 (0.54, 1.07)		
2017-2018	81 (21.0)	304 (79)	0.95	0.99 (0.70, 1.39)		
Duration of treatment						
0-2 months	15 (36.6)	26 (63.4)		1.00	1.00	
3-5 months	17 (27.4)	45 (72.6)	0.09	0.66 (0.28, 1.53)	0.83 (0.34, 2.00)	0.67
6-12 months	214 (18.5)	940 (81.5)	0.01	0.40 (0.21, 0.76)*	0.48 (0.25, 0.94)**	0.03
Treatment outcome						
Unsuccessful	35 (26.7)	96 (73.3)	0.03	1.58 (1.04, 2.39)*		
Successful	211 (18.5)	915 (81.5)		1.00		

* $p < 0.05$, crude odds ratio; ** $p < 0.05$, adjusted odds ratio

Africa, and Asian countries, with TB/HIV co-infection rates ranging from 23% to 42% [38-41]. This discrepancy might be due to different duration of the studies and level of attention to screen TB patients for HIV. Furthermore, this study demonstrated that HIV infection prevalence was significantly decreased across the investigated years, from 3.1% in 2013 to 2.5% in 2018, which was a higher reduction rate than a trend of national HIV infection in general population, from 1.5% in 2011 to 1.1% in 2015 in Ethiopia [42]. Possible justification for this discrepancy might be duration of the study and sam-

ple size. On the other hand, HIV infection prevalence was 58% among all TB forms, which was lower than the national HIV prevalence of 68% among all TB forms [42]. This discrepancy might be due to a large sample size used in the national estimation of HIV prevalence. In this study, HIV infection prevalence was slightly higher in male patients than females. This finding is inconsistent with several studies that showed females being more prone to HIV infection than their male counterparts [43, 44]. Even though the majority of the TB/HIV co-infected participants was males, females

presented with nearly two times higher risk to develop HIV infection than males. High prevalence of HIV co-infection among males and higher risk among females might be due to behavioral factors, including risky sexual behavior, alcohol consumption, and khat chewing as well as lack of education. Moreover, cultural traditions, such as involuntary marriage, females' genital mutilation, and older men's preference for younger women contribute to the observed increased female vulnerability to HIV. A high prevalence of HIV infection (39.8%) was also noted in the age group of 25-44 years old, which was slightly higher than that reported in Metama hospital, Ethiopia (32.4%) [25]. The most productive age group of 25-44 years old was almost four times higher at risk to develop HIV infection than the under twenty-four age group. This finding is also similar to studies carried out in Dabat, Ethiopia [45] and Malawi hospital [46]. The consistency of this finding might be due to similar set up of healthcare facilities. Odds of having HIV infection among previously treated TB patients were higher risk of HIV infection than transferred in TB patients. This might be due that they patients follow a treatment for a long period of time, which may predispose them to risky behavioral practices, such as alcohol drinking. Regarding the duration of treatment, the TB patients within a six to twelve-month treatment regimen presented a lower risk of HIV infection than TB patients in zero to two treatment regimens. In our study, death rate of HIV co-infected TB patients was 11.8%, which is in line with a study conducted in Southeastern Nigeria [47], and higher than previous study findings in Malawi (5%) [46], respectively. However, this finding was lower than that reported from India (19%) [32]. This dissimilarity might be due to differences in study setting and its' duration.

Limitations of the study

Our results should be viewed in light of the following limitations. The current study was based on a retrospective review of TB registers and the findings depend on the quality of patients' records. These records considered hospital settings only, and generalization of this study could be limited to hospitals of Bale Zone and not to smaller healthcare facilities, such as health centers and health posts found in the Bale Zone. Some variables, including educational level, economic status, marital status, and behavioral factors, which could affect their status with respect to HIV infections among TB patients were not examined. Since we analyzed the trend of only five years of data of two public hospitals, we recommend further investigations, which incorporate HIV/TB co-infection data of several years and greater number of health facilities.

Conclusions

In this study, nearly one-fifth of TB patients were infected with human immunodeficiency virus, of which males and age category of 25-34 years old significantly influenced

the participants. A declining trend of HIV prevalence among TB patients was observed over the year of treatment. Moreover, this study identified sex, age, TB patient category, and duration of treatment as independently associated factors of HIV infection prevalence among TB patients. Therefore, intensive efforts and interventional techniques, such as screening of all TB patients for HIV and linkage of co-infected patients to HIV care are recommended.

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Conflict of interest

The authors declare no conflict of interest.

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