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Prevalence and Associated Factors of HIV Infection among Pulmonary Tuberculosis Patients: Empirical Evidence from North Wollo Zone, Amhara Region, Ethiopia

Meaza Bezabih Asfaw, Professor Wan Cheng-Song

Department of Public Health, School of International Education, Southern Medical University, Postal Code: 510515, P.R. China

Email: meazabezabih@yahoo.com, gzwcs@smu.edu.cn

Abstract: The bidirectional relationship between the twin epidemics of Tuberculosis (TB) and the Human Immunodeficiency Virus (HIV) causes major global health challenges in the twenty-first century. TB-HIV co-infected people face multifaceted problems like a high loss to follow-up rates, poor treatment adherence, high TB recurrence rate, and high mortality risk. Our objective was to assess the prevalence and associated factors of HIV patients among PTB patients in Woldia comprehensive specialized hospital, Ethiopia, 2021. A retrospective study was conducted among 584 TB/HIV co-infected patients registered from 2015 to 2019 in a hospital in Woldia town. The data were collected through document review by using a pre-tested structured data extraction checklist. The data were analyzed using SPSS Version 25. Bivariate and multivariate logistic regressions were determined at 95% confidence intervals. Among the 584 PTB cases, the prevalence of HIV was 170, 29.1 %. PTB WHO stage 3 was 2.69 times more likely HIV positive than WHO stage 1 (AOR: 2.69, 95% CI (1.28-5.66). PTB patients who had an opportunistic infection were 5.27 times more likely to have HIV infection than patients who had not (AOR: 5.27, 95% CI (2.05-13.56)). The category of patient retreatment PTB cases was 5.02 times more likely HIV patient compared to new cases (AOR: 5.02, 95% CI (1.97-12.78). **T**he prevalence of HIV infection among PTB cause is high. Late HIV stage, history of opportunistic infection and not taking opportunistic infection are associated with HIV infection. Therefore, diagnosing HIV among TB patients and treating TB cases to opportunistic parasitic infection could help prevent TB/HIV co-infections.

Keywords: Prevalence, Pulmonary tuberculosis, HIV, Co-infection, Woldia

1. Introduction

TB is a chronic mycobacterial contagious disease caused primarily by M. tuberculosis and occasionally by M. Bovis and M. Africanism in humans. The disease is, spreading through the air by coughing, sneezing, or spitting, and it has remained a public health challenge in the world and is considered a major cause of morbidity and mortality [3]. Tuberculosis is a chronic infectious disease caused by Mycobacterium tuberculosis. It typically affects the lungs but can affect other parts of the body. The disease is spread via droplet infection when people with pulmonary TB expel the bacilli while coughing, sneezing, talking, etc. Without treatment, mortality rates are high [4]. The global TB report showed that there had been an estimated 10 million incident cases and 12 million prevalent cases of TB globally. Overall, 90% of the infection occurred in adults; of this 9% were people living with HIV (72% in Africa). About 26% of incident TB cases occurred in Africa, and 23% of the world's population are estimated to possess a latent TB infection and are thus in danger of developing active TB during their lifetime [2]. TB is a major public health issues in Ethiopia context. Currently, Ethiopia is ranked eighth among the 22 high TB burden countries worldwide and at rank three in Africa. The incidence rate of all styles of TB is estimated at 164 per 100,000 populations, resulting in an annual fatality rate of 27.5 per 100,000 Population [1,2]. Tuberculosis is exclusively transmitted supported environmental and private risk factors, especially during a social mixing setting (together with overcrowding) and conditions which prolong the length of exposure to an infectious patient like health system-related factor including delay in diagnosis can increase TB transmission [2,3].

Additionally, the chance of infection following TB exposure is primarily governed by exogenous factors and an intrinsic combination of the infectiousness of the source case, proximity to contact and social and behavioral risk factors, including smoking, alcohol, and indoor pollution [4]. Patients with asymptomatic phthisis transmit the bacilli to risky groups through inhalation. Identify and investigating infected individuals among contacts of patients with infectious tuberculosis is that the best method of preventing the later development of the disease in populations. Additionally, to the current situation, contact tracing is incredibly important to ascertain the first source of TB disease and detect those who are secondarily infected by proper diagnosis and prompt treatment [2]. Now a day, the world's population is estimated to be infected with tubercle bacilli phenomena. Hence almost millions of people are at the risk of developing active disease per year. According to World Health Organization 2018 global TB report, an estimated 10 million people have developed TB disease in 2017, of which 5.8 million were men, 3.2 million among women, and 1 million were children. Overall, 90% were adults, and 9% were people living with HIV. There were also an estimated 1.3 million TB deaths in 2017 and an additional 0.3 million deaths resulting from TB disease among HIV-positive people [3].

The majority of the community lacks awareness that HIV-infected is increasing risk or suspected of Tuberculosis in Ethiopia. The analysis of any data is the backbone of interpreting any public health raw data. As a public health domain, the TB data also needs to be interpreted as other data since it is one of the public health concerns in Ethiopia context. There is lack of quality information concerning to the existing tuberculosis problem and trends of TB cases. Tuberculosis is exclusively transmitted based on environmental and personal risk factors, especially in a social mixing setting (together with overcrowding) and conditions which prolong the length of exposure to an infectious patient like health system-related factor including delay in diagnosis can increase TB transmission [4]. This study tried to address the stated objectives and research questions as follows.

1.1. Objectives of the Study

1.1.1. General Objective

- To analyze the prevalence and Associated Factors of HIV infection among pulmonary Tuberculosis patients by using retrospective data from Woldia Comprehensive Specialized Hospital, Ethiopia.

1.1.2. Specific Objectives

- To assess the prevalence of HIV infection among pulmonary Tuberculosis Patients in Woldia district, Ethiopia.
- To determine associated factors of HIV infection among pulmonary Tuberculosis patients
- To share the findings and recommendations of the research with relevant governments bodies.

1.2. Research Questions

- What is the prevalence of HIV infection among pulmonary Tuberculosis patients in the study area?
- What are the associated factors of HIV infection among Pulmonary Tuberculosis Patients in the study area?

2. Literature Review

Epidemiology of Tuberculosis:

Tuberculosis is a chronic infectious disease which is caused by Mycobacterium tuberculosis problem. It typically affects the lungs but can affect other parts of the body as well [2]. The causative agent Mycobacterium tuberculosis (Mtb), has been estimated to be 3 million years old and probably originated in East Africa. Evidence of infection in humans includes identification of Mtb DNA in Egyptian mummies [29]. And, likely, a clinical condition called phthisis (or consumption) described in the Aphorisms of Hippocrates in ancient Greece was an early depiction of TB. The pathogenesis of the disease was first outlined in 1819 by the French pathologist Laennec. Although controversies regarding the nature of TB as a genetic or a transmissible disease continued until 1882 when Robert Koch convincingly established that the etiology involved Mtb. This breakthrough was based on discovering a technique using a stain that could impregnate the waxy cell walls of the bacteria, thus rendering them visible under a light microscope [30]. In the 19th century, TB was common in Europe and the United States, causing up to 1,000 deaths per 100,000 persons annually [29]. A gradual decline was seen in the Western world from the 1920s, which is usually attributed to better living conditions and less crowding and a lesser extent to introducing BCG vaccination and anti-mycobacterial agents after discovering streptomycin in 1944 [31]. However, on a global scale, the rates did not decline and showed a dramatic increase in the latter part of the 20th century, primarily due to the emergence of HIV. Shortly after HIV was established as the cause of AIDS, increased numbers of TB cases were seen in the United States [32]. A study indicated that TB had increased in 20 African nations from 1985 to1992 on average 7.7% annually [33]. According to the WHO global tuberculosis report, the total number of TB cases worldwide was 9.0 million in 2014 [4].

Interaction between HIV and TB:

HIV and TB have reciprocal interactions that benefit the proliferation of both pathogens [2]. HIV raises the risk of TB approximately tenfold. However, this cannot be entirely explained by a low CD4 cell count because the increase is seen even during the early stages of infection [35], and the risk is not eliminated (albeit is lowered considerably) by ART [36]. The growth and proliferation of Mtb can be augmented during several stages of HIV infection. Increased survival of Mtb has been observed in infected macrophages [36], and it is also clear that the lack of a cell-mediated immune system plays an essential role in the increased risk of TB seen in HIV patients. The importance of CD4 cells is illustrated by an investigation showing that both progressions to active TB after exposure to Mtb and reactivation of latent TB occurred to a higher degree in macaques depleted of CD4 cells than in control animals with normal CD4 cell levels [31]. In human HIV patients with severely depressed CD4 cell counts, granulomas are ill-formed, necrotic, and multibacillary [2]. Furthermore, preferential depletion of Mtb-specific CD4 cells during HIV infection has been observed [8]. Conversely, TB has been found to increase the risk of both HIV-related death and other opportunistic infections [38]. It has been explained by increased viral loads [39] in co-infected patients. Still, it is also possible that other mechanisms of immune activation related to TB can contribute to this exacerbation of HIV.

Treatment of HIV/TB Co-Infected Patients:

Treatment of TB in HIV-positive patients follows the same guidelines as in HIV-negative patients, although the underlying evidence is not as strong. The most effective approach to prevent TB infection in HIV patients is to give ART, which has been shown to

provide a risk reduction of 54–92% [43]. As in HIV-negative patients, it is also recommended that IPT be given for at least 6 months to patients with positive or unknown TST results and in whom the active disease has been ruled out [40], although only 30% of patients eligible for IPT were given such treatment in 2012 [5]. A meta-analysis recently showed that this approach is beneficial in that it reduces morbidity of TB even if it does not affect mortality in HIV/TB-co-infected patients [42]. However, as IPT is part of a scheme including screening for TB, this interventional package may still have an important impact on survival [44]. The timing of ART in TB patients has been heavily debated, starting with early concerns about drug interactions, and it was recommended, if possible, to defer ART until after ATT [45]. After a series of randomized trials [46], it was evident that mortality was decreased if ART was introduced during treatment of TB; in a sub-analysis from one of the studies, there was also a trend towards improved survival if treatment was initiated early (within 2 weeks) and in patients with severe immunosuppression (<50cells/mm3) [47]. These observations resulted in a change in the WHO recommendations in 2013 to recommend that ART be started within 2 weeks in patients with a CD4 cell count of < 50/mm3 and within the intensive phase (8 weeks) in patients with less severe immunosuppression [41]. However, in 2014 a large multicenter study carried out in Africa [46], showed no increase in survival in patients with CD4 cell counts of > 220/mm3, and the authors suggest that ART could be deferred in patients above this threshold. Furthermore, Török et al. [47] found that early ART led to increased mortality in patients with TB meningitis.

Treatment of HIV infection-related TB:

In principle, TB treatment in individuals with HIV infection should be the same as that for patients with TB who do not have HIV disease. Standard first-line therapy for TB with a 4-drug intensive treatment phase of 2 months, followed by 4 months of treatment with a 2-drug regimen, is highly effective in patients with HIV-infection-related TB. Unlike the treatment of HIV-uninfected patients, however, treatment of HIV-infected patients with TB presents a myriad of clinical challenges regarding the duration of treatment, frequency of administration, management of drug interactions, and complications of therapy, such as drug toxicity and immune reconstitution disease. Because such patients are being treated for 2 diseases, the goals of therapy must be balanced so that optimal outcomes in terms of treatment response and prevention of drug resistance are achieved for both conditions. Early reports of treatment outcomes in patients with HIV-infection-related TB revealed that initial outcomes were generally very good. Still, long-term outcomes were poor because of HIV infection-related mortality [6]. In recent years, because of the more effective treatment of HIV infection, long-term outcomes of TB therapy have improved, and additional problems, such as recurrent TB, drug-drug interactions, and overlapping drug toxicities, have emerged. Duration of treatment. Because initial responses to therapy are most excellent in both HIV-infected and HIV-uninfected patients, the optimal duration of TB treatment is determined by the risk of relapse. Currently, treatment guidelines recommend that the duration of TB therapy should be the same for both HIV-infected and HIV-uninfected persons [7,9].

For pulmonary infection with drug-susceptible Mycobacterium tuberculosis, a 6-month course of rifamycin-based therapy is the standard of care [7], because of comparable rates of TB relapse among persons receiving 6-month regimens of rifamycin-based therapy (e.g., rifampin or rifabutin) [10,11]. However, most of the studies that have shown equal efficacy were relatively small and not randomized. Only 2 randomized trials have been reported on relapse rate among HIV-infected persons with TB, compared with that among HIV-uninfected patients with TB, who receive 6 months of rifamycin-based therapy [12,13]. These studies, both performed in settings with very high community rates of TB, showed that a longer duration of therapy was associated with a lower short-term recurrence rate. Perriens et al. [12], working in former Zaire, found that 12 months of standard rifampin-based therapy resulted in a significantly lower recurrence rate at 18 months than a 6-month regimen. Fitzgerald et al. [13] studied HIV-infected and HIV uninfected patients with TB in Haiti and found that recurrences were significantly reduced only among HIV-infected patients when isoniazid was continued for 1 year after a 6-month standard regimen for TB.

Nonetheless, these trials suggest that, in high-burden areas, the likelihood of recurrent TB is reduced by either longer treatment of the initial episode or secondary prophylactic (suppressive) therapy with isoniazid. In addition to this, various served studies have suggested that the relapse rate after such therapy may be higher among HIV-infected persons than among HIV-uninfected persons, with rates of ∼2% among HIV-uninfected persons and as high as 9% among HIV-infected persons [14,16]. In an observational cohort study involving South African gold miners, Churchyard et al. [17] found that secondary isoniazid preventive therapy reduced the risk of recurrent TB substantially.

The primary risk factor for TB recurrence among HIV-infected patients with TB appears to be low CD4+T lymphocyte count, with the risk highest among persons with a CD4+ T lymphocyte count 100 cells/mm3 [15,16]. Low CD4+ T lymphocyte count appears to be a stronger risk factor than the factors associated with relapse in HIV-seronegative persons: cavitary pulmonary disease, positive sputum culture result after 2 months of treatment, bilateral pulmonary disease, low body weight, and white race [15]. However, large-scale comparative studies of risk factors for relapse in HIV-infected persons with TB are needed in HIV-uninfected patients with TB. A recent study from Botswana found that low pyrazinamide concentrations were associated with poor treatment outcome (defined as treatment failure or death) after adjusting for HIV infection and CD4+ T lymphocyte count [18].

3. Material and Methods

3.1. Description of Study Area

North Wollo is one of 10 zones of the Amhara Region of Northern Ethiopia. It is located 521 kilometers away from the capital city of Addis Ababa. Woldia has an estimated total population of 46,139 people. out of this 23, 000 are males, and 23,139 are females (Endeshaw Abatenh 2018).

3.2. Population and Sample Determination

Source of population: The Pulmonary TB diagnosed people in the study area.

3.3. Study population:

The HIV infection among Pulmonary Tuberculosis Patients in 2015-2019 In Woldia Comprehensive Specialized Hospital, Ethiopia. Those who have been diagnosed with Pulmonary TB in Woldia Comprehensive Specialized Hospital and have accurate information and peoples who have HIV and have been diagnosed with Pulmonary TB during the study period.

3.4. Study design and period:

The Prevalence and Associated Factors of HIV infection among Pulmonary Tuberculosis Patients Retrospective Study was conducted based on data collected from Woldia Comprehensive Specialized Hospital, Ethiopia (2015-2019).

3.5. Source of data:

The five years (2015-2019) retrospective data were collected from the Woldia Comprehensive Specialized Hospital health records to review and analyze HIV infection among pulmonary TB and associated factors in the study area. Additionally, data was collected from Amhara Regional State Health bureau, North Wollo Zone Health Department and the Woldia District Health Office.

3.6. Inclusion and exclusion criteria:

Inclusion criteria: The Pulmonary TB diagnosed (WHO, Golden Standard TB test) people in 2015-2019 In Woldia Comprehensive Specialized Hospital, Ethiopia, at the time of the study.

Exclusion criteria: People who did not have Pulmonary TB when they were diagnosed and did not have accurate information in Woldia Comprehensive Specialized Hospital, Ethiopia, at the time of the study.

3.7. Study Variables

The Dependent variable (outcome) in this study was the HIV positive among pulmonary tuberculosis patients. Socio-demographic characteristics (Age, sex, residence, educational status of patients, occupational status, marital status and monthly income) Behavioral factors (smoking and excessive alcohol dirking use) and Clinical factors of patients (Previous History of PTB, Year of TB Diagnosis conducted, Category of Patient, Types of PTB, WHO stage, CD4 count cells, Duration on ART, CPT initiated, History of Opportunistic, Asthma, Nutritional status, Pretreatment weight, Pretreatment BMI Kg/m2, DM, Cough, Cough length, Fever and Night sweet) were the independent variables.

3.8. Data analysis:

All Data was entered into an MS Excel spreadsheet and analyzed using SPSS statistical software package (version 25). Frequency, percentage and range were used to present the data. The logistic regression was used to assess the association between dependent and independent variables. Associations between variables were determined using the odds ratio and 95 % confidence interval (CI). A p-value of <0.05 was considered statistically significant.

4. Results

4.1. Descriptive statistics of Socio-demographic Characteristics analysis

A total of 584 TB infected patients under PTB treatment were included. Out of those respondents, 170 (29.1%) were HIV patients, whereas 414 (70.89%) were done not have HIV. Of the 584 patients, 221 (37.8%) were female, and 363 (62.2%) were males. Regarding the marital status patients, 120 (20.5%) were single, 367(62.2%) were married 48 (8.2%) were widowed, and 49(8.4%) were divorced. Among resident patients, 319 (54.6%) were urban and 265(45.4%) rural.

4.2. The prevalence of IHV among PTB patients

Among the total PTB cases, the proportion of HIV infection among males was 31.4 % (114/170) which is higher than the HIV infection among females 25.4 % (56/170). In the age group of ≤24 years, the proportion of HIV 54.7% (93/170) was higher than the prevalence 31.1% (53/170) among the 25-45 age groups.

The overall prevalence shows that the number of tuberculosis patients is high in 2016, 2017 and 2019 respectively and in 2017, 2018, and 2019 indicates that the number of people living with HIV is high.

Of the 601 patients screened, 584 were positively diagnosed with pulmonary TB Figs. (1 and 3) giving the overall prevalence rate of 70.9 % Fig. (2). in the present study, more than a half (n=148; 25.3%) of participants had CD4 count ranged between 200-500/µl, 54.6% (n=319) of respondents had CD4 count <200/µl and 20 % (n=117) of respondents had CD4 count >500/µl.

Table 1. The prevalence of HIV patients among PTB patients at Woldia comprehensive specialized hospital, Woldia town, northeastern Ethiopia, 2021

Variables		HIV status		COR (95%CI)	P-value
	Total (No, %)	Negative (No, %)	Positive (No, %)		
Sex					
Male	363(62.2%)	249 (68.6)	114 (31.4)	0.74 (0.509-1.07)	0.118 *
Female	221(37.8%)	165 (74.6)	56 (25.4)	1	
Age					
≤24	360(61.6%)	267(74.1)	93(54.7)	1.33 (0.74-2.27)	0.305
25-45	148(25.3%	95(64.2)	53(31.1)	0.83 (0.46-1.49)	0.53
≥46	76(13.0%)	52(68.4)	24(14.1)	1	
Occupation status					
Housewife	80(13.7%)	63(78.7)	17(21.3)	1.8 (0.99-3.45)	0.052
Daily labor	62(10.6%)	41(66.2)	21(33.8)	0.98 (0.53-1.805)	0.94
Government employed	104(17.8%)	73(70.2)	31(29.8)	1.18 (0.69-1.99)	0.54
Merchant	167(28.6%)	123(73.6)	44(26.4)	1.4 (0.87-2.23)	0.161
Farmer	171(29.3%)	114(66.6)	57(33.4)	1	
Marital status					
Single	120(20.5%)	82(68.3)	38(31.7)	0.30 (0.12-0.77)	0.12
Married	367(62.8%)	251(68.4)	116(31.6)	0.30 (0.125-0.73)	0.008
Widowed	48(8.2%)	38(79.2)	10(20.8)	0.53 (0.18-1.59)	0.26
Divorced	49(8.4%)	43(87.7)	6(12.3)	1	
Income					
<1000	156(26.7%)	118(75.6)	38(24.4)	1.28 (0.722-2.27)	0.40
1000-2000	332(56.8%)	228(68.7)	104(31.3)	0.93 (0.55-1.49)	0.69
>2000	96(16.4%)	68(70.8)	28(29.2)	1	
Educational status					
No education	228(39.0%)	157(68.8)	71(31.2)	1.15 (0.78-1.82)	0.565
Primary	142(24.3%)	108(76)	34(24)	1.65 (0.96- 2.81)	0.068
Secondary	91(15.6%)	68(74.7)	23(25.3)	1.53 (0.840-2.78)	0.164
Certificate and above	123(21.1%)	81(65.9)	42(34.1)	1	
Residence					
Urban	319(54.6%)	228(71.5)	91(28.5)	1.064 (0.744-1.52)	0.734
Rural	265(45.4%)	186(70.2)	79(29.8)	1	

Total	584	414(70.9)	170(29.1)

1 Reference category

* Variables from Bivariable analysis of p<0.05

4.3. Clinical characteristics of the study participant

The majority (96.2%) (95% CI: 2.25-14.6) of the study participants category were retreatment TB cases. Four hundred fifteen (71.1%) of the study participants had smear-positive Pulmonary TB,93, (15.9%) had smear-negative Pulmonary TB, and the remaining 76, (13.0%) had Extra pulmonary TB, and 68 (11.6%) were categorized to WHO stage 3 HIV disease during the initiation of their TB treatment. 66 (11.5%) of the patients had experienced opportunism. The majority (88.8%) with 95% CI: 0.14–0.650) of study participants did not take CPT. from 584 PTB patients 66 (11.3%) were Smokers and 518 (88.7%) were nonsmoker.

From bivariable analysis clinically characteristics factors, participants smoker 1.21 were higher odds of who were nonsmoker patients (COR: 1.21, 95% CI (0.674-2.16). Participants WHO stage 3 were 3.11 higher times odds of HIV positive compared with stage 1 (COR: 3.11, 95% CI (1.5-6.48). among participants who have a history of opportunistic infection were 5.7 higher odds of HIV positive compared with who do not have an opportunistic infection (COR: 5.7, 95% CI (2.25-14.6). Among PTB patients, the retreatment case was 5.63 were higher odds of HIV than new cases (COR:5.6, 95% (CI 2.25-14.06). (Table 2).

4.3. Factors associated with HIV infection among PTB from multivariable and Bi-variable analysis

All P-value < 0.25 were taken from Bivariable, and multivariable analysis entered into multiple logistic regression models by using backward logistic regression to control confounders and get P- value < 0.05 significant association to HIV among PTB patients. In the multivariable analysis from clinically characteristics factors WHO stage 3, category of patient and history of opportunistic infection was a significant association with HIV patients among PTB.

WHO 3 was 2.69 times more likely HIV positive than WHO stage 1 (AOR: 2.69, 95% CI (1.28-5.66). Patients who had opportunistic infection were 5.27 times more likely HIV patients than patients who had not (AOR: 5.27, 95% CI (2.05-13.56)). And the category of patient retreatment cases was 5.02 times more likely HIV patients compared to new cases (AOR: 5.02, 95% CI (1.97-12.78)).

Table 2. The univariate and multivariate analysis of factors associated with HIV infection at Woldia comprehensive specialized Hospital, Woldia town, Ethiopia, 2021

Variables		**HIV statues**		**COR (95%**CI)	**P-value**	**AOR (95%**CI)	**P-value**
		Negative (No %)	**Positive (No %)**				
Sex	Male	249	114	1.35(0.92-1.96)	0.118	0.74(0.51-1.08)	0.118
	Female	165	56	1			
Age	≤24	267	93	1.081 (0.71-1.64)	0.713	0.45(0.23-0.85)	0.014
	25-45	95	53	2.22 (1.17-4.19)	0.014	0.48(0.24-0.97)	0.042
	≥46	52	24	1			
Smoking	Yes	49	17	0.83 (0.46-1.48)	0.525	1.208(0.67-2.16)	0.525
	No	365	153	**1**			
Alcohol drinking	Yes	69	21	0.705 (0.42-1.2)	0.191	1.42 (0.84-2.4)	0.191
	No	345	149	1			
Asthma	Yes	44	14	0.755 (0.402-1.42)	0.38	1.33(0.71-2.49)	0.38
	No	370	156	1			
Nutritional status	Normal	237	97	0.87 (0.55-1.38)	0.545	1.15(0.73-1.83	0.545
	Moderate	84	40	0.75 (0.43-1.29)	0.292	0.86(0.55-1.34)	0.504
	SAM	93	33	1			
WHO staging	Stage I	261	124	1			
	Stage II	45	15	1.42 (0.77-2.6)	0.264	1.26 (0.65-2.43)	0.496
	Stage III	59	9	3.11 (1.5-6.48)	0.002	2.69 (1.28-5.66)	**0.009**

	Stage IV	49	22	1.06 (0.61-1.82)	0.84	0.95 (0.54-1.68)	0.87
History of Opportunistic	Yes	61	5	5.7(2.25-14.46)	0.000	5.27(2.05-13.56)	0,001
	No	353	165	1			
Category of Patient	New	7	15	1			
	Retreatment	407	155	5.63(2.25-14.63)	0.000	5.02(1.97-12.78)	0.001
CD4 count cells	<200	212	107	0.38 (0.22-0.66)	0.001	2.63(1.51-4.48)	0.001
	200-500	104	44	0.46(0.250-	0.011	1.19(0.78-1.82)	0.413
	>500	98	19	1			

1 Reference category

** Variables from Univariate and multivariable analysis of $p<0.05$

5. Discussions of Results

This study used a retrospective design to assess the prevalence and associated factors of HIV patients among PTB patients in Woldia comprehensive specialized Hospital, Woldia, North-Eastern Ethiopia. The study found that the prevalence of HIV patients among PTB was 29.1%. The North Wollo Zone has a high prevalence of HIV infection among the Amhara region in Ethiopia. It is concerned with the Community living standard, lack of awareness of the transmission of HIV, and there is a balance between unemployment and job creation. It has increased the prevalence of HIV in the context of the study area.

In this study, WHO stage 3, opportunistic infection and category of patient retreatment were significantly associated with HIV patients among PTB. Tuberculosis and HIV are incorporated with the main burden of infectious disease in those whose resources are limited countries [19,20]. The TB treatment TB-HIV outcome co-infected patients in various settings could provide evidence for evaluating the country's TB control program and determining future directions.

According to WHO 2017 report, the global treatment success rate for HIV-associated TB cases among the 2015 cohort was 78%, and in the WHO Africa region, it was 80% [25]. In this study, among those HIV screened TB patients, the proportion of TB/HIV co-infection was 29.1% that was much higher than reports from Ethiopia, 6.3–20 % [27]. Similar to Bahirdar University (2016) similarly to North-Eastern Ethiopia (2015), this was 24.3% it has better finding results when compared to other similar studies such as Nigeria on 20.5% [23].

Overlapping comorbid diseases are growing in resource-limited countries like Ethiopia (36); it might be due to multi-TB and HIV-related risk factors. These are: the communities are well-known in this area with the practice of dating sisters-in-law or brothers-in-law. The practices have a significant impact on HIV transmission. Second, the community, especially the farmers, is a well-known drinker of local beer or Teji (local Amharic Language) in the study area. Their actions might push the community to have unprotected sexual practices. Finally, because the area is prone to draughts and lacks access to food, many divorced women migrate to the Middle East to work as housemaids. Furthermore, due to financial constraints, many beautiful women are forced to perform sex work. The link between poverty and tuberculosis has also been established [24,26]. Hence, it might increase TB/ HIV co-infection cases in the area. Fourth, the presence of many illegal private TB-drug sellers in the area might contribute a high TB and drug-resistant-TB. It will be HIV-associated tuberculosis when a high number of HIV cases happened.

It has an observed variation due to the difference of quality of service in the TB/HIV clinic, proper counseling, health education, and appropriate follow concerning the clinician. The inclusion of transferred outpatients on the final analysis of previous studies could be another other potential issue. TB/HIV co-infected patients were transferred out in proportions ranging from 3.8% in Nigeria's Ebonyi State to 64.2% in Ethiopia's Mizan Aman [22].

The TB treatment outcomes in TB/HIV co-infected patients are heavily influenced by various factors. In this regard, our research found that the patient's age, type of TB, WHO staging, and history of opportunistic infection were all associated with the success of TB treatment. The retreatment group of TB/HIV co-infected patients had a higher rate of unsuccessful treatment outcomes rather than new patients. Other socio-demographic characteristics were factors that influenced TB/HIV infection, with older people having a higher risk.

The current study's ART coverage was higher (76.3%) than a WHO report from Ethiopia (68%) but fell short of the WHO target of 100% [27]. According to other reports, ART coverage in Ethiopia and the Amhara region was 50.5 percent and 40.2 percent, respectively [28]. This could be due to the health centers' proximity to the community. Furthermore, local stakeholders may use communication and social mobilization to diagnose and link more patients to ART. Furthermore, unpublished community reports show that while safe sex and condom use are low, people's awareness of the value of ART is high.

6. Conclusions and Recommendation

Conclusion

The findings conclude that the overall TBHIV co-infected patients in this study were higher than many previous studies. TB/HIV patient's retreatment TB advanced HIV late WHO clinical stage, history of opportunistic infection and no CPT initiated were at a high risk of HIV disease. Therefore, HIV treatment facilities should give special attention to those TB-HIV co-infected patients with a higher risk of TB treatment.

Recommendation

1) To all Woreda/ district and Zone health institutions

Based on the study findings, the spread of tuberculosis shows that the problem is serious and that the institutions need to raise public awareness and address the problem, Information regarding HIV/TB con infection should be provided to the public through available channels and practical models. Promoting messages focusing on Patients' proper use of treatment should be scaled up into the community throughout. Providing enough information about HIV treatment. and I recommended other researches should conduct a research work to explain the Clinical features of treatment outcomes in the retrospective data obtained from the Woldia comprehensive specialized hospital.

2) To the community

According to the results of the findings, the community-level should be strengthened and enhance the agenda of TB/HIV co-infection closer to the community, the study recommends that the North Wollo zonal health department use participatory approaches to promote community behavioral change for long-term HIV/TB treatment. And A committee established and responsible to promote TB/HIV activities social mobilization activity.

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