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Transfusion-transmissible infection surveillance among blood donors in Southwest Ethiopia: A six years retrospective study

Wakjira Kebede^{1*}, Zeleke Mekonnen¹, Asfaw Gerbi², Gameda Abebe^{1,3}¹Department of Medical Laboratory Science and Pathology, Health Sciences College, Jimma University, Jimma, Ethiopia²Department of Biomedical Science, Health Sciences College, Jimma University, Jimma, Ethiopia³Mycobacteriology Research Centre, Institute of Biotechnology Research, Jimma University, Jimma, Ethiopia

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ABSTRACT

Objective: To determine trends in the prevalence of major transfusion-transmissible infectious pathogens among blood donors in the southwest Ethiopia.**Methods:** A retrospective study was conducted by reviewing records of all blood donors at Jimma zone blood bank center from 2010 to 2015. Data were analyzed in an undisclosed way with respect to the results of serological screening for common infectious diseases like hepatitis B virus (HBV), hepatitis C virus (HCV), HIV, and syphilis. Logistic regression analysis was used to determine risk factors associated with transfusion-transmissible infections. $P \leq 0.05$ was considered statistically significant.**Results:** From the total of 10733 individuals who donated blood between 2010 and 2015, 7608/10733 (70.8%) were males, and 9162/10733 (85.4%) of the donors were volunteers. Overall, 388/10733 (3.61%) blood units had serological evidence of infections for at least one pathogen. The seroprevalence of HBV, HCV, HIV and syphilis was 328/10733 (3.05%), 22/10733 (0.20%), 23/10733 (0.21%) and 15/10733 (0.14%), respectively. A majority of infections [328/388 (84.5%)] detected was hepatitis B surface antigen, with statistically significant difference in trends from year to year ($\chi^2 = 21.90$, $P = 0.001$). The HCV prevalence has steadily increased from 2/1414 (0.14%) in 2013 to 13/3756 (0.35%) in 2015 and also replacement donors were more likely to be infected by HCV (crude odds ratio = 5.1, 95% confidence interval: 1.2–22.2, $P = 0.029$) when compared with the volunteers.**Conclusions:** Trends in the seroprevalence of HBV and HIV during the study period were declining, while the seroprevalence of HCV was rising among blood donors. Volunteer donors were found to be relatively safer as compared to replacement donors. Efforts should be designed to the introduction of screening for antibody to hepatitis B core antigen and nucleic acid testing to increase the detection rate of these infections and prevent transmission.

1. Introduction

In modern health services, the aim of blood transfusion is basically life-saving intervention. But at the same time, every blood transfusion carries a potential risk of transmitting blood-borne pathogenic organisms like viruses, bacteria, and parasites. Unsafe transfusion practices may also increase the risk of transfusion-transmissible infections (TTI). Therefore, the donated blood safety

remains an issue of major concern in transfusion medicine, mainly in developing countries[1,2]. The highest risk groups are victims of major trauma, children suffering from malaria and anemia, and women with pregnancy-related hemorrhage who might require emergency blood transfusion.

TTI agents such as HIV, hepatitis C virus (HCV), hepatitis B virus (HBV) and syphilis (caused by *Treponema pallidum*) are among the greatest risk for transfusion recipients. Furthermore, TTI associated problems are also serious to public health, where there is a scarcity of proper infrastructure, trained personnel, and financial resources[3,4].

The most commonly encountered transfusion infection is of viral origin[5]. In Sub-Saharan Africa, HIV infection related to blood transfusion was estimated, with just over 10% of the world's

*Corresponding author: Wakjira Kebede, Department of Medical Laboratory Science and Pathology, Health Sciences College, Jimma University, P.O. Box 378, Jimma, Ethiopia.

Tel: +251 911 378 386

E-mail: wakjirakebede@yahoo.com, wakjira.kebede@ju.edu.et

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population[6]. Adult HIV prevalence in Ethiopia was reported as on the way of declining from 1.5% in 2011 to 1.1% in 2016[7]. The estimated prevalence of HIV infection among blood donors in Ethiopia ranged from 0.1%–11.7%[8-10]. Therefore, still donated blood safety remained as a major concern in transfusion medicine in Ethiopia.

Similarly, viral hepatitis was the seventh leading causes of death among world population[11]. Approximately, 150 million people of the world's population are chronically infected with HCV, and more than 350000 people are estimated to die each year[12]. There is also evidence indicating that 360 million people have chronic HBV infection and about 620000 people of them are estimated to die every year[13]. Ethiopia is considered of intermediate to high HBV endemicity which accounts for 7%[14]. However, HBV prevalence in blood donors reported in different parts of Ethiopia (Gondar, Wolaita and Jigjiga) ranged from 0.7%–10.9%[7-9]. These results reflect that hepatitis infection rate has been varies from place to place in the country, and the virus is relatively easy to be transmitted from one infected person to another through unprotected sex and sharing of contaminated needles.

Infectious diseases are a major public health problem in Ethiopia. Thus, the safety of donated blood is a major concern in transfusion medicine in the country where southwest part of the country is not an exception. To make available safe donated blood, the proper selection of donors and screening of donor's blood, together with continuous monitoring of TTI epidemiology in replacement and volunteer donors is crucial[15,16]. There is scarcity of comprehensive data on prevalence and trends of major TTI among blood donors in the study area. Therefore, this study aimed to determine trends and prevalence of HBV, HCV, HIV and syphilis infections from 2010 to 2015 among blood donors in Southwest Ethiopia.

2. Materials and methods

2.1. Study setting

The data was retrospectively collected from the Jimma zone blood bank center. The Jimma zone blood bank center is located in the Jimma town, Oromia Regional State and is found at about 350 km in the southwest direction from the capital city, Addis Ababa. Jimma zone blood bank center provided services for patients by supplying blood for transfusion medicine at Jimma University Specialized Hospital, the hospital serving as referral hospital in the southwest part of Ethiopia, and to other general hospitals found in Jimma zone

(Shanan Gibe, Agaro, Limu Genet, and Seka). Moreover, Bonga and Mizan hospitals, governed by the South Nation and Nationality People, also have access to blood units for transfusion from this center.

2.2. Study design and study population

An institution based retrospective analysis of consecutive blood donors' records were reviewed over a period of six years between January 2010 and December 2015 at Jimma zone blood bank center. All blood donors including volunteers and replacement who went through a physical examination and health history interview prior to donation in an attempt to ensure their eligibility for donating blood and those screened for HIV, HCV and syphilis antibodies, and hepatitis B surface antigen (HBsAg) marker at Jimma zone blood bank center.

2.3. Data collection and laboratory test results

Based on the guideline of the blood bank center and exclusion criteria, individuals who had a history of febrile or debilitating illness, ages below 18 or over 65 years, pregnant or lactating, body weight lower than 45 kg and hemoglobin level of 12.5 g/dL or lower were excluded from donation. For those eligible donors, their records of medical and socio-demographic data were analyzed in an unnamed way with respect to their test results following standard procedures. All blood samples were collected and tested at Jimma zone blood bank center for anti-HIV, HBsAg, and anti-HCV, and anti-syphilis antibody with standard ELISA test kits. It was recorded that those tests were done in accordance with the standard operating procedures and following the manufacturer's instructions at the center (Table 1).

2.4. Statistical analysis

The descriptive statistics was used to describe all blood donor categories with regard to independent variables (age, sex, occupation, level of education, and donation type). Data were entered, cleaned and analyzed using SPSS version 20 statistical package. *Chi-square* test was used to test trends in the prevalence of TTI markers (HBV, HCV, HIV and syphilis) for independent variables significance. Binary logistic regression analysis was done to determine risk factors associated with TTI. Variables with $P \leq 0.05$ were considered statistically significant.

Table 1

Kits used in donors' blood screening at Jimma zone blood bank center, Southwest Ethiopia.

Kits name	Company/Manufacturer	Sensitivity	Specificity
Wanti HIV 1+2 Ag/Ab ELISA Kit	Beijing Wanti Biological Pharmacy Enterprise co., Ltd.	100%	99.80%
Quick Guide-anti-HCV ELISA kit	Human Gesellschaft für Biochemica und Diagnostica mbh, Germany	100%	99.75%
Dialab ELISA test kit for HBsAg	Dialab Production und Vertrieb von Chemisch-technischen Produkten und Laborinstrumenten Gesellschaft m.b.h.	100%	99.50%
Dialab ELISA test kit for ant-syphilis Ab	Dialab Production und Vertrieb von Chemisch-technischen Produkten und Laborinstrumenten Gesellschaft m.b.h.	99.10%–100%	99.70%–99.90%

2.5. Ethical consideration

The ethical clearance was obtained from ethical review board of College of Health Sciences, Jimma University. However, we acknowledge that informed consent was not obtained from the study subjects for the reason that our study design was a retrospective analysis of blood donors' records, and yet personal identification data like names were not linked to these analyses/findings.

3. Results

3.1. Socio-demographic characteristics of blood donors

During the six-year period from 2010 to 2015, a total of 10733 donated bloods were screened for TTI at Jimma zone blood bank center. Among them, 7608 (70.8%) were male donors and 3125 (29.2%) were female donors. The age group of 18–25 years accounted for 61.7% followed by age group of 26–35 years for 22.5% contributed to a large percentage of all donations, while the least age group was greater than 45 years representing only 5.2%. The majority of the donors were educated with 41.4% had university level education, while only a few donors were identified as illiterate. Volunteer donation represented the majority of 9162 (85.4%) whereas only 1571 (14.6%) donation was from the replacement donors. Students, Government employees, and private workers constituted the majority of donors. ABO blood distributions among the donors were more accounted for O group with Rh (+) (Table 2).

3.2. Seroprevalence and associated risk factors for HBV, HCV, HIV and syphilis infections

Out of the 10733 blood units collected during the study period, 388 (3.6%) had serological evidence of infection for at least one pathogen. The overall positivity rates for HBV, HCV, HIV and syphilis was 328 (3.05%), 22 (0.20%), 23 (0.20%) and 15 (0.14%), respectively. None of the blood donors were identified as having had co-infection during this study period. The prevalence of HCV was 15 (0.2%) for males and 7 (0.2%) for females among blood donated individuals with significant gender difference ($P = 0.001$). Females were 0.4 times less likely to be infected with HCV when compared with males [crude odds ratio (COR) = 0.40, 95% confidence interval (CI): 0.16–1.05, $P = 0.001$]. The rate of HBV positivity among blood donors also showed significant differences with respect to different age groups. The age groups of 18–25 years were 0.14 times less likely to be infected with HBV than age groups of greater than 45 years (COR = 0.14, 95% CI: 0.05–0.43, $P = 0.001$). The replacement donors showed the highest incidence 126 (8.0%) of TTI. Of whom, 2 (0.1%) and 16 (1.0%) were infected with HCV and HIV, respectively. The positivity rates of HCV and HIV during the study period also showed significance differences among donor types. The replacement groups were 5.10 times more likely to be infected by HCV when compared with volunteer groups (COR = 5.10, 95% CI: 1.20–22.2, $P = 0.029$) (Table 3), and 0.19 times less likely to be infected with HIV (COR = 0.19, 95% CI: 0.07–0.47, $P = 0.001$) (Table 4).

Table 2

Socio demographic characteristics of blood donors at Jimma zone blood bank center in the southwest Ethiopia from 2010 to 2015 ($n = 10733$).

Variables	Years						Total
	2010	2011	2012	2013	2014	2015	
Number of donors	1061	1212	1329	1414	1961	3756	10733
Gender							
Male	847 (79.8)	985 (81.3)	1069 (80.4)	1130 (79.9)	1329 (67.8)	2248 (59.9)	7608 (70.8)
Female	214 (20.2)	227 (18.7)	260 (19.6)	284 (20.1)	632 (32.2)	1508 (40.1)	3125 (29.2)
Age group							
18–25	660 (62.2)	616 (50.8)	744 (56.0)	962 (68.0)	1127 (57.5)	2520 (67.1)	6629 (61.8)
26–35	220 (20.7)	448 (37.0)	384 (28.9)	338 (23.9)	437 (22.3)	595 (15.8)	2422 (22.6)
36–45	154 (14.5)	112 (9.2)	192 (14.4)	104 (7.4)	230 (11.7)	350 (9.3)	1142 (10.6)
> 45	27 (2.6)	36 (3.0)	9 (0.7)	10 (0.7)	167 (8.5)	291 (7.7)	540 (5.0)
Occupation							
Student	462 (43.5)	420 (34.7)	552 (41.5)	780 (55.2)	943 (48.1)	2205 (58.7)	5362 (50.0)
Government employee	220 (20.7)	280 (23.1)	240 (18.1)	78 (5.5)	230 (11.7)	1190 (31.7)	2238 (20.9)
Private worker	176 (16.6)	140 (11.6)	216 (16.3)	260 (18.4)	368 (18.8)	105 (2.8)	1265 (11.7)
Daily laborer	110 (10.4)	112 (9.2)	192 (14.4)	182 (12.9)	92 (4.7)	40 (1.1)	728 (6.8)
Farmer	44 (4.1)	56 (4.6)	25 (1.9)	78 (5.5)	138 (7.0)	20 (0.5)	361 (3.4)
Soldier	44 (4.1)	112 (9.2)	0 (0.0)	0 (0.0)	50 (2.5)	14 (0.4)	220 (2.0)
Driver	5 (0.5)	90 (7.4)	32 (2.4)	36 (2.5)	50 (2.5)	42 (1.1)	255 (2.4)
Others*	0 (0.0)	2 (0.2)	72 (5.4)	0 (0.0)	90 (4.6)	140 (3.7)	304 (2.8)
Education level							
University education	357 (33.6)	400 (33.0)	504 (37.9)	572 (40.4)	765 (39.0)	1848 (49.2)	4446 (41.4)
Secondary education	286 (27.0)	336 (27.7)	480 (36.1)	390 (24.6)	621 (31.7)	1296 (34.5)	3409 (31.8)
Primary education	264 (24.9)	336 (27.7)	225 (17.0)	348 (27.6)	414 (21.1)	468 (12.5)	2055 (19.1)
Illiterate	154 (14.5)	140 (11.6)	120 (9.0)	104 (7.4)	161 (8.2)	144 (3.8)	823 (7.7)
Donor category							
Volunteers	878 (82.8)	928 (76.6)	930 (70.0)	1170 (82.7)	1751 (89.3)	3505 (93.3)	9162 (85.4)
Replacement	183 (17.2)	284 (23.4)	399 (30.0)	244 (17.3)	210 (10.7)	251 (6.7)	1571 (14.6)
ABO blood group							
O	682 (64.3)	522 (43.1)	480 (36.1)	576 (40.7)	814 (41.5)	1386 (36.9)	4460 (41.6)
A	242 (22.8)	384 (31.7)	480 (36.1)	400 (28.3)	660 (33.7)	1023 (27.2)	3189 (29.7)
B	132 (12.5)	279 (23.0)	269 (20.2)	336 (23.8)	330 (16.8)	924 (24.6)	2270 (21.1)
AB	5 (0.4)	27 (2.2)	100 (7.6)	102 (7.2)	157 (8.0)	423 (11.3)	814 (7.6)
Rhesus (Rh) type							
Positive	1061 (100.0)	1152 (95.0)	1269 (95.5)	1359 (96.1)	1922 (98.0)	3719 (99.0)	10482 (97.7)
Negative	0 (0.0)	60 (5.0)	60 (4.5)	55 (3.9)	39 (2.0)	37 (1.0)	251 (2.3)

*: Housewife, Merchant and construction worker.

Table 3

Seroprevalence of HBV and HCV infections by demographic characteristics of blood donors at Jimma zone blood bank center in the Southwest Ethiopia from 2010 to 2015 ($n = 10733$).

Variables		Number of donors	Positive [n (%)]	HBsAg ⁺ [n (%)]	COR (95% CI)	P	HCV ⁺ [n (%)]	COR (95% CI)	P
Gender	Female	3 125	66 (2.1)	52 (1.7)	1.60 (0.82–3.14)	0.159	7 (0.2)	0.40 (0.16–1.05)	0.001
	Male	7 608	322 (4.2)	276 (3.6)	1.00	-	15 (0.2)	1.00	-
Age (years)	18–25	6 629	241 (3.6)	214 (3.2)	0.14 (0.05–0.43)	0.001	12 (0.2)	2.90 (0.59–14.5)	0.186
	26–35	2 422	90 (3.7)	72 (3.0)	0.28 (0.09–0.89)	0.031	5 (0.2)	2.60 (0.45–14.9)	0.279
	36–45	1 142	42 (3.7)	34 (2.9)	0.69 (0.75–0.96)	0.043	3 (0.3)	2.00 (0.30–13.3)	0.474
	> 45	540	15 (2.8)	8 (1.5)	1.00	-	2 (0.4)	1.00	-
Education	University	4 446	104 (2.3)	80 (1.8)	0.80 (0.28–2.08)	0.060	11 (0.2)	1.80 (0.37–8.46)	0.472
	Secondary	3 409	148 (4.2)	129 (3.8)	0.40 (0.20–0.90)	0.018	6 (0.2)	3.90 (1.07–14.7)	0.038
	Primary	2 055	104 (5.0)	93 (4.5)	0.49 (0.30–0.95)	0.036	3 (0.1)	2.80 (1.00–7.80)	0.050
	Illiterate	823	32 (3.9)	26 (3.2)	1.00	-	2 (0.2)	1.00	-
Donor type	Replacement	1 571	126 (8.0)	107 (6.8)	0.90 (0.50–1.70)	0.884	2 (0.1)	5.10 (1.20–22.2)	0.029
	Volunteers	9 162	262 (2.9)	221 (2.4)	1.00	-	20 (0.2)	1.00	-

+: Positive test results.

Table 4

Socio-demographic characteristics of blood donors by HIV seropositivity among blood donors at Jimma zone blood bank center in the Southwest Ethiopia from 2010 to 2015 ($n = 10733$).

Variables		Number of donors	Anti-HIV ⁺ [n (%)]	COR (95% CI)	P
Gender	Female	3 125	4 (0.13)	1.03 (0.34–3.13)	0.096
	Male	7 608	19 (0.25)	1.00	-
Age (years)	18–25	6 629	11 (0.17)	1.45 (0.18–12.4)	0.710
	26–35	2 422	8 (0.33)	0.73 (0.08–6.30)	0.777
	36–45	1 142	3 (0.26)	0.92 (0.08–9.60)	0.951
	> 45	540	1 (0.19)	1.00	-
Level of Education	University	4 446	4 (0.09)	0.28 (0.06–1.12)	0.050
	Secondary	3 409	8 (0.23)	0.55 (0.16–1.95)	0.085
	Primary	2 055	7 (0.34)	0.70 (0.20–2.40)	0.359
	Illiterate	823	4 (0.49)	1.00	-
	Donor type	Replacement	1 571	16 (1.02)	0.19 (0.07–0.47)
	Volunteers	9 162	7 (0.07)	1.00	-

Anti-HIV: Antibody against HIV; +: Positive test results.

3.3. Trends of HBV, HCV, HIV and syphilis seroprevalence

Overall, TTI agents were more prevalent in males, replacement groups and primary level educated donors during the study period. Over the six-years period, the prevalence rates of HBV showed significant declining from 3.95% in 2010 to 2.05% in 2015 ($P = 0.001$). The prevalence rates of HCV was 0.09% in 2010 and increased to 0.14% in 2013 and subsequently increased to 0.35% in 2015 among blood donated individuals, without significant difference in the trends ($P = 0.06$), while the least percentage was recorded for HIV and syphilis (Table 5). In general, a high percentage of TTI was reported as 48 (4.52%) in 2010, followed by 83 (4.23%) in 2014, while the least report 2.82% was in 2015 (Figure 1).

Table 5

Trends of positivity rate of HBV, HIV, HCV and syphilis markers among blood donors at Jimma zone blood bank center in the Southwest Ethiopia from 2010 to 2015 ($n = 10733$).

Years	2010	2011	2012	2013	2014	2015	Total
No. of donors	1 061	1 212	1 329	1 414	1 961	3 756	10 733
Positive for TTI	48 (4.52)	42 (3.46)	55 (4.13)	54 (3.81)	83 (4.23)	106 (2.82)	388 (3.61)
HBsAg ⁺	42 (3.95)	36 (2.97)	5 (0.38)	51 (3.60)	69 (3.50)	77 (2.05)	328 (3.05)
Anti-HCV ⁺	1 (0.09)	0 (0.00)	0 (0.00)	2 (0.14)	6 (0.30)	13 (0.35)	22 (0.20)
Anti-HIV ⁺	4 (0.38)	6 (0.50)	2 (0.14)	1 (0.07)	7 (0.36)	3 (0.08)	23 (0.22)
Anti-TP ⁺	1 (0.09)	0 (0.00)	0 (0.00)	1 (0.07)	1 (0.05)	12 (0.32)	15 (0.14)

Anti-HIV: Antibody against HIV; anti-TP: Antibody to *Treponema pallidum*; +: Positive test results.

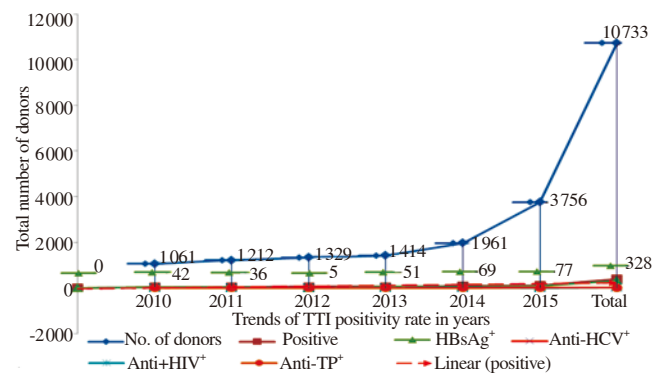


Figure 1. Trends of TTI markers among blood donors at Jimma zone blood bank center in the Southwest Ethiopia.

4. Discussion

In the present study, the prevalence and trends of major TTI (HBV, HIV, HCV, and syphilis) in blood units collected in the southwest Ethiopia during the study period was determined. This study noted that over the six-year period, the total annual number of blood donations increased progressively year after year with a cumulative total of 10 733.

The results of our study clearly demonstrated that 3.61% of the donated blood had serological evidence of infections for at least one pathogen. The present result was lower than previous studies reported from south (Wolaita, 9.5%), east (Jigjiga, 11.5%), and northeast (Gondar, 9.5%) parts of Ethiopia[8–10]. It is also lower compared to similar studies from other parts of the world, 28.8% and 11.9% in Nigeria and India, respectively[17,18]. However, the prevalence of TTI reported in the present study is higher than the study reported from Iran, 0.254%[19]. This is probably because of the actual differences in population risks or effectiveness and stringent procedures of donor screening.

In this study, male donors constitute approximately two-thirds of the donors (70.8%) which is similar with the previous studies from Ethiopia, 87.9% in Gondar, 74.6% in Wolaita

and 98.7% Jigjiga[8-10], and 98.2% in India[20]. The majority, 61.7%, of age groups donated blood in the present study were those ranging from 18–25 years. This report is in agreement with World Health Organization which reported that 45.0% of blood donors aged 25 or less[21]. Furthermore, in this study, more positive results of TTI were found in the age group of 26–35 which is similar with the previous study done in Sudan[5]. This is probably because they are active in different aspects like sexual activity and this may put this age group at greater risk.

Viral hepatitis was reported as the seventh leading causes of deaths worldwide[11]. It was estimated that more than half a million people die every year because of chronic HBV infection[13]. However, results of the current study revealed very low rates of HBV infection among blood donors in Southwest Ethiopia. The seroprevalence rate for HBV observed in the present study is only 3.05% which is lower than those reported in previous studies from Ethiopia, 4.7%[8], 9.5%[9], and 10.9%[10]. This is probably because of the differences in the geographical distribution of the infection and the burden of the disease in the society, population differences regarding social behavior, lifestyle, socioeconomic status and level of awareness in different regions of the country. Although, some possible differences in specificity and sensitivity of screening tests used at different sites during the time of screening might also explain in-part for the observed variations.

The overall seroprevalence for HCV (0.20%) noted in the current study is similar to the previous reports from India, 0.2% in 2016[22]. This prevalence is lower than studies from Ethiopia, 0.7%[8], 0.4%, [10], and 8.5%[9], and also from another parts of the world, 0.43% in India[17], 3.0% in Sudan[5], and 0.51% in China[23]. But, higher than reports from India, 0.18%[20]. These variations in the prevalence of HCV infection in different parts of the world could be as a result of a combination of several factors including absence of immunization, level of safety measures in public health services, effectiveness of donor selection program, and quality of blood screening tests. Besides, donors donating blood without being screened for HCV and the strain may be circulating in the community without noticing.

According to the present study in 2010, the proportion of HCV-positive donors with detectable antibody was only 1/1 061 (0.09%). The overall HCV infection proportion had gradually increased from 2/1 414 (0.14%) in 2013 to 13/3 756 (0.35%) in 2015. This result likely reflects that HCV infection showed increasing trend from 2013 to 2015 among blood donors in the study area. This finding is in agreement with previous results reported in India, 0.31% for HCV infection in replacement

groups[17]. It is probably due to a similarity in specificity and sensitivity of screening tests used for anti-HCV marker detection.

The result of the current study indicates that the risk of having HCV infection among the replacement donors was 5.10 times more likely to be infected when compared with volunteer donors.

There were 23 HIV infections detected among all donations from 2010 to 2015 (16 in replacement and 7 in volunteer donors). The prevalence of HIV infection among replacement donors during the study period remained lower than reported nationally, 1.5%, but comparatively much higher than that in volunteer donors, 0.07%. Furthermore, this result revealed that the HIV prevalence in replacement donors is 1.5 times lower than the prevalence reported nationally in 2011[7]. The difference in prevalence of HIV in replacement and volunteer donors were statistically significant ($P = 0.001$). This is probably because volunteer donors know their serostatus for HIV infection before donating blood.

The rate of syphilis infection in blood donors remained low in this study with only 15 (0.14%) donors identified. There does not appear to be any clearly visible trends because of the small number of infections prohibiting meaningful analysis.

The present study clearly shows a declining trend in the seroprevalences of HBV and HIV in donated blood from 2010 to 2015, but the seroprevalence of HCV was rising among blood donors. Voluntary donors were found to be relatively safer than replacement donors. Therefore, stringent donor selection criteria shall be strictly adhered with emphasis on getting more voluntary donors and efforts should be designed to the introduction of screening for antibody to hepatitis B core antigen and nucleic acid testing. Furthermore, results of this study reflect the prevalence and circulation of these infections among apparently healthy population and warrant measures that should be taken to detect these common infections and other newly emerging and re-emerging potential TTI and thereby to prevent transmission.

Conflict of interest statement

We declare that we have no conflict of interest.

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