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ORIGINAL RESEARCH

Estimating the Transmission Risks of Viral Hepatitis and HIV Among Blood Donors in Hossana, Southern Ethiopia

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Purpose: Screening of viral transfusion-transmissible infections (TTIs) among blood donors is of public health concern. It is a cost-effective method to monitor the occurrence, distribution, and trends of TTIs in healthy people. This study aimed to estimate the magnitude of the three common viral TTIs among blood donors in Hossana, Ethiopia.

Methods: A cross-sectional study was conducted among 417 blood donors from April to May 2020 in Southern Ethiopia. Data were collected using a structured questionnaire and laboratory blood screening for hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) using Wantai AiDTM HBsAg, anti-HCV, and HIV 1 + 2 Ag/Ab ELISA. Data were entered into Epi-Data version 3.1 and analyzed using SPSS version 21.0. A binary logistic regression model was fitted to identify factors associated with each viral infection. The odds ratio with a 95% confidence interval was calculated. A p-value <0.05 was considered statistically significant.

Results: A total of 417 blood donors participated in this study producing an overall prevalence of viral TTI was 14.38%. HBV, HCV, and HIV prevalence were 9.83%, 2.39%, and 4.31%, respectively. HBV-HIV was a common co-infection, which had 1.2%. In multivariate logistic regression analysis, family history of hepatitis (AOR=5.2, 95% CI (2.92, 7.41)) and multiple sexual contacts (AOR=4.2, 95% CI (2.32–7.43)) were significantly associated with HBV; low educational level (AOR=3.1, 95% CI (2.58–15.25)) and multiple sexual contacts (AOR=4.9, 95% CI (3.51–7.96)) were significantly associated with HIV, but the only variable alcohol consumption (AOR=2.7, 95% CI (6.72–23.76)) was also associated with HCV infection.

Conclusion: In this study, the magnitude of viral TTIs among blood donors is high. This indicates that there are high risks of transmission for these infectious pathogens. Therefore, effective stringent donor selection and screening protocols should be developed.

Keywords: HBV, HCV, HIV, seroprevalence, blood transfusion

Introduction

Blood transfusion is an effective treatment that saves millions of lives every year all over the world. It is a crucial component of the health-care service; however, it is associated with major TTIs risks.[1] TTIs are a major problem associated with blood transfusion, particularly in developing countries.[2,3] Usually, it leads to the transmission of infectious agents from asymptomatic donor to recipient. HBV, HCV, and HIV are common viral infections that can be transmitted from person to person through parenteral administration of blood or blood products.[4,5] About 350 million people worldwide are chronically infected with HBV, more than 71 million with HCV, and 38 million with HIV.[6,7]

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The prevalence of TTIs among blood donors is widely used as an indicator of the problem.[8–10] In several settings, HBV, HCV, and HIV are the major TTIs.[2,6,8] TTIs can exist asymptomatically in donors and each blood transfusion carries a risk of transmitting blood-borne pathogens[12–16] For instance, in sub-Saharan Africa, 12.5% of patients who received blood transfusions are at risk of post-transfusion hepatitis infection, and 5–10% of HIV transmission is as a result of contaminated blood transfusions.[17–20]

In Ethiopia, studies are showing the prevalence of transfusion transmitted infection burden varies in different places. In most of the transfusion centers, the testing of the blood for the presence of such pathogens was not universal.[21–23] This difference in screening practices for TTIs in transfusion centers affects the prevalence estimation of TTIs. Studies showed that the total seroprevalence of TTIs among blood donors is 9.5%[17] and 6.55%[10] from Northern Ethiopia. A study conducted in Wolayta Sodo showed 8.5% seroprevalence of these infections[11] and in Dire Dawa showed 3.7% prevalence of TTIs in blood donors.[22]

Infection by such major viral transfusion-transmissible infections causes mortality, morbidity, and financial burden and thus is a major global health problem. Therefore, the prevention and control of TTIs is the concern and priority of the World Health Organization and blood transfusion programs in Sub-Saharan African countries, including Ethiopia.[23–27] Laboratory testing of the blood is very crucial to prevent the transmission of these infections to safe healthcare delivery through blood transfusions. The screening for HBV, HCV, and HIV among blood donors can be a cost-effective approach to monitor the prevalence, distribution, and trends of these infections within the populations.

Since TTIs may occur in donors without symptoms, they must be screened for these high-risk behavior-related diseases. In Ethiopia, testing of the blood for the presence of major infectious pathogens such as HBV, HCV, and HIV is important for monitoring the magnitude of these infections, determining the risks, and optimizing donors' recruitment strategies to minimize these disease transmissions. Therefore, this study aimed to estimate the magnitude of transmission risks of the three common viral TTIs among blood donors in Southern Ethiopia.

Materials and Methods

Study Setting

The study was conducted in the Southern Nation Nationalities of People Region, Hossana district blood bank. The blood bank was established in 2014 in Hossana town, Hadiya zone, which is located 232 km southwest of the capital city, Addis Ababa. It provides services for a population of approximately seven million people in the district and neighboring district. The blood bank mainly provides services for hospitals and referral units around the district by sustaining all the blood needs of patients. On average, the blood bank collects greater than 8000 units of blood from voluntary blood donors annually.

Study Design and Subjects

A facility-based cross-sectional study design was conducted among 417 blood donors to estimate the transmission risks of viral hepatitis and HIV. This study design considered appropriate for the objective, as its main intention was to estimate the prevalence of TTIs and to identify associated factors simultaneously at single-point data collection period of April to May 2020 in Hossana district blood bank. The source population was all potential donors who visited Hossana blood bank centre; while all blood donors who attended the blood bank during the study period and who were eligible to donate blood were the study population. Participants were included in the study if they met the national and regional donation requirements, which included being between the ages of 18 and 65, having a bodyweight greater than 45 kg, and having a hemoglobin level greater than 12.5 g/dL. All blood donors' medical histories, physical examinations, and screenings were completed and registered, and eligibility to donate blood was checked. The donors who were not willing to consent to participate in the study were excluded. Every prospective blood donor who visited the blood bank and satisfied the inclusion criteria was selected once the person consented to be part of the study.

Sample Size Determination and Sampling Techniques

The sample size to estimate the transmission risks of viral TTIs among blood donors was determined by using single population proportion formula considering the seroprevalence of major blood-borne infections among blood donors based on the study conducted in Eastern Ethiopia 12.4%[23] with 95% confidence interval, 3% margin of error. Finally, it increased by 10% sample size to account for contingencies such as non-response rate and recording errors. Accordingly, the sample size was calculated to be 417.

Data Collection Process and Tools

Blood donors were interviewed by trained professional health-care workers using closed-ended structured questionnaires. The collected data were socio-demographic, behavioral, and clinical factors. The laboratory screening outcomes of the various infections were recorded for each interviewed blood donor.

Specimen Collection and Processing

About 5 mL of blood sample was collected from each collected blood bag using a sterile syringe. The serum was separated by centrifuging the blood at 2000 r/min for 5 minutes. Serums were collected in Eppendorf tubes and stored in a refrigerator at a temperature of below –20°C until the tests were done.

Serological Analysis

Blood samples were tested for HBV, HCV, and HIV using Wantai AiDTM HBsAg Enzyme-Linked Immuno-Sorbent Assay (ELISA), Wantai AiDTM anti-HCV ELISA, and WANTAI HIV 1 + 2 Ag/Ab ELISA test kits (Beijing Wantai Biological Pharmacy Enterprise Co., Ltd. China Laboratory Diagnosis), respectively. All of the positive-tested blood samples were repeated once before being reported positive by the same tests.

Data Entry and Analysis

Data was entered using Epi-Data version 3.1 and analyzed using SPSS version 21.0. Descriptive statistics; mean and standard deviation for continuous variables and frequency for categorical variables were used. A binary logistic regression model was fitted to identify factors associated with seroprevalence for HBV, HCV, and HIV infections. The variables in bivariate analysis with a p-value of <0.25 were taken as candidates for multivariate analysis. Those independent variables which showed association in the binary logistic regression analysis were considered as final predictors of the dependent variable. The variables that showed significant associations were reported by using p-value, odds ratios, and 95% CI. A p-value <0.05 was considered statistically significant.

Quality Assurance

The training was given to data collectors on the objective of the study, the benefit, individual rights, informed consent and techniques of the interview, laboratory personals, and supervisors to ensure the quality of data. Supervisors checked the collected data daily to maintain its accuracy and completeness. The Manufacturer's instructions and standard operating procedures were strictly followed during laboratory tests. Positive and negative controls were used to check the quality of reagents.

Ethical Approval and Consent to Participate

The study was conducted in accordance with the Declaration of Helsinki, after receiving ethical approval from the Institutional Review Board of Aklilu Lemma Institute of Pathobiology, Addis Ababa University (Reference Number ALIPB IRB/002/2011/2018). An official letter was submitted to the concerned administrative office in the district to get permission for the study, and written informed consent was obtained from each participant who participated in the study following an explanation of the purpose, the possible risks, and the importance of the study in their local languages. The participants were assured that they had the full right to participate or not to participate in the study. Individuals who tested positives were advised and linked to health facilities to obtain treatment and care. All information obtained in the study was maintained confidentially.

Results

Socio-Demographic Characteristics

A total of 417 (58.3% males, age 20–65 years, mean age ± SD = 25.62 ± 4.31 years) blood donors participated in this study. Of the total, 277 (66.4%) donors were urban residents, 413 (99.0%) were voluntary donors, and 360 (86.3%) were those who donated blood for the first time (Table 1).

Magnitude of HIV, HBV and HCV

The overall prevalence of viral TTI was 60 (14.38%). The magnitude of HBV, HCV and HIV was 41 (9.83%), 10 (2.39%), 18 (4.31%), respectively. Nine out of 417 (2.16%) had multiple infections. The combinations were HBV-HIV 6 (1.44%) and HCV-HIV 3 (0.72%) (Table 2).

In this study, high rate of HBV and HIV was observed in relation to some risk factors characteristics of the study participants. Among participants with family history of hepatitis infection (n=32), individuals having multiple sexual contact (n=82), participants who had history of contact with hepatitis/jaundiced patients (n=41), alcohol consumption (n=89), and chat chewing (n=74) the magnitude of

Table 1 Socio-Demographic Characteristics of Blood Donors in Hossana District Blood Bank, Southern Ethiopia, 2020 (n = 417)

	Characteristics	Frequency	Percentage
Gender	Male	243	58.3
	Female	174	41.7
Age category (years)	18–30	146	35.0
	31–45	194	46.5
	46–65	77	18.5
Residence:	Rural	140	33.6
	Urban	277	66.4
Marital status	Married	235	56.4
	Single	178	42.7
	Widowed	2	0.5
	Divorced	2	0.5
Educational status	No formal education	55	13.2
	Primary level	193	46.3
	Secondary level and above	169	40.5
Occupation	Employed	147	35.3
	Daily laborer	40	9.6
	Student	107	25.7
	House wife	44	10.6
	Other*	79	18.9
Religion	Orthodox	52	12.5
	Muslim	89	21.3
	Protestant	174	41.7
	Catholic	92	22.1
	Other**	10	2.4
Donation type	Voluntary	413	99.0
	Replacement	4	1.0
Frequency of donation	First time	360	86.3
	Repeated	57	13.7

Notes: *Private work like driving, shopping; **seventh day apostolic, Jehovah witness and without any religion.

HBV was 18.8%, 17.1%, 17.1%, 15.7% and 14.9%, respectively. Whereas the magnitude of HIV was 8.5%, 8.1% and 7.9% among participants with risk characteristics multiple sexual contact, Khat chewing and alcohol consumption respectively (Table 3).

Factors Associated with Viral TTIs

Potential factors associated with three viral TTI statuses among blood donors in the study district were analyzed. Multivariable analysis was conducted to control the potential confounders. In this regard, those individuals who had family history of hepatitis patients were 5.2 times more likely to be infected with HBV (AOR= 5.2; 95% CI: 2.92, 7.41) compared to their counterparts. Individuals who had the exposure of having multiple sex partners were 4.2 times more likely associated with HBV compared to their counterparts (AOR = 4.2; 95% CI: 2.32, 7.43) and 4.91 times more likely associated with HIV compared to their counterparts (AOR = 4.9; 95% CI: 3.51, 9.65). Those who had no formal education were 3.1 times more likely to be at risk of infection with HBV than secondary and above level (AOR = 3.1; 95% CI: 2.58, 15.25). The odds of HIV were 2.7 times higher for individuals who had alcohol compared to those who had no alcohol (AOR = 2.7; 95% CI: 6.72, 23.76) (Tables 4 and 5).

Discussion

Blood transfusion is considered to be a potential risk factor for the transmission of blood-borne viral infections such as HBV, HCV, and HIV, which are the greatest threats to blood safety for the recipients.[28–30] A safe blood supply is an essential component in improving health care.[32–35] Every blood transfusion therefore carries a potential risk for transmissible diseases.[36–40] Countries with scarce resources, such as sub Saharan, are constantly faced with a shortage of healthy blood for transfusion.[40–44] This study revealed the overall magnitude of three common viral TTIs in the donor population was 14.4%. This finding is somewhat similar to that of studies conducted in Easter region, Jigjiga 11.5%[50] and Northwest region, Felege Hiwot 13.3%[17] in Ethiopia and other developing countries; 12.0% in Kenya,[7] 13.7% in Eritrea,[20] 13.0% in Nigeria[5] but lower studies reported in other locations of south Ethiopia; 29.5% in Sodo Wolaita,[11] and 43.2% in Bahir Dar[8] and other African countries; 29.85% in Burkina Faso,[30] 21.2% in Cameroon[32] and 37.4% in Equatorial Guinea.[49] This is probably because of the actual differences in study, population, duration, variation in occupation, and geographical differences of the study populations; moreover, the prescreening procedure may also play a role in the observed variations. In addition, this study focused on volunteer donors that might decrease the prevalence rates of TTIs from other studies. The World Health Organization encourages blood donation from voluntary donors because this kind of donation is believed to have a lesser chance of harboring and transmitting TTIs.[36] Furthermore, the lower magnitude of TTIs in this study may be attributed to the fact that it only looked at three viral infections while other studies looked at including the magnitude of syphilis and malaria as well.[29,33]

Table 2 Magnitude of Viral TTIs in Different Socio-Demographic Variables Among Blood Donors, in Hossana Blood Bank District, Southern Ethiopia

Variables	Characteristics	Total No of Participants	HBV+	HCV+	HIV+
			N (%)	N (%)	N (%)
Gender	Male	243 (58.3)	26 (10.7)	4 (1.7)	14 (8.1)
	Female	174 (41.3)	15 (3.7)	6 (3.4)	4 (2.3)
Age category (years)	18–30	146 (35.0)	13 (8.9)	3 (2.1)	5 (3.4)
	31–45	194 (46.5)	24 (12.4)	6 (3.1)	10 (5.2)
	46–65	77 (18.5)	4 (5.2)	1 (1.3)	3 (3.9)
Residence	Rural	140 (33.6)	12 (8.6)	3 (2.1)	4 (2.6)
	Urban	277 (66.4)	29 (10.5)	7 (2.5)	14 (5.1)
Marital status	Married	235 (56.4)	32 (13.6)	8 (3.4)	12 (5.1)
	Single	178 (42.7)	9 (5.1)	2 (1.1)	6 (3.4)
	Widowed	2 (0.5)	–	–	–
	Divorced	2 (0.5)	–	–	–
Educational status	No formal education	55 (13.2)	7 (12.7)	1 (1.8)	3 (5.5)
	Primary level	193 (46.3)	23 (11.9)	4 (2.1)	10 (5.2)
	Secondary and above	169 (40.5)	10 (5.9)	5 (3.0)	5 (3.0)
Occupation	Employed	147 (35.3)	19 (12.9)	3 (2.1)	9 (6.1)
	Daily laborer	40 (9.6)	5 (12.5)	1 (2.5)	1 (2.5)
	Student	107 (25.7)	10 (9.4)	3 (2.8)	6 (5.6)
	House wife	44 (10.6)	2 (4.6)	1 (2.3)	2 (4.6)
	Other	79 (18.9)	5 (6.3)	2 (2.6)	2 (2.5)
Religion	Orthodox	52 (12.5)	3 (5.8)	1 (1.9)	2 (3.9)
	Muslim	89 (21.3)	9 (10.1)	2 (2.2)	3 (3.4)
	Protestant	174 (41.7)	21 (12.1)	5 (2.9)	10 (5.8)
	Catholic	92 (22.1)	7 (7.6)	2 (2.2)	3 (3.3)
	Other	10 (2.4)	1 (10.0)	–	–
Donation type	Voluntary	413 (99.0)	41 (9.9)	10 (2.4)	18 (4.4)
	Replacement	4 (1.0)	–	–	–
Frequency of donation	First time	360 (86.3)	39 (10.8)	9 (2.9)	16 (4.4)
	Repeated	57 (13.7)	2 (3.51)	1 (1.8)	2 (3.5)

Abbreviations: TTIs, transfusion transmissible viral infections; HBV+, hepatitis B virus positive; HCV+, hepatitis C virus positive; HIV+, Human Immunodeficiency Virus positive.

On the other hand, the current study finding is much higher than previous studies conducted in Ethiopia and other developing countries, like from Gondar 2.6%,[47] and 6.55%,[10] 7.0% in Hawassa[12] in different parts of Ethiopia and other developing countries like 3.8% in Eretria,[20] 3.9% in Democratic Republic of Congo,[26] 5.7% in Uganda,[24] 0.98% in Iraq,[38] 3.7% in Yemen,[41] 7.29% in Saudi Arabia[39] and 1.9% in India.[4] Hence, compared with other resource-constrained settings, the burden of viral TTIs is quite high in this study. The widest difference in our country and the others could be due to the use of different generations of ELISA test kits having different sensitivities, and specificities in addition to differences in study design, population, duration, variation in occupation, and geographical factors.

HBV is endemic in most African countries, including Ethiopia.[35] In this study, the magnitude of HBV is 9.8% which was somewhat similar to other studies conducted in Jigjiga (10.9%),[50] and in Felege Hiwot (11.7%)[17] of Ethiopia and other African countries like Nigeria (10.9%),[5] Mozambique (10.6%)[44] and Equatorial Guinea (10.1%),[49] but higher compared with previous reports from Gondar (3.6%),[10] Bahir Dar (4.11%)[8] and Dire Dawa (3.7%)[22] of Ethiopia and in Sudan 4.2%,[2] Eritrea

Table 3 HBV, HCV and HIV Magnitude in Relation to Different Risk Factors Characteristics of the Study Participants

Variables	Participants	HBV+	HCV+	HIV+
	N (%)	N (%)	N (%)	N (%)
Hospital admission				
Yes	47 (11.3)	5 (10.6)	2 (4.3)	3 (6.4)
No	370 (87.7)	36 (9.3)	8 (2.2)	15 (4.1)
Surgical procedure				
Yes	28 (6.7)	3 (10.7)	1 (3.6)	1 (3.6)
No	389 (93.3)	38 (9.8)	9 (2.3)	17 (4.4)
Multiple sexual contact				
Yes	82 (19.7)	14 (17.1)	3 (3.7)	7 (8.5)
No	335 (80.3)	27 (8.1)	7 (2.1)	11 (3.3)
Alcohol consumption				
Yes	89 (21.3)	14 (15.7)	4 (4.5)	7 (7.9)
No	328 (78.7)	27 (8.2)	6 (1.9)	11 (3.4)
Intravenous drug use				
Yes	106 (25.4)	12 (11.3)	3 (2.8)	5 (4.7)
No	311 (74.5)	29 (9.3)	7 (2.3)	13 (4.2)
Tooth extraction				
Yes	61 (14.6)	8 (13.1)	2 (3.3)	3 (4.9)
No	356 (85.4)	33 (9.3)	8 (2.3)	15 (4.2)
Contact with hepatitis/jaundiced patients				
Yes	41 (9.8)	7 (17.1)	2 (4.9)	2 (4.9)
No	376 (90.2)	34 (9.0)	8 (2.1)	16 (4.3)
History of tattooing/piercing				
Yes	72 (17.3)	9 (12.5)	3 (4.2)	4 (5.6)
No	345 (82.7)	32 (9.3)	7 (2.1)	14 (4.1)
Family history of hepatitis				
Yes	32 (7.7)	6 (18.8)	1 (3.1)	1 (3.1)
No	390 (92.3)	35 (9.0)	9 (2.3)	17 (4.4)
Chat chewing				
Yes	74 (17.4)	11 (14.9)	3 (4.1)	6 (8.1)
No	343 (82.6)	30 (8.4)	7 (2.1)	12 (3.5)

Abbreviations: HBV+, hepatitis B virus positive; HCV+, hepatitis C virus positive; HIV+, Human Immunodeficiency Virus positive.

2.58%[20] in other African countries. Socio-demographic and cultural differences might be a possible factor for these differences though there is a similarity between risk factors and route of transmission between viral TTIs. The reported prevalence of HBV was higher as compared to HCV and HIV. Several studies have shown similar findings compared with the present study.[9,17,41] The probable reason for this high prevalence may be due to higher infectivity of HBV compared to HCV and HIV as well as poor awareness of the community towards hepatitis transmission and infection.

In this study, the magnitude of HCV infection was 2.4%, which is slightly comparable with previous studies (2.2%) in Ethiopia[38] and elsewhere in Africa; like 2.8% in Nigeria[5] and 3.21% in Kenya.[34] It also significantly lower than previous studies reported 8.5% from Wolayta Sodo, Ethiopia[11] and 6.0% in Nigeria,[13] but it was also higher compared to different reports from Gondar 0.8%,[10] Hawasa 0.6%,[12] Jigjiga 0.7%[1] in Ethiopia and elsewhere in the world; 0.51% in China,[40] 0.21 and 0.03% in India,[16,37] 0.8% in Yemen,[6] and 1.3% in Cameroon.[28] These variations could be a result of

Table 4 The Magnitude of HBV in Relation to Risk Factors Characteristics of the Study Participants

Characteristics	HBV Test Result			
	Positive	Negative	COR (95% CI)	AOR (95% CI)
Multiple sexual contact				
Yes	14	68	2.3 (1.9, 18.3)*	4.2 (2.33, 7.43)**
No	27	308	1.00	1.00
Alcohol consumption				
Yes	14	75	2.1 (3.1, 20.2)*	2.7 (6.7, 43.8)**
No	27	301	1.00	1.00
Tooth extraction				
Yes	8	53	1.5 (1.62, 32.2)*	2.3 (0.41, 22.26)
No	33	323	1.00	
Contact with/ jaundiced hepatitis patients				
Yes	7	34	2.1 (7.8, 14.1)*	3.4 (0.67, 14.13)
No	34	342	1.00	
Family history of hepatitis				
Yes	6	26	2.4 (1.5, 8.9)*	5.2 (2.92, 7.41)**
No	35	350	1.00	
Chat chewing				
Yes	11	63	1.8 (1.2, 9.2)*	2.2 (0.86, 45.7)
No	30	313	1.00	
Educational level				
No formal education	7	48	1.1 (4.23, 11.14)*	1.3 (0.91, 12.23)
Primary level	23	170	3.2 (3.17, 8.46)*	3.1 (2.58, 15.25)**
Secondary and above	10	159	1.00	

Notes: *Candidate variable for multivariate analysis at P < 0.25. *Variable significant, **variable highly significant by the multivariate analysis at P < 0.05.
Abbreviations: COR, crude odds ratio; AOR, adjusted odds ratio; CI, confidence interval; 1, reference.

a combination of several factors, including the absence of immunization, low safety measures in public health services, the effectiveness of donor selection programs, and the quality of blood screening tests. Besides, donors donate blood without being screened for HCV, and the strain may be circulating in the community without noticing.

The overall magnitude of HIV in this study is 4.3%, which is nearly similar to that of studies conducted in Ethiopia like Felege Hiwot 3.8%,[17] in Gondar 5.9%,[47] and in other developing countries like Cameroon (4.1%).[32] However, it is much higher than the findings from studies conducted in Jigjiga (0.1%),[1] Hawassa (1.6%)[39] and Yirgalem (1.6%)[12] in Ethiopia and another world; from Eritrea (0.18%),[20] Yemen (0.14%),[41] and India (0.09%). The higher report from our study is probably due to the rise in seropositivity of HIV among the general population recently. It also explains the highest geographic distributions of HIV infection in the study area, which is in some way greater than Ethiopian national data.[21] Variations in the disease's burden in society, population differences in social behavior, lifestyle, socioeconomic status, level of understanding, and variation in the study environment, as well as a strict nonstop establishment of HIV awareness in the previously listed study, may all contribute to the observed variations. In this study, most of the study participants have practiced multiple sexual contacts, body tattooing, dental extraction procedures, having alcohol, and chewing Khat. Ethiopian studies show a relationship between Khat use and unsafe sex more likely to have multiple sexual partners, which may predispose to HIV infection and viral hepatitis.[3,43]

The overall magnitude of HBV, HCV, and HIV co-infection in our study was 2.16%. Different studies conducted in Ethiopia also report that the co-infection rate of these TTIs ranges from 0.19% to 4.8%.[21,42,47] The most common co-infection was HBV-HCV 9(2.16%). Comparable results were observed in Ethiopia[17,50] and

Table 5 The Magnitude of HIV in Relation to Risk Factor Characteristics of the Study Participants

Characteristics	HIV Test Result		COR (95% CI)	AOR (95% CI)
	Positive	Negative		
Multiple sexual contact				
Yes	7	75	2.7 (1.91, 13.37)*	4.9 (3.51, 9.65)**
No	11	324	1.00	1.00
Alcohol consumption				
Yes	7	82	2.5 (3.1, 20.2)*	2.7 (6.7, 43.8)**
No	11	317	1.00	1.00
Tooth extraction				
Yes	3	58	1.2 (0.62, 32.2)	1.8 (0.27, 21.23)
No	15	341	1.00	1.00
Intravenous drug use				
Yes	5	101	1.1 (7.8, 54.1)*	1.3 (0.86, 4.33)
No	13	298	1.00	1.00
Surgical procedure				
Yes	1	27	0.8 (1.5, 8.9)	1.2 (0.62, 11.2)
No	17	372	1.00	1.00
Chat chewing				
Yes	6	68	2.3 (1.2, 9.2)*	3.2 (8.6, 45.7)**
No	12	331	1.00	1.00

Notes: *Candidate variable for multivariate analysis at P < 0.25. *Variable significant, **Variable highly significant by the multivariate analysis at P < 0.05.
Abbreviations: COR, crude odds ratio; AOR, adjusted odds ratio; CI, confidence interval; 1, reference.

elsewhere in the world.[5,18,28] The occurrence of co-infections could be because these infections share similar modes of transmission.[32,33]

In this study, multiple sexual contacts, family with hepatitis or HIV and caring for hepatitis or HIV patients, non-formal or primary education status, and alcohol intake were significantly associated with viral TTIs. This finding is consistent with studies conducted in Ethiopia and other countries.[11,31,46] Participants who had a family history of hepatitis infection were 5.2 times more likely to be infected with HBV ($p < 0.05$) and it was found to be an independent risk factor and supported by other studies conducted in Ethiopia,[8,11,48] and other African countries.[14,19,25] This indicates that the main root for transmission of HBV is cross-contamination of body fluids; hence, this could explain the presence of close contact with hepatitis patients or sexual contact increases the chance of HBV transmission. Regarding this study, blood donors who were educated at the primary level and below were 3.3 times more likely to have HBV infection compared to literate donors. The relatively higher HBV seropositivity among the less educated might be attributed to poor awareness regarding mode of transmission due to their low educational status in which these individuals might have sexual contact and share sharp materials with a person infected with these types of HBV.

Multiple sexual activities were statistically associated with positivity of HIV (P-value < 0.05). Being a sexually transmitted disease, it is not surprising that increased exposure to sexual activity is associated with increased HIV prevalence. The key mode of acquiring HIV in Africa is sexual activity, multiple partners being one of the main risk factors.[14,15] Non-formal or primary education status was identified to be independently associated with positive HIV status. The magnitude of HIV in this study was found to decrease with increasing levels of education among blood donors. This might be attributed to the fact that as the level of education increases, there is a high probability of being aware of preventive measures against HIV infection. Additionally, those with high education likely understand the criteria for self-deferral better. Some studies suggest that better educational attainment may correlate with a lower risk of infection among blood donors, as they are most likely to understand risky sexual relationships that may expose them to TTIs.[36,45]

Conclusion

The magnitude and transmission risk level of common viral TTIs among blood donors in this study is high. This indicates there are high risks of transmission for these infectious pathogens among volunteer donors despite the current public health preventive measures. The most dominant viral TTI was HBV (9.8%), followed by HIV (4.3%). Family history of hepatitis or HIV (giving care to hepatitis or HIV patients), education level, multiple sex partners, and alcohol consumption were all linked to viral TTIs.

In the study district, special attention should be paid to HBV and HIV infections. Almost all donors were volunteers, proper screening of donated blood for HBV, HCV, and HIV with test methods that have improved diagnostic performance should be used, lowering the rate of hidden transmission (due to window time or poor test detection). Stringent donor selection and screening protocols, creating awareness among the general public regarding viral TTIs transmission and prevention should be strengthened. In addition, further assessment should be conducted at the community level to take measures on the potential risk factors of major TTIs in the district.

As a limitation, in this study, blood donors come from different places and included non-randomly; therefore it may not represent the population around the study area. Behavioral and lifestyle factors of STIs were self-reported, and it could very subjective. Another weakness may be related to the inherent weakness of the diagnostic test used which employs serological rather than molecular techniques. Therefore, the results reported in this study may underestimate (presence of a window period) or overestimate (high rate of false positivity) the prevalence of viral TTIs among donors in this population.

Data Sharing Statement

The data analyzed during the current study are available from the corresponding author on a reasonable request.

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Author Contributions

All authors made substantial contributions to conceptualization and design, acquisition of data, or analysis and interpretation of data; contributed in drafting the article or revising it critically for significant intellectual content; read and approved the final version of the manuscript to submit to the current journal; and agreed to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no conflicts of interests in this work.

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