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ORIGINAL RESEARCH

Prevalence of Hepatitis B Virus, Human Immune Deficiency Virus and Associated Risk Factors Among Individuals with Presumptive Pulmonary Tuberculosis Attending at Saint Peter's Specialized Hospital, Addis Ababa, Ethiopia

Kahasit Gebrehiwet[1,2], Endalkchew Biranu[2], Wondatir Nigatu[3], Atsbeha Gebreegziabher[4], Kassu Desta[1]

[1]Addis Ababa University College of Health Sciences, Department of Medical Laboratory Sciences, Addis Ababa, Ethiopia; [2]St. Peter's Specialized Hospital, Addis Ababa, Ethiopia; [3]Ethiopian Public Health Institute, Tuberculosis /HIV Research Directorate, Addis Ababa, Ethiopia; [4]Ethiopian Public Health Institute, Addis Ababa, Ethiopia

Correspondence: Endalkchew Biranu, Addis Ababa, Ethiopia, Tel +251-913186148, Email endalkalem16@gmail.com; Kassu Desta, Addis Ababa University College of Health Sciences, Department of Medical Laboratory Sciences, Addis Ababa, Ethiopia, Tel +251911107099, Email Kassudesta2020@gmail.com

Background: Hepatitis B virus (HBV), human immunodeficiency virus (HIV) and tuberculosis are the causes of widely spread infectious disease, especially in resource-limited countries. The extent of HBV infection and its contributing factors among people with suspected pulmonary tuberculosis (PTB) were not adequately addressed.

Objective: To assess the prevalence of HBV, HIV & their associated risk factors and the magnitude of TB among individuals with presumptive pulmonary tuberculosis attending at St. Peter's Specialized Hospital, Addis Ababa, Ethiopia.

Methods: A cross-sectional study was conducted among 387 individuals with presumptive PTB from October to December 2020. A standard questionnaire was used to collect socio-demographic data and associated risk factors. Sputum samples were analyzed by GeneXpert, Florescent Microscopy and Ziehl-Nelson staining technique. HBsAg test was carried out using Murex Version 3 ELISA test kit from serum/Plasma samples, HIV testing was performed by rapid HIV test kits and data were analyzed using SPSS version 23.

Results: The mean age of study participants was 44.2 years. Overall, 14 (3.6%), 28 (7.2%) and 37 (9.6%) of them were positive for HBV, HIV & TB, respectively. Only single patient was HBV-HIV co-infected (0.3%). The TB-HIV co-infection was identified in 6 (1.6%). In multivariate analysis, being partner separated, alcohol consumption, body piercing and having multiple sexual partners were significantly associated with HBV infection. Having a spouse, who is divorced, widowed, sharing scissors, alcohol consumption and contact with multiple sexual partners also significantly associated with HIV infection.

Conclusion: This study showed that HBV, HIV and TB are still public health issues that need awareness and health education on the risky behaviors and transmission of HBV, HIV & TB among individuals with presumptive TB suspects. Further large-scale study is necessary.

Keywords: hepatitis B virus, human immunodeficiency virus, presumptive pulmonary tuberculosis

Background

Hepatitis B virus (HBV) is an enveloped DNA (Deoxyribo nucleic acid) virus that infects the liver and causes cirrhosis, failure and cancer of the liver. HBV infection can be either acute or chronic and may range from asymptomatic infection or mild disease to severe hepatitis.[1,2] A third of the world's population is infected with HBV, according to studies, of which 400 million people have a chronic infection and 350 million people are still asymptomatic carriers.[3,4] Over 75 million people in Africa are infected with HBV, with 13.6% of the population in Nigeria, 11% in Senegal, and 5.7% in Ethiopia affected. Around 10% of people in Africa have HBV infection on average.[5,6]

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HIV is a virus that infects CD4 lymphocytes and causes Acquired Immunodeficiency Syndrome (AIDS) if not managed early.[7,8] According to UNAIDS 2016 global HIV statistics 36.7 million people are living with HIV and one million people died in AIDS-related diseases worldwide.[9–12] A person with HIV is more likely to co-infect with HBV since the two diseases are transmitted via comparable routes.[13]

Mycobacterium is a rod shaped; obligate aerobic, non-spore forming and acid fast bacilli that causes a contagious bacterial disease called Tuberculosis (TB).[14,15] Tuberculosis is the most common opportunistic infection in HIV-positive people worldwide, high mortality has been reported among HIV-positive people treated for active TB, particularly in patients with advanced disease.[16] An estimated 10.4 million people worldwide were expected to have TB infections in 2016. Among them, 1.2 million (11%) of all new TB cases were caused by persons living with HIV, and of the 1.7 million people who died from the disease, 0.4 million of those deaths were caused by HIV. More than 95% of TB deaths take place in developing and middle-income nations.[9–12]

HBV, HIV and TB are widely spread infectious diseases worldwide. Studies show that chronic liver disease raises the risk of hepatotoxicity during anti-TB treatment, fourteen fold increase in the risk of anti-TB hepatotoxicity has been also reported in HIV and viral hepatitis co-infected patients.[17–19] Patients who already have liver damage brought on by the hepatitis B virus may get liver failure as a result of the hepatic toxicity of anti-TB and anti-HIV medications.[16]

TB kills 400, 000 people worldwide each year and is the leading cause of mortality for HIV-positive people. People with HIV have a 20–30 fold increased risk of getting active TB disease compared to those without the virus. Together, HIV and TB are lethal because they both hasten the progression of the other. HIV-related TB claimed the lives of about 0.4 million people in 2016. TB was the cause of death for about 40% of HIV-positive individuals. The number of new cases of TB among HIV-positive individuals was predicted to be 1.4 million that year, with 74% of those individuals living in Africa. Hepatotoxicity risk is also increased in TB patients who have HBV.[12,20,21] There is currently little information available on the frequency of HBV and HIV among presumptive TB patients in Ethiopia, and hence we planned to assess the prevalence of HBV, HIV & their associated risk factors and the magnitude of TB among individuals with presumptive pulmonary tuberculosis patients attending at St. Peter's Specialized Hospital, Addis Ababa, Ethiopia. The current study provided current information on prevalence of HBV and HIV among presumptive TB patients that could benefit doctors to choose the right medications, assess the patient's liver functions and increase the use of first-line TB medications.

Materials and Methods

Study Area

St. Peter's Specialized Hospital in Addis Ababa, Ethiopia, was the site of the study. St. Peter's Specialized Hospital was established in 1953, by the time the clinical TB service has been provided. It is managed by Ethiopia's Federal Ministry of Health (FMoH). It started providing MDR-TB treatment in April 2009, making it Ethiopia's first national hospital. It operated as a center of excellence and training as the nation's MDR-TB treatment clinics were expanding. The hospital is currently offering a variety of specialized services to the locals.

Study Design and Population

A cross-sectional study was conducted from October to December 2020. The source population were individuals who have sign and symptoms of TB and visit the St. Peter's Specialized Hospital during the study period. Individuals with suspected TB who visited the Cougher OPD (outpatient department) in the study area during the study period made up the study population.

Inclusion and Exclusion Criteria

Individuals with presumptive TB previously not on ART and/or anti HBV treatment were included. Individuals with previously confirmed pulmonary tuberculosis cases who were on treatment or relapse and children under eighteen years old were not included in the study.

Dependent Variables

Prevalence of HIV, HBV and Pulmonary tuberculosis and co-infections were considered as the outcome variable.

Independent Variables

Socio-demographic variables and Risk factors for HBV & HIV.

Sample Size Determination

Sample size was determined by single population proportion using Epi-info sample size calculator by considering a population prevalence of P = 8.92% from a related study. We considered 95% confidence intervals, where the margin of error tolerated is 5% (0.05), and the non-response rate is 10%.[22] As a result, a total of 125 sample size was determined. The sample size was also further increased to 138 after considering 10% contingency. Although 138 was the projected minimum sample size, this study included almost three times that number to better represent the study participants. Three hundred and eighty-seven participants, in other words, were used.

Sampling Method

A convenient sampling technique was employed to draw the study subjects who meet the inclusion criteria until the needed sample size was achieved.

Data Collection Procedure

A well-designed and pretested questionnaire was used to gather socio-demographic and risk factor data from individuals who gave their assent. Before collecting blood samples for HIV and HBV testing, well-trained nurses were tasked with gathering data and counseling participants.

Clinical Sample Collection & Processing

Five mL of venous blood sample was collected aseptically from each study subjects by the assigned laboratory personnel. Then, the blood sample was allowed to clot and centrifuged for 10–15 minutes at 3000 rpm and serum samples were separated and transferred to eppendorf tubes and one portion of the serum samples were transported to the Ethiopian Public Health Institute using cold box stored at −20°C until HBV testing was done. While presumptive TB patients were visited the cougher clinic, they were also given capillary blood for HIV testing.

At the same time, 3–5 mL of sputum samples were collected according to the established guidelines and standard operating procedures of the hospital laboratory to diagnose tuberculosis. HBsAg was tested using enzyme linked Immunosorbent assay (ELISA) (Murex version 3) ELISA test kit following the manufacturer instruction and the standard operating procedure of the EPHI serology laboratory. Serum sample who had absorbance value above the cutoff value was considered as positive for HBsAg, and if it is below the cutoff it was considered as negative. HIV testing was done by using the national algorithm protocols by using HIV ½, STAT-PAK™ assay as screening test and positive results were confirmed with ABON HIV 1/2/O Tri-Line & SD BIOLINE HIV-1/2 test kits.

About 3–5mL sputum samples were collected as per the guidelines of the hospital laboratory and portion of samples were analysed for X pert MTB/RIF assay and the other portion was used for Ziehl Neelsen & fluorescence microscopy (2 spot Sputum samples). Patients were considered as TB according to the result of X pert MTB/RIF assay kit and/or Ziehl Neelsen & fluorescence microscopy results.

Data Quality Assurance

Specimen was collected and transported based on the recommended procedure and the instrument was established based on manufacturer recommended. Commercially, quality control materials were used in the same manner as patient specimen to assure the precision and accuracy of the instrument. To assure the quality of the data, the questionnaires were validated by pre-testing on about 10% of sample size on some randomly selected patients who were not included in the study, and the results were recorded and handled appropriately and stored in secured place until entered into statistical

software. Moreover, to assure the quality of the data socio-demographic and clinical data, blood sample collection and laboratory test process were supervised by principal investigator. The collected data was checked regularly for any error, and the necessary correction was taken on the same date of errors occurred.

Data Analysis

Data from the investigation was pre coded, checked and analyzed using SPSS version 23. Descriptive statistics and logistic regression were calculated at 95% of confidence interval to the different variables. In all cases, P-value less than 0.05 was considered as statistically significant.

Ethical Considerations

This study was approved by the Department of Research and Ethics Committee (DREC) of Medical Laboratory Sciences, College of Health Sciences Addis Ababa University (Approval number-DRERC/376/18/MLS) and Saint Peter specialized hospital Informed consent was obtained from each participant, and sensitive information that could identify the patients was not disclosed to protect confidentiality, and our study was complied with the declaration of Helsinki.

Definitions

Presumptive TB: an individual with a cough for three weeks or more but no bacteriological evidence of TB is said to have presumed TB.

HBV infected: Hepatitis surface antigen in blood found.

Chronic infections: History of any chronic infection during three years.

HIV/HBV co-infection: An individual infection with both HIV and HBV.

HIV/TB co-infection: An individual infection with both HIV and TB.

Alcohol: took 4 beers or related alcohol types more than once per week.

Blood transfusion: Any history of life-time blood transfusions.

Household contact: A person who interacts with chronically ill people at home.

Hospital Admission: An individual who had admitted at least one.

Injection drug users: People, who inject (usually illicit) drugs such as heroin, cocaine, steroids into a vein, muscle, or under their skin.

Multiple Sexual Partners: a person who has multiple sexual partners.

Regular sexual partners: A person having only one regular sexual partner.

Results

Socio-Demographic Characteristics of Participants

A total of 387 individuals with presumptive TB were included. Among them, 214 (55.3%) were male. Male to female ratio is 1.2:1. The mean age was 44.19 years with a standard deviation of 15.177, most of them, 93 (24.1%), were between the ages of 35 and 44. Three hundred and ten (80.1%) of the participants were urban residents. Majority of the study participants 209 (54.0%) were married and 264 (68.22%) had monthly income of less than 1000 birr (ETB) (Table 1).

Prevalence of HBV Among the Study Participants

The overall prevalence rate of HBV positive was 14 (3.6%). The prevalence of HBV was higher in males 12 (5.6%) as compared with females which composed of 2 (1.2%). The prevalence of HBV was 5.2% and 3.2% among the Rural & Urban residents, respectively (Table 1).

Table 1 Socio-Demographic Characteristics of Study Participants Among Individuals with Presumptive Pulmonary Tuberculosis Attending at St. Peter's Specialized Hospital, Addis Ababa, Ethiopia 2019 (n = 387)

Variables		Frequency (n=387)	Percent (%)
Sex	Male	214	55.3
	Female	173	44.7
Age (in years)	15–24	38	9.8
	25–34	70	18.1
	35–44	93	24.1
	45–54	86	22.2
	55–64	55	14.2
	>64	45	11.6
Residence	Urban	310	80.1
	Rural	77	19.9
Current occupational status	Driver	12	3.1
	Merchant	23	5.9
	Government Employee	48	12.4
	Jobless	27	7.0
	Student	23	5.9
	Farmer	61	15.8
	Other	193	49.9
Educational status	Cannot write and read	67	17.3
	No formal education	65	16.8
	Grade 1–4	41	10.6
	Grade 5–8	81	20.9
	Grade 9–10	57	14.7
	Grade 11–12	38	9.8
	College	20	5.2
	University	18	4.7
Marital status	Single	77	19.9
	Married	209	54.0
	Widowed	59	15.2
	Divorced	38	9.8
	Separated	4	1.0

(*Continued*)

Table 1 (Continued).

Variables		Frequency (n=387)	Percent (%)
Monthly Income	<1000 birr	264	68.2
	1001–2500 birr	78	20.2
	2501–3999 birr	27	7.0
	4000 birr and above	18	4.7

Prevalence of HIV Among Study Participants

The overall prevalence of HIV in this study was 7.2% (28/387). HIV prevalence among participants who were both male and female was 18 (8.4%) and 10 (5.8%), respectively. One participant had HBV-HIV co infection (0.3%). Urban residences accounted 8.4% HIV prevalence followed by rural residences 2.6% (Table 2).

Prevalence of TB Among Study Participants

The overall prevalence of TB was 9.6% (37). Male participants had a TB prevalence of 11.7%, whereas female participants had a TB prevalence of 6.9%. The TB-HIV co-infection was 6 (1.6%) (Figure 1).

Table 2 Socio-Demographic Characteristics of Study Subjects versus HBV, HIV & HBV-HIV Co-Infection Among Individuals with Presumptive Pulmonary Tuberculosis Attending at St. Peter's Specialized Hospital, Addis Ababa, Ethiopia, 2019 (n = 387)

Variables		HBV Status		HIV Status		HBV-HIV Co-Infection	
		Negative (%)	Positive (%)	Negative (%)	Positive (%)	Negative (%)	Positive (%)
Sex	Male	202(94.4)	12(5.6)	196(91.6)	18(8.4)	213(99.5)	1(0.5)
	Female	171(98.8)	2(1.2)	163(94.2)	10(5.8)	173(100.0)	0(0.0)
Age Group (in year)	15–24	38(100.0)	0(0.0)	38(100.0)	0(0.0)	38(100.0)	0(0.0)
	25–34	66(94.3)	4(5.7)	62(88.6)	8(11.4)	70(100.0)	0(0.0)
	35–44	89(95.7)	4(4.3)	80(86.0)	13(14.0)	92(98.9)	1(1.1)
	45–54	82(95.3)	4(4.7)	79(91.9)	7(8.1)	86(100.0)	0(0.0)
	55–64	54(98.2)	1(1.8)	55(100.0)	0(0.0)	55(100.0)	0(0.0)
	>64	44(97.8)	1(2.2)	45(100.0)	0(0.0)	45(100.0)	0(0.0)
Residence	Urban	300(96.8)	10(3.2)	284(91.6)	26(8.4)	309(99.7)	1(0.3)
	Rural	73(94.8)	4(5.2)	75(97.4)	2(2.6)	77(100.0)	0(0.0)
Current occupational status	Driver	11(91.7)	1(8.3)	9(75.0)	3(25.0)	12(100.0)	0(0.0)
	Merchant	22(95.7)	1(4.3)	21(91.3)	2(8.7)	23(100.0)	0(0.0)
	Gov. Employee	45(93.8)	3(6.2)	44(91.7)	4(8.3)	48(100.0)	0(0.0)
	Jobless	26(96.3)	1(3.7)	24(88.9)	3(11.1)	27(100.0)	0(0.0)
	Student	23(100.0)	0(0.0)	23(100.0)	0(0.0)	23(100.0)	0(0.0)
	Farmer	57(93.4)	4(6.6)	59(96.7)	2(3.3)	61(100.0)	0(0.0)
	Other	189(97.9)	4(2.1)	179(92.7)	14(7.3)	192(99.5)	1(0.5)

(*Continued*)

Table 2 (Continued).

Variables		HBV Status		HIV Status		HBV-HIV Co-Infection	
		Negative (%)	Positive (%)	Negative (%)	Positive (%)	Negative (%)	Positive (%)
Educational status	Cannot write and read	64(95.5)	3(4.5)	66(98.5)	1(1.5)	67(100.0)	0(0.0)
	No formal education	63(96.9)	2(3.1)	63(96.9)	2(3.1)	65(100.0)	0(0.0)
	Grade 1–4	40(97.6)	1(2.4)	38(92.7)	3(7.3)	41(100.0)	0(0.0)
	Grade 5–8	79(97.5)	2(2.5)	72(88.9)	9(11.1)	80(98.8)	1(1.2)
	Grade 9–10	56(98.2)	1(1.8)	52(91.2)	5(8.8)	57(100.0)	0(0.0)
	Grade 11–12	38(100.0)	0(0.0)	33(86.8)	5(13.2)	38(100.0)	0(0.0)
	College	17(85.0)	3(15.0)	17(85.0)	3(15.0)	20(100.0)	0(0.0)
	University	16(88.9)	2(11.1)	18(100.0)	0(0.0)	18(100.0)	0(0.0)
Marital status	Single	76(98.7)	1(1.3)	73(94.80)	4(5.2)	77(100.0)	0(0.0)
	Married	198(94.7)	11(5.3)	196(93.8)	13(6.2)	208(99.5)	1(0.5)
	Widowed	59(100.0)	0(0.0)	55(93.2)	4(6.8)	591(0.4)	0(0.0)
	Divorced	37(97.4)	1(2.6)	34(89.5)	4(10.5)	38(100.0)	0(0.0)
	Separated	3(75.0)	1(25.0)	1(25.0)	3(75.0)	4(100.0)	0(0.0)
Monthly Income in birr	<1000 birr	258(97.7)	6(2.3)	249(94.3)	15(5.7)	263(99.6)	1(0.4))
	1001–2500	73(93.6)	5(6.4)	70(89.7)	8(10.3)	78(100.0)	0(0.0)
	2501–3999	25(92.6)	2(7.4)	22(81.5)	5(18.5)	27(100.0)	0(0.0)
	4000 and above	17(94.4)	1(5.6)	18(100.0)	0(0.0)	18(100.0)	0(0.0)

Abbreviations: HBV, hepatitis B virus; HIV, human immune deficiency virus.

Associated Risk Factors for Hepatitis B Virus

In the bivariate analysis, being male, having a separated partner, a needle stick or sharp injury, history of previous surgery, body piercing, sharing scissors with others, habits of alcohol consumption more than one a week, had multiple

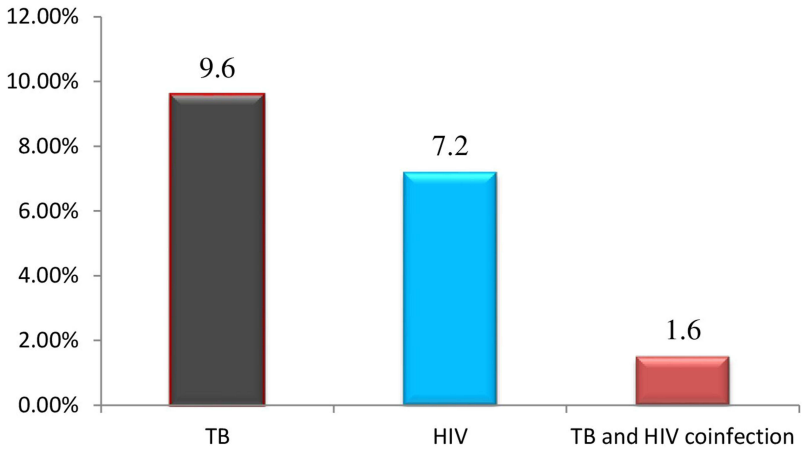

Figure 1 Prevalence of TB, HIV & TB-HIV co-infection among individuals with presumptive pulmonary tuberculosis attending at St. Peter's Specialized Hospital.

sexual partner found to be risk factors for HBV. In the multivariate analysis, alcohol consumption (AOR = 11.100; 95% CI, 2.147–57.383), body piercing (AOR = 8.068; 95% CI, 1.725–37.737), having multiple sexual partner (AOR = 4.573; 95% CI, 1.187–17.613) and had partner separated (AOR = 113.603; 95% CI, 1.556–8293.97) found to be independent predictors for HBV infection (Table 3).

Associated Risk Factors for HIV Seropositivity

The bivariate analysis involved having a partner separated, a needle stick or sharp injury, alcohol consumption, sharing scissors with others, history of unsafe injection, had history of STI & contact with multiple sexual partner found to be as risk factors for HIV. In the multivariate analysis after adjusted for the socio demographic variables and associated risk factors had partner separated (AOR = 49.849; 95% CI; 2.200 −1129.498), widowed (AOR = 14.286; 95% CI, 1.551–131.584), sharing scissors (AOR = 4.416; 95% CI, 1.134 −17.205), alcohol consumption (AOR = 7.323; 95% CI, 2.068–25.934) and contact with multiple sexual partner (AOR = 29.984; 95% CI, 7.9212–124.667) were found to be independent predictors to test positive for HIV (Table 4).

Table 3 Associated Risk Factors, Bivariate and Multivariate Analysis of HBV Among Individuals with Presumptive Pulmonary Tuberculosis Attending at St. Peter's Specialized Hospital, Addis Ababa, Ethiopia 2019 (n = 387)

Variables		Total (%)	HBsAg Pos=No (%)	COR (95% CI)	P-value	AOR	P-value
Needle stick or sharp injury	No	345(89.1)	10(2.9)	1	0.041	1	0.920
	Yes	42(10.9)	4(9.5)	3.53(1.055–11.791)		0.911(0.150–5.520)	
History of surgery	No	367(94.8)	12(3.3)	1	0.137	1	0.254
	Yes	20(5.2)	2(10.0)	3.29(0.684–15.801)		4.27(0.353–51.606)	
Traditional tooth extraction	No	367(94.8)	13(3.5)	1	0.735	1	0.565
	Yes	20(5.2)	1(5.0)	1.43(0.178–11.537)		2.13(0.163–27.780)	
Tattooing	No	370(95.6)	14(3.8)	1	0.999	1	0.998
	Yes	17(4.4)	0(0.0)	0.00		0.00	
Unsafe injection	No	383(99.0)	14(3.6)	1	0.999	1	0.999
	Yes	4(1.0)	0(0.0)	0.00		0.00	
Body piercing	No	279(72.1)	6(2.2)	1	0.019	1	0.008*
	Yes	108(27.9)	8(2.4)	3.64(1.232–10.751)		8.07(1.725–37.737)	
Sharing scissors with others	No	339(87.6)	8(2.4)	1	0.002	1	0.114
	Yes	48(12.4)	6(12.5)	5.91(1.956–17.866)		3.58(0.737–17.371)	
Unsafe Abortion	No	385(99.5)	14(3.6)	1	0.999	1	0.999
	Yes	2(0.5)	0(0.0)	-		0.00	
Organ transplantation	No	387 (100.0)	0(0.0)	-		-	NA
	Yes	0(0.0)	0(0.0)	-		-	
Sharing toothbrushes	No	387 (100.0)	14(8.3)	1	0.999	-	NA
	Yes	0(0.0)	0(0.0)	-		-	

(*Continued*)

Table 3 (Continued).

Variables		Total (%)	HBsAg Pos=No (%)	COR (95% CI)	P-value	AOR	P-value
Circumcision	No	263(68.0)	7(2.7)	1	0.152	1	0.875
	Yes	124(32.0)	7(5.6)	2.188(0.750–6.380)		1.139(0.225–5.766)	
History of hospital admission	No	352(91.0)	13(3.7)	1	0.801	1	0.249
	Yes	35(9.0)	1(2.9)	0.767(0.097–6.043)		0.157(0.007–3.654)	
Blood transfusion	No	383(99.0)	14(3.7)	1	0.999	1	0.999
	Yes	4(1.0)	0(0.0)	-		0.00	
STIs	No	339(87.6)	13(3.8)	1	0.549	1	0.242
	Yes	48(12.4)	1(2.1)	0.534(0.068–4.173)		0.209(0.015–2.884)	
History of chronic infections	No	375(96.9)	13(3.5)	1	0.391	1	0.087
	Yes	12(3.1)	1(8.3)	2.53(0.304–21.102)		11.418(0.702–185.718)	
Alcohol Consumption	No	329(85.0)	6(1.8)	1	0.000	1	0.004*
	Yes	58(15.0)	8(13.8)	8.61(2.868–25.866)		11.1(2.147–57.383)	
Intra Venus drug use	No	387 (100.0)	14(3.6)	-		-	NA
	Yes	0(0.0)	0(0.0)	-		-	
Contact with HBV infected	No	387 (100.0)	12(3.1)	1	0.999	-	NA
	Yes	0(0.0)	0(0.0)	-		-	
Regular sexual partner	No	178(46.0)	2(1.1)	1	0.810	1	0.410
	Yes	209(54.0)	12(5.6)	1.141(0.388–3.353)		1.783(0.450–7.061)	
Multiple Sexual partner	No	301(77.8)	5(1.7)	1	0.001	1	0.027*
	Yes	86(22.2)	9(10.5)	6.919(2.254–21.241)		4.573(1.187–17.613)	

Abbreviations: AOR, Adjusted Odds Ratio; HBsAg, Hepatitis surface antigen, COR, Crud Odds Ratio; CI, Confidence of interval; *significant.

Table 4 Associated Risk Factors, Bivariate and Multivariate Analysis of HIV Among Individuals with Presumptive Pulmonary Tuberculosis Attending at St. Peter's Specialized Hospital, Addis Ababa, and Ethiopia 2019 (N = 387)

Variables		Total (%)	HIV Pos=No (%)	Crude OR (95% CI)	P-value	Adjusted OR	P-value
Needle stick or sharp injury	No	345(89.1)	17(4.9)	1	0.000	1	0.464
	Yes	42(10.9)	11(26.2)	6.846 (2.946–15.908)		1.737(0.397–7.607)	
History of surgery	No	367(94.8)	26(7.1)	1	0.626	1	0.803
	Yes	20(5.2)	2(10.0)	1.457 (0.321–6.625)		0.736(0.066–8.176)	
T. tooth extraction	No	367(94.8)	25(6.8)	1	0.182	1	0.592
	Yes	20(5.2)	3(15.0)	2.414 (0.663–8.795)		1.730(0.233–12.872)	

(*Continued*)

Table 4 (Continued).

Variables		Total (%)	HIV Pos=No (%)	Crude OR (95% CI)	P-value	Adjusted OR	P-value
Tattooing	No	370(95.6)	26(7.0)	1	0.467	1	0.418
	Yes	17(4.4)	2(11.8)	1.764 (0.383–8.133		2.656(0.249–28.282)	
Unsafe injection	No	383(99.0)	25(6.5)	1	0.001	1	0.067
	Yes	4(1.0)	3(75.0)	42.96(4.311–428.149)		34.06(0.78–1492.274)	
Body piercing	No	279(72.1)	18(6.5)	1	0.341	1	0.214
	Yes	108(27.9)	10(9.3)	1.480(0.660–3.316)		2.222(0.630–7.834)	
Sharing scissors with others	No	339(87.6)	17(5.0)	1	0.000	1	0.032
	Yes	48(12.4)	11(22.9)	5.631(2.452–12.930)		4.416(1.134–17.205)	
Unsafe Abortion	No	385(99.5)	28(7.3)	1	0.999	1	0.999
	Yes	2(0.5)	0(0.0)	0.00		0.000	
Organ transplantation	No	387(100.0)	28(7.2)	1	NA	1	NA
	Yes	0(0.0)	0(0.0)	-		-	
Sharing toothbrushes	No	387(100.0)	28(7.2)	1		1	NA
	Yes	0(0.0)	0(0.0)	-		-	
Circumcision	No	263(68.0)	16(6.1)	1	0.207	1	0.631
	Yes	124(32.0)	12(9.7)	1.654(0.757–3.612)		0.728(0.199–2.662)	
Hospital admission	No	352(91.0)	24(6.8)	1	0.321	1	0.765
	Yes	35(9.0)	4(11.4)	1.763 (0.575–5.409)		0.743(0.106–5.190)	
Blood transfusion	No	383(99.0)	28(7.3)	1	NA	1	0.999
	Yes	4(1.0)	0(0.0)	0.00		0.000	
STIs	No	339(87.6)	19(5.6)	1	0.002	1	0.629
	Yes	48(12.4)	9(18.8)	3.887 (1.645–9.184)		1.411(0.349–5.699)	
History of chronic infections	No	375(96.9)	27(7.2)	1	0.882	1	0.559
	Yes	12(3.1)	1(8.3)	1.172 (0.146–9.419)		2.442(0.122–48.702)	
Alcohol Consumption	No	329(85.0)	12(3.6)	1	0.000	1	0.002
	Yes	58(15.0)	16(27.6)	10.063(4.456–22.729)		7.323(2.068–25.934)	
Intra Venus drug use	No	387(100.0)	28(7.2)	1	0.999	1	NA
	Yes	0(0.0)	0(0.0)	0.00		-	
Contact with HIV infected	No	387(100.0)	28(7.2)	-	NA	-	NA
	Yes	0(0.0)	0(0.0)	-		-	

(*Continued*)

Table 4 (Continued).

Variables		Total (%)	HIV Pos=No (%)	Crude OR (95% CI)	P-value	Adjusted OR	P-value
Regular sexual partner	No	178(46.0)	14(7.9)	1	0.659	1	0.340
	Yes	209(54.0)	14(6.7)	0.841(0.390–1.815)		1.780(0.544–5.824)	
Multiple Sexual partner	No	301(77.8)	3(1.0)	1	0.000	1	0.000
	Yes	86(22.2)	25(29.1)	40.71(11.91–139.12)		29.98(7.212–124.667)	

Discussion

Worldwide infectious diseases are primarily caused by HBV, HIV, and M.TB, especially in nations with little resources. Hepatotoxic medications are frequently used to treat active TB, HIV, and opportunistic infections. Thus, co-infection with HIV, TB, and HBV has raised the risk of hepatotoxicity, which could provide difficulties for patient management and lead to treatment failure and drug resistance.[19]

The prevalence rate of HBV 3.6% found in this study is similar with previous studies done by Abera et al, 2017 (3.1%) and Zenebe et al, 2018 (3.8%) in Ethiopia.[23,24] While it is lower than HBV, 1.3% from a study done by Yami et al, 2011 (2.1%) among blood donors in Ethiopia[25] and also a study done in Tehran by Amiri et al, 2014 (2.6%).[24] Comparatively higher prevalence rate of HBV than the current study reported (7.4%) by Erena et al, 2014 a study done in Ethiopia.[26] This variance might be attributed to socio demographic traits, behavioral variations for the risk factors of HBV infection, and methodological variation. In our study, the prevalence of HBV was higher in males as compared to females. This could be due to variations to different exposure factors. Males are more likely to have outdoor exposure to risky behaviors that could increase their risk of getting hepatitis B infection than females. This finding is in line with a study done in Ethiopia by Gebremariam et al, 2019.[27]

In the current study, the overall prevalence of HIV is 7.2%. This finding is comparable with a study in Ethiopia by Zenebe et al 2014, 6.6%[28] but which is higher than the national adult HIV prevalence estimation and projection 2016 (1.1%) and study done by Abera et al, 2017 (3.3%).[23,29] The finding also higher than a study done in Iran by Amiri et al, 2014 (3.4%).[24] This finding is lower than previous studies (11.1%) done northern Ethiopia done by Endris et al, 2017 and north west Ethiopia (17.5%) done by Alemayehu et al 2017.[30,31] These variations could be the result of difference in study populations, living situations, and behavioral factors associated with HIV infection.

The prevalence of HIV 8.4% in men and 5.8% in women in the current study is higher than the national male and female HIV prevalence 0.7% and 1.4%.[29] It is also higher than a study done by Hussain et al, 2016 in North India, 1.5% of males and 1.1% females were HIV-positive[32] but lower than a study from West Arsi Zone, Ethiopia, 14.3% in male and 16.0% in female reported by Mengesha et al.[22] This difference could be differences in study population and risky behaviors associated to HIV. In this study, HIV prevalence is higher in males, which contrasted with the national HIV prevalence 0.7% in males and 1.4% in females[29] and study done in Gojjam, North west, Ethiopia, 1.7% in males and 5.2% in females.[23] This might mean males could have more exposure to risky behaviors that were strongly linked to HIV infection, which is also linked with drinking alcohol and having numerous partners.

Urban residences accounted 8.4% HIV prevalence followed by rural residences 2.6% in the present study, although, urban residents were more aware of the transmission of HIV but the higher prevalence could be due to carelessness and pay less attention for the transmission and prevention mechanisms of HIV. Urban people made up a large portion of the study's participants and this could also contribute for difference in HIV prevalence than the rural counterparts.

In this study, the magnitude of HBV and HIV co-infection was 0.3%. In general, the HBV-HIV co-infection in our study is lower than in previous studies done by Weldemhret et al, 2016 in Ethiopia Mekelle hospital 5.9%[33] and in Goba general hospital 42.3% done by Erena et al, 2014.[26] This low HBV-HIV co-infection in this study might be due to intravenous drug users and sex worker which were highly associated with transmission of HBV & HIV were not participated; it could be also due to the difference in study population and exposure of the participants to the risky behaviors that contribute to the spread of these infections.

The prevalence of TB was determined to be 9.6% overall in this study. Although the prevention and treating of TB is well around the world but it is still a problem in countries with limited resource like Ethiopia, the living condition, immunological status of the population, less awareness in early diagnosing and treating of the infection, less awareness in properly using the anti TB drugs, these all make difficult full control of the infection. This finding is higher than previous studies done 5.3% in Ethiopia from Hawassa by Abera et al, 2018.[34] This could be because our study site is a referral site for Tuberculosis-related cases highly TB suspected individuals might include in our study. However, this finding is lower than 15.11% studies in Government hospitals in Addis Ababa by Gebrecherkos et al, 2019.[35] These variations could be the result of various study populations, participant exposure rates to dangers associated with TB infection, and diagnostic method.

In the study, TB -HIV co-infection was 1.6%. This finding is comparable with a previous study 1.48% in north India by Hussain et al, 2016.[32] The current findings are lower than from other studies in the Arsi zone, Ethiopia 14.98% by Mengesha et al, 2015[22] and Tehran prison 5.9% done by Farhoudi et al, 2016.[36] This might be due to differences in study populations, exposure to risk factors for the infections and test methods. Low TB-HIV co-infection in our study indicates there is less TB-HIV collaboration due to individuals being able to diagnose TB or HIV early than previous times before loss their immunity. The TB-HBV co-infection was 0.3% in this study. This finding is lower than other study from north India 2.96% done by Hussain et al, 2016.[32] This could be due to differences in exposure to risk factors for HBV infection.

In the present study, there was no HBV-HIV-TB triple infection; this differs from a study in Arsi zone, Ethiopia 8.92% by Mengesha et al, 2015.[22] This might be because our study involved people with suspected TB, whereas the study in the Arsi zone involved TB patients who might be less immunological and had different exposure to the risk factors for HBV and HIV.

The most important risk factors for HBV identified in our study were having separated partner, body piercing, alcohol consumption and having multiple sexual partners. This might reflect individual risky behaviors and traditional practices using unsterilized piercing materials contribute role in the transmission of HBV. This finding is in line with a study done in Ethiopia Tigray by Weldemhret et al, 2016[33] in Goba by Erena et al, 2012[26] and also in Brazil by da Motta et al, 2019[37] which detected having multiple sexual partner had statically significant association with HBsAg positivity. This finding also agrees with a previous study in Romania by Gheorghe et al, 2013[38] that detected drinking alcohol as a significant risk factor for HBsAg sero-positivity. A study done in Eastern Ethiopia by Umare et al, 2016[39] which detected nose piercing and having multiple sexual partners was significantly associated with HBsAg positivity. In contrast, our finding differs from other studies in Addis Ababa, Ethiopia, identified history of abortion, surgery and tattooing as risk factors by Desalegn et al, 2016[40] in North-west Ethiopia showed history of contact with HBV infected and history of jaundice as risk factors of HBV infection by Yizengaw et al, 2018[41] and, in Iran, a study done by Moradi et al, 2018 detected history of drug use.[42] These variations could result from variations in the study population and exposure rates for risk factors for HBV infection.

Our study identified marital statuses that were widowed, separated, sharing scissor with others, having multiple sexual partner and alcohol consumption as independent predictors for HIV positivity. This shows individual risky behaviors and use of sharp objects in common contribute in the transmission of HIV. This finding is in line with a previous study done by Mengesha et al, 2015 in Arsi zone, Ethiopia that identified partner separated and having multiple sexual partners as risk factors for HIV positivity[22] and other studies from Nigeria by Agaba et al, 2016[43] and south Sudan done by Courtney et al, 2017 that identified having multiple sexual partner significantly associated to be tested positive for HIV and alcohol consumption had significantly associated with HIV positivity[44,] South Africa by Giorgio et al, 2017[45] and also in Sierra Leone by Djibo et al, 2017.[46] In contrast, our findings differ from other studies done in Bahir Dar Ethiopia by Zenebe et al, 2014 which indicated having an abortion before as HIV risk factors.[28] This may be because, regardless of age group, all study participants were TB suspects, and there were relatively few individuals who had ever undergone an abortion. Based on our findings, health institutions should provide health education to raise public knowledge regarding the spread of HBV, HIV, and TB. Health education regarding the harmful behaviors of HBV and HIV is also a call for raising awareness. The prevalence of HIV and HIV among people who are suspected of having TB requires additional large-scale investigation. This study has some limitations; first, we used ELISA methods alone for the diagnosis of HBV which may underestimate the HBV prevalence. Being a cross-sectional study we could not link which comes first, TB, HBV or HIV, this needs further investigation.

Conclusion

This study showed that TB, HBV, and HIV remain serious public health concerns. Although it has decreased from earlier studies, the prevalence of TB was still relatively high in this study. The co-infection of TB and HIV was comparatively moderate. There was no TB-HIV-HBV triple infection, and TB-HBV co-infection was very rare. Partners being separated, having several sexual partners, drinking alcohol, getting body piercings, and being separated or widowed are some behavioral and sociodemographic risk factors that have been reported to be strongly associated with HBV and HIV infections, respectively. Through co-infection surveillance, raising public awareness, and health education on some behavioral and sociodemographic risk factors, the risk for HBV, HIV, and TB must be reduced. A large-scale observational study is necessary to ascertain the potential contribution of the disease and the risk factors related to it.

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Author Contributions

All authors contributed significantly to the work that was published, whether it is in the ideation, study design, execution, data collection, analysis, and interpretation, or in all of these areas. They also all participated in writing, revising, or critically reviewing the article and gave their final approval before it was published. They also all agreed on the journal to which the article was submitted and agreed to be responsible for all aspects of the work.

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