Original Article

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Seropositivity and Trends of Transfusion Transmitted Infections among Blood Donors: Five Years Cross-sectional Study on 20,392 Blood Donors in a Tertiary Care Hospital of Ahmedabad, Gujarat, India

Transfusion Medicine Section

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ABSTRACT

Introduction: Blood transfusion is a lifesaving intervention. However, it can also be a source of Transfusion-transmissible Infections (TTIs), posing a potential threat to the recipient. Testing for TTIs before blood transfusion is crucial for the safety of recipients. However, donations occurring during the window period, the prevalence of asymptomatic carriers, viral strains with high genetic variability, and technical errors are responsible for TTIs and remain one of the greatest obstacles in transfusion medicine to deal with. All blood donors are to be screened against five major infections-Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Syphilis, and Malaria.

Aim: To study the seroprevalence and trends of TTI among healthy blood donors at the Blood Centre of Ahmedabad, Gujarat, India.

Materials and Methods: A cross-sectional study was carried out by reviewing blood donors' records over a period of five years from January 1, 2018, to December 31, 2022, at the Blood Centre, Department of Pathology, of Sheth L.G. General Hospital, Maninagar, Ahmedabad, Gujarat, India. The data collected for each seropositive donor included the results of TTI testing, the age group of donors, the type of donation, the frequency of donation, and co-infection. The results were expressed in numbers and percentages.

Results: Among a total of 20,392 healthy blood donors during the five-year period, the total number of seropositive cases (n) was 243 (1.19%). TTI seropositive donors in years 2018, 2019, 2020, 2021, and 2022 were 60 (1.29%), 50 (1.16%), 39 (1.22%), 45 (1.14%), and 49 (1.16%), respectively. A maximum of 118 (48.56%) seropositive donors were recorded in age group of 18-29 years. Individual seropositive donors during the five-year period for HIV, HBV, HCV, syphilis, and malaria were 19 (0.09%), 155 (0.76%), 28 (0.14%), 41 (0.20%), and 00 (0.00%), respectively. Voluntary Blood Donors (VBD) 10,933 (53.61%) exceeded Replacement Donors (RD) 9,459 (46.39%), and repeat blood donors 14,462 (70.92%) surpassed first-time donors 5,930 (29.08%). The seroprevalence of TTI among replacement, voluntary, first-time, and repeat blood donors was 2.41%, 0.14%, 2.06% and 0.84% respectively. Out of 243 seroreactive donors, two donors (0.82%) showed dual reactivity for TTI during the five-year period.

Conclusion: Implementation of strict donor selection criteria, utilisation of sensitive screening modalities, promoting public awareness, and dispelling myths regarding the merits of voluntary blood donation, judicious use of blood products, and mass immunisation for Hepatitis B infection are essential interventions needed to curb TTI to a significant extent.

Keywords: Blood transfusion, Hepatitis, Human immunodeficiency virus, Malaria, Syphilis

INTRODUCTION

Although blood transfusion is a life-saving procedure, it is also an important source of infection for the recipient, so it should be used cautiously [1]. TTIs can remain as silent killers in hosts, and acquiring such infections during the window period from blood donors can be a potential hazard to the safety of collected donations [2]. Various infectious agents such as bacteria, viruses, and parasites can be transmitted via blood transfusion. Among them, significant transfusion-transmissible viruses are HIV-1/2, HBV, HCV, Parvovirus B19, and Cytomegalovirus (CMV). As donors can transmit infectious diseases during their asymptomatic phase, such infections can contribute to a large pool of infection in society [3]. Currently, there are more sensitive methods existing to detect markers of TTI. However, false negative results persist due to the prevalence of asymptomatic carriers in society, donors donating in the window period, viral strains with high genetic variability, and technical errors. Hence, prevention of TTI remains one of the greatest obstacles in transfusion medicine to deal with [4]. According to the guidelines of the Ministry of Health and Family Welfare (Government of India) under the Drugs and Cosmetics Act, 1945 (Amendments 2020), all blood donors are to be screened against five major infections: HIV 1 and 2, HBV, HCV, Syphilis, and Malaria [5]. HIV, HBV, and HCV are of high concern because of prolonged viraemia and a long latency period. They can lead to chronic and life-threatening disorders [6]. Hepatitis B is one of the most common diseases transmitted by blood and has infected millions of people worldwide, with approximately 400 million chronically infected cases [7]. Individuals with chronic infections have an increased risk of developing liver cirrhosis and hepatocellular carcinoma [8]. Blood transfusion is the causative factor in about 15% of the total patients infected with HIV [9]. Evaluation of TTI is important for estimating the safety of the blood supply and in the surveillance of the efficiency of currently employed screening procedures [10]. Thus, the study was undertaken to evaluate the overall seroprevalence and assess trends of TTI for a period of 5 years. It also aimed to determine seropositivity for each year and among different age groups. The

study further evaluates seropositivity based on the types and frequency of blood donation. Co-infection among blood donors was also studied.

MATERIALS AND METHODS

A cross-sectional study was carried out from January 1, 2018, to December 31, 2022, in the Blood Centre, Department of Pathology, Sheth L.G. General Hospital, Maninagar, Ahmedabad, Gujarat, India. Institutional ethical approval was obtained from the Institutional Review Board (Reference Letter No: NaMoMC/IRB/2023/89).

Inclusion criteria: Physically fit donors of 18-65 years, weighing atleast 45 kg with haemoglobin of atleast 12.5 g/dL. The upper age limit for first-time donors was 60 years and for repeat blood donors was 65 years. The inclusion criteria taken into account were according to the Standard Operating Procedure in the Blood Centre as per the criteria listed in Blood Donor Selection and Referral [11].

Exclusion criteria: High-risk behaviour, asthmatics on steroids, patients on anticoagulants, etc. The exclusion criteria taken into account were according to the Standard Operating Procedure in the Blood Centre as per the criteria listed in Blood Donor Selection and Referral [11].

Study Procedure

Healthy blood donors were screened by trained medical officers with a detailed history and physical examination according to the standard operating procedures of the Blood Centre as per the Guidelines for Blood Donor Selection and Referral [11]. A questionnaire in English as well as the vernacular Gujarati language, prepared as per the annexure of Blood Donor Selection and Referral [11], was provided to the donors to record information regarding name, age, gender, date of birth, marital status, occupation, email address, contact number, and address for communication. This also included information regarding general well-being, time of meal, sleep adequacy, history of jaundice, heart diseases, renal diseases, sexually transmitted diseases, high-risk behaviours, current febrile illness, tattooing, alcohol intake, and drug history. The donors were counselled by a trained counselor about issues related to donor health and the blood donation process. Upon assessing the responses provided by donors, those found fit and willing to donate blood gave their consent, after which a unique identification number was allotted to each donor. Under aseptic precautions, 2 mL venous blood was collected in a plain vacutainer, allowed to clot at room temperature, and centrifuged to separate serum for serological testing. A 2 mL Ethylenediaminetetraacetic Acid (EDTA) blood was also collected for testing malaria.

Serological analysis: The serum separated was used for TTI testing. The tests included HIV, HBV, HCV, and syphilis. For the detection of antibodies to HIV-1/2 and "O" subtypes and HIV-1 p24 antigen, 4th generation QualisaTM-HIV Ag and Ab kits (Qualpro Diagnostics) were used with 100% sensitivity and 99.71% specificity. For Hepatitis B Surface Antigen (HBsAg) detection, Merilisa HBsAg Enzyme Linked Immunosorbent Assay (ELISA) kits (Meril Diagnostics Pvt. Ltd.,) were used with 100% sensitivity and 100% specificity. For the detection of antibodies to HCV, 3rd generation Erba Lisa HCV Enzyme Linked Immunosorbent Assay (ELISA) kits (Transasia Bio-medicals Ltd.,) were used with 100% sensitivity and specificity. For syphilis diagnosis, rapid plasma reagin tests (Biolab Diagnostics (I) Pvt. Ltd.,) were used.

The equipment used in serological testing included the ELISA Washer (Tulip), ELISA Washer (BIORAD), Venereal Disease Research Laboratory (VDRL) Shaker (BRIGHT), Incubator (SEDKO), Centrifuge (REMI), and Blood Centre Refrigerator (TERUMO PENPOL).

Malaria testing was conducted using the rapid test for malaria PF/PV (PAN) (Biolab Diagnostics (I) Pvt. Ltd.), which utilises whole blood to detect malarial parasite antigen. This test is sensitive to 5 parasites/microlitre of whole blood and has a specificity of 98%. Tests were performed on donors' blood according to the manufacturer's provided instructions, including literature and positive and negative controls. In-house positive and negative controls were simultaneously conducted for each reagent lot. The blood centre also participated in external quality assessment programs. Seropositive samples were confirmed by repeat testing. Seropositive donors underwent further counselling, and the confidentiality of reports was maintained. The seroreactive blood bag units were discarded in accordance with Biomedical Waste Management regulations [12].

Information regarding age, seropositivity, type of donation (voluntary or replacement), and frequency of donation (first-time or repeat blood donor) was extracted from blood centre records. The data were collected and the results were evaluated.

STATISTICAL ANALYSIS

The collected data were recorded in a Microsoft excel spreadsheet. Categorical data were expressed as frequency using the Statistical Package for the Social Sciences for Windows version 20.0 (SPSS).

RESULTS

Out of the total 20,392 donors from the general population who donated blood over a five-year period, 243 were seroreactive. The seroprevalence rate during this period was 1.19%. The total seroprevalence of TTI in the years 2018, 2019, 2020, 2021, and 2022 was 60 (1.29%), 50 (1.16%), 39 (1.22%), 45 (1.14%), and 49 (1.16%), respectively [Table/Fig-1]. Donors were further categorised into four different age groups. The highest percentage of total TTI was noted in the age group of 18-29 years, 118 (48.56%) whereas the least percentage of total TTI was observed in the older age group of 50-60 years, 06 (2.47%) [Table/Fig-2]. The seropositive donors during the five-year period for HIV, HBV, HCV, syphilis, and malaria were found to be 19 (0.09%), 155 (0.76%), 28 (0.14%), 41 (0.20%), and 0, respectively. Over time, the seropositivity of HBsAg and HIV among donors depicted a declining pattern. An escalating seroprevalence of syphilis cases was a prominent finding until 2020, followed by a gradual decline. In terms of the seroprevalence of TTI over the last five years among donors, Hepatitis B infection predominated, followed by syphilis, Hepatitis C, and HIV [Table/Fig-3].

The total number of replacement, voluntary, first-time, and repeat blood donors were 9459, 10933, 5930, and 14462, respectively.

Year	Number of donors	Number of seropositive donors (n)	Seropositivity (%)
2018	4665	60	1.29%
2019	4328	50	1.16%
2020	3208	39	1.22%
2021	3957	45	1.14%
2022	4234	49	1.16%
2018-2022	20392	243	1.19%

[Table/Fig-1]: Total seroprevalence in 5 years duration.
{1st January 2018 to 31st December 2022 (60 months)}

Age group (Years)	HIV	HBsAg	HCV	Syphilis	Malaria	Total seropositivity	
						Cases (n)	Percentage (%)
18-29	11	70	17	20	00	118	48.56%
30-39	03	62	07	11	00	83	34.16%
40-49	05	19	04	08	00	36	14.81%
50-60	00	04	00	02	00	06	2.47%
Total	19	155	28	41	00	243	100%

[Table/Fig-2]: Age-wise distribution of TTI.
{1st January 2018 to 31st December 2022 (60 months)}

Year	HIV n (%)	HBsAg n (%)	HCV n (%)	Syphilis n (%)	Malaria n (%)	Seropositivity n (%)	Total donors
2018	07 (0.15)	44 (0.94)	04 (0.09)	05 (0.11)	00	60 (1.29)	4665
2019	05 (0.12)	32 (0.74)	02 (0.05)	11 (0.25)	00	50 (1.16)	4328
2020	02 (0.06)	22 (0.69)	06 (0.19)	09 (0.28)	00	39 (1.22)	3208
2021	03 (0.08)	27 (0.68)	06 (0.15)	09 (0.23)	00	45 (1.14)	3957
2022	02 (0.05)	30 (0.71)	10 (0.24)	07 (0.17)	00	49 (1.16)	4234
Total	19 (0.09)	155 (0.76)	28 (0.14)	41 (0.20)	00	243 (1.19)	20392

[Table/Fig-3]: Seroprevalence and trends of TTI year-wise.
{1st January 2018 to 31st December 2022 (60 months)}

The RDs donate blood when it is required by a member of their family or community and don't receive any kind of payment for it. Out of 9459 RDs, 228 were seropositive. The seroprevalence of TTI among RDs was 2.41%. In RDs, the highest seroprevalent TTI during the five-year duration was found to be Hepatitis B 143 (1.51%), followed by Syphilis 40 (0.42%), Hepatitis C 26 (0.27%), and HIV 19 (0.20%). There were no malarial positive donors in the present study. A decreasing trend of Hepatitis B and HIV among RDs had been noticed over time. A drastic increase in the seroprevalence of syphilis among RDs was seen in 2019, after which it slightly declined in 2020 and reached a plateau in 2021 before further waning in 2022. An increasing trend of the seroprevalence of HCV among RDs was seen over time [Table/Fig-4].

Year	HIV n (%)	HBsAg n (%)	HCV n (%)	Syphilis n (%)	Malaria n (%)	Seropositivity n (%)	Total RD
2018	07 (0.29)	41 (1.70)	04 (0.17)	05 (0.21)	00	57 (2.36)	2415
2019	05 (0.27)	30 (1.61)	02 (0.11)	11 (0.59)	00	48 (2.58)	1859
2020	02 (0.13)	22 (1.40)	05 (0.32)	08 (0.51)	00	37 (2.35)	1576
2021	03 (0.17)	25 (1.41)	06 (0.34)	09 (0.51)	00	43 (2.43)	1770
2022	02 (0.11)	25 (1.36)	09 (0.49)	07 (0.38)	00	43 (2.34)	1839
Total	19 (0.20)	143 (1.51)	26 (0.27)	40 (0.42)	00	228 (2.41)	9459
Total seropositivity in RD						2.41%	

[Table/Fig-4]: Seroprevalence of TTI among Replacement Donors (RD) (N=9459).
{1st January 2018 to 31st December 2022 (60 months)}

The VBDs donate blood under their free will and don't receive any kind of payment for it. Out of 10933 VBDs, 15 were seropositive. The seroprevalence of TTI among voluntary donors was 0.14%. There were no malaria or HIV seropositive voluntary donors in the present study. During the five-year duration among VBDs, the seroprevalence of TTI was highest for Hepatitis B 12 (0.11%), followed by Hepatitis C 2 (0.02%), and syphilis 1 (0.01%) [Table/Fig-5].

Year	HIV n (%)	HBsAg n (%)	HCV n (%)	Syphilis n (%)	Malaria n (%)	Seropositivity n (%)	Total VBD
2018	00	03 (0.13)	00	00	00	3 (0.13)	2250
2019	00	02 (0.08)	00	00	00	2 (0.08)	2469
2020	00	00	01 (0.06)	01 (0.06)	00	2 (0.12)	1632
2021	00	02 (0.09)	00	00	00	2 (0.09)	2187
2022	00	05 (0.21)	01 (0.04)	00	00	6 (0.25)	2395
Total	00	12 (0.11)	02 (0.02)	01 (0.01)	00	15 (0.14)	10933
Total seropositivity in VBD				0.14%			

[Table/Fig-5]: Seroprevalence of TTI among Voluntary Blood Donors (VBD) (N=10933).
{1st January 2018 to 31st December 2022 (60 months)}

Out of 5930 first-time donors, 122 were seropositive. The seroprevalence of TTI among first-time donors was 2.06%. The seroprevalence of TTI among first-time donors was highest for Hepatitis B (n=82, 1.38%), followed by Hepatitis C (n=15, 0.25%), syphilis (n=14, 0.24%), and HIV (n=11, 0.19%). Along with time, a sharp decline in Hepatitis B among first-time donors was noted in 2021 before an upsurge in 2022. A decreasing trend of HIV infection was observed among first-time donors over time [Table/Fig-6].

Year	HIV n (%)	HBsAg n (%)	HCV n (%)	Syphilis n (%)	Malaria n (%)	Seropositivity n (%)	Total first time donors
2018	03 (0.22)	20 (1.46)	02 (0.15)	03 (0.22)	00	28 (2.04)	1371
2019	04 (0.32)	19 (1.54)	00	03 (0.24)	00	26 (2.11)	1233
2020	01 (0.18)	12 (1.41)	04 (0.47)	01 (0.18)	00	18 (2.12)	850
2021	02 (0.15)	12 (0.92)	04 (0.31)	04 (0.31)	00	22 (1.69)	1298
2022	01 (0.08)	19 (1.61)	05 (0.42)	03 (0.25)	00	28 (2.38)	1178
Total	11 (0.19)	82 (1.38)	15 (0.25)	14 (0.24)	00	122 (2.06)	5930
Total seropositivity in first time donors						2.06%	

[Table/Fig-6]: Seroprevalence of TTI among first time blood donors (N=5930).
{1st January 2018 to 31st December 2022 (60 months)}

Out of 14462 repeat blood donors, 121 were seropositive. The seroprevalence of TTI among repeat donors was 0.84%. Among TTI, Hepatitis B infection 73 (0.50%) predominated with the highest seroprevalence in repeat blood donors, followed by syphilis 27 (0.19%), Hepatitis C 13 (0.09%), and HIV 8 (0.06%). A dwindling trend of HIV among repeat blood donors was observed [Table/Fig-7].

Year	HIV n (%)	HBsAg n (%)	HCV n (%)	Syphilis n (%)	Malaria n (%)	Seropositivity (%)	Total repeat donors
2018	04 (0.12)	24 (0.73)	02 (0.06)	02 (0.06)	00	32 (0.97)	3294
2019	01 (0.03)	13 (0.42)	02 (0.06)	08 (0.26)	00	24 (0.78)	3095
2020	01 (0.04)	10 (0.42)	02 (0.08)	08 (0.34)	00	21 (0.89)	2358
2021	01 (0.04)	15 (0.56)	02 (0.08)	05 (0.19)	00	23 (0.86)	2659
2022	01 (0.03)	11 (0.36)	05 (0.16)	04 (0.13)	00	21 (0.69)	3056
Total	08 (0.06)	73 (0.50)	13 (0.09)	27 (0.19)	00	121 (0.84)	14462
Total seropositivity in repeat blood donors						0.84%	

[Table/Fig-7]: Seroprevalence of TTI among repeat blood donors (N=14462).
{1st January 2018 to 31st December 2022 (60 months)}

Dual infection was seen in 2 (0.82%) donors, out of 243 seroreactive donors, both of which were replacement and first-time donors. HIV and VDRL co-infection was seen in a 42-year-old donor, whereas HIV and HCV co-infection was noted in a 26-year-old donor [Table/Fig-8].

Serial no.	Co-infection	Age (years)	Voluntary/Replacement Donors (RD)	First time/ repeat donors
1	HIV and VDRL	42	Replacement	First time
2	HIV and HCV	26	Replacement	First time

[Table/Fig-8]: Co-infection of seropositive donors.
{1st January 2018 to 31st December 2022 (60 months)}

[Table/Fig-3] depicts the year-wise trend of HIV, HBV, HCV, syphilis, and malaria among blood donors. HBV infection among blood donors had the highest seropositivity throughout the study period.

[Table/Fig-4] depicts the year-wise trend of HIV, HBV, HCV, syphilis, and malaria among replacement blood donors. HBV infection among replacement blood donors had the highest seropositivity throughout the study period.

[Table/Fig-5] depicts the year-wise trend of HIV, HBV, HCV, syphilis, and malaria among VBD. In the year 2020, syphilis had the maximum seropositivity among VBD, whereas no HBV infections were recorded among VBD in the year 2020.

[Table/Fig-6] depicts the year-wise trend of HIV, HBV, HCV, syphilis, and malaria among first-time blood donors. HBV infection among first-time blood donors had the highest seropositivity throughout the study period.

[Table/Fig-7] depicts the year-wise trend of HIV, HBV, HCV, syphilis, and malaria among repeat blood donors. HBV infection among repeat blood donors had the highest seropositivity throughout the study period.

[Table/Fig-8] depicts co-infection among blood donors. The two co-infections that were noted among 243 seropositive donors were HIV/VDRL and HIV/HCV.

DISCUSSION

Blood is an expensive human resource and it should be prescribed justifiably and appropriately due to its scarcity. Prescribing recommendations should be based on national guidelines on the clinical usage of blood, taking into account the patient's needs, minimum cost and wastage, optimum safety, and efficacy [13]. Due to the long-term repercussions of TTI for the recipients, every healthcare organisation is bound to provide safe blood transfusion services [14]. The presence of TTI is inexorable due to the prevalence of asymptomatic carriers and donations occurring during the window period of infections [15]. Only incessant improvement, implementation of stringent donor screening and selection, and sensitive screening tests can curb the risks of acquiring TTI [16].

In the present study, the highest percentage of total TTI was observed in the age group of 18-29 years, 118 (48.56%). The percentage of total TTI declined with advancing age groups. The pinnacle of rates of TTI in adulthood is related to the acquisition of infection in sexually active age groups and may include a population with high-risk behavioural activities [17]. Mandal R and Mondal K in their study have also shown the highest prevalence of TTI in the age group of 26-35 years [18]. Maximum seropositivity in the study by Mendhe VV and Dongre DT was observed in the age group of 21-30 years, whereas the least seropositivity was noted in the age group of 50 years and older, which resembled the present study with 18-29 years, 118 (48.56%); and 50-60 years, 06 (2.47%) [Table/Fig-2] [19].

In the present study, each and every donor was a voluntary unpaid donor, out of which voluntary unpaid family donors who donated blood during emergencies to save the lives of their loved ones (RD) represented 9459 (46.39%), while only 10933 (53.61%) of donors were greatly encouraged to donate blood in conducted blood camps. Thus, voluntary motivated donors surpassed voluntary unpaid family donors. A similar result was noted in a study conducted by Naik VSS et al., (VBD: 61.69%; RD: 38.31%) [20]. However, this result was in discordance with studies conducted by Singh B et al., (VBD: 17.6%; RD: 82.4%), Kakkar N et al., (VBD: 5.3%; RD: 94.7%), Pahuja S et al., (VBD: 0.52%; RD: 99.48%), Natasha M et al., (VBD: 35%; RD: 65%), Ataro Z et al., (VBD: 11.43%; RD: 88.57%), and Cheema S et al., (VBD: 21.65%; RD: 78.35%) [14,21-25]. In the present study, VBD donating in camps could be more to yield this result. The blood donation camps should be well planned, well promoted, and conducted regularly. Promoting voluntary donations would dampen the risk of single as well as co-infections. Thus, augmenting voluntary blood donations in order to curtail the risk of TTI should be prioritised, in compliance with the National Blood Policy of India [26].

The present study depicts a higher seropositivity of TTI in RD (2.41%) over voluntary donors (0.14%). In a study conducted by Singh B et al., syphilis seropositivity in voluntary and replacement blood donors was 1.4% and 2.8%, respectively [21]. A similar pattern is observed in the present study, where syphilis seropositivity predominates in replacement (0.42%) over voluntary (0.01%) blood donors. None of the VBD tested positive for HIV in the present study, which is consistent with the study carried out by Arora D et al., where there were no HIV seropositive VBD [27]. The total seroprevalence of TTI was 1.19%, which is lower than in other studies by Bagde S et al., (1.46%) and Matee MI et al., (15.9%) [28,29]. However, the seroprevalence was higher than in a similar study conducted in Southern India by Lakshmikumar MT et al., (1.07%) [30]. The lower rate of seroprevalence of (1.19%) in the present study is due to better donor cognizance and rigorous donor selection criteria followed at the present blood centre. Hepatitis B infection happens to be the most seroprevalent TTI in the present study during the 5-year period. This observation was similar to a study conducted by Mendhe VV et al., (HBV=0.7%), Naik VSS et al., (HBV=1.82%), and Bhawani Y et al., (HBV=1.41%) [Table/Fig-9] [19,20,31].

In a study conducted by Chandra T et al., HBV seropositivity among RD was highest (1.96%) as compared to other TTIs (HCV=0.85%, HIV=0.23%, Syphilis=0.01%) [32]. HBV infection predominates among RD in the present study (seropositivity of HIV, HBV, HCV, and syphilis among RD was 0.20%, 1.51%, 0.27%, and 0.42%, respectively). Syphilis was the second most common seropositive TTI noted among blood donors in the present study (HIV=0.09%, HBV=0.76%, HCV=0.14%, syphilis=0.20%, and malaria=0%), which was also observed by Arif SH et al., (HIV=0.35%, HBV=2.38%, HCV=1.27%, syphilis=1.29%, and malaria=0.29%) and Sharma RI et al., (HIV=0.03%, HBV=0.29%, HCV=0%, syphilis=0.04%, and malaria=0%) [Table/Fig-9] [33,34].

In order to alleviate the incidence of Hepatitis B infection after blood transfusion, it is essential to consider tests that detect HBV during the window period. In such cases, Nucleic Acid Testing (NAT) assay is helpful as it has remarkably truncated the window period. But the high cost of this assay makes it unaffordable for the majority of the centres [35]. In the present study, none of the donors were found to be positive for malaria parasites. In studies conducted by Srikrishna A et al., Mendhe VV and Dongre DT et al., Pallavi P et al., Prakash VB et al., Kaur G et al., Makroo RN et al., and Sethi B et al., no donors were positive for malarial parasites [4,19,36-40].

Study	Publication year	Place of study	Total no. of sample size (Total donors)	HIV	HBsAg	HCV	Syphilis	Malaria
Kaur G et al., [38]	2010	Chandigarh, India	42439	0.60	1.70	0.80	0.70	00
Bhawani Y et al., [31]	2010	Andhra Pradesh,India	8097	0.39	1.41	0.84	0.08	-
Leena MS and Mohd S, [45]	2012	South India	6939	0.27	0.71	0.14	0.10	0.12
Sethi B et al., [40]	2014	Uttarakhand, India	7884	0.19	0.63	0.20	0.02	00
Mandal R and Mondal K, [18]	2015	Darjeeling, India	28364	0.42	1.24	0.62	0.65	0.004
Makroo RN et al., [39]	2015	New Delhi, India	180477	0.24	1.18	0.43	0.23	00
Assessment of NACO supported blood banks-A Preliminary Report 2016 (Gujarat) [46]	2016	Gujarat, India	606683	0.11	0.64	0.15	0.18	0.039
Sharma RI et al., [34]	2018	Gujarat, India	13724	0.03	0.29	00	0.04	00
Naik VSS et al., [20]	2020	Andhra Pradesh, India	54937	0.23	1.82	0.31	0.04	0.01
Arif SH et al., [33]	2021	Uttar Pradesh, India	36614	0.35	2.38	1.27	1.29	0.29
Cheema S et al., [25]	2022	Haryana, India	10797	0.03	0.49	0.50	0.05	0.009
Mendhe VV and Dongre DT [19]	2023	Maharashtra, India	12193	0.09	0.7	0.106	0.04	00
Present study	2024	Gujarat, India	20392	0.09	0.76	0.14	0.20	00

[Table/Fig-9]: List of various studies showing seropositivity (in percentages) of blood donors [18-20,25,31,33,34,38-40,45,46].

The total seropositivity of TTI in first-time blood donors, 122 (2.06%) exceeded those found in repeat blood donors, 121 (0.84%). Repeat donors generally have an altruistic behaviour and a sense of responsibility towards the safety of the recipients [41]. Such donors are tested every time they donate, and if found positive for any of the infectious agents, they will be unable to donate blood any longer [42]. In the present study, the majority of repeat donors were voluntary donors who were tested repeatedly. This explains the lower TTI rate in the repeat donor category.

Dual infection was seen in 2 (0.82%) donors out of 243 seroreactive donors, both of which were replacement and first-time donors. This is less than the study conducted by Kaur R et al., (Co-infection=1.2%) and Kaur H et al., (Co-infection=4.04%) [43,44]. Co-infection is relevant since these infections have an impact not only on the course of the disease but also on the quality of life. Moreover, these infections have epidemiological similarities like common risk factors and routes of transmission [44]. The seroprevalence of individual TTI in the blood centre of Sheth L.G. General Hospital, Ahmedabad, can be compared to those in other studies listed in [Table/Fig-9] [18-20,25,31,33,34,38-40,45,46].

In the present study, the seroprevalence of HIV is the lowest (HIV=0.09%) and resembles Mendhe VV and Dongre DT et al., (HIV=0.09%) [19]. The seroprevalence of HCV infection (HCV=0.14%) in the present study resembles that of Leena MS and Mohd S study (HCV=0.14%) [45].

Limitation(s)

The actual seroprevalence of TTI may be underestimated owing to the presence of the window period in HIV, HBV, and HCV infections.

CONCLUSION(S)

In the present study, the overall seroprevalence of TTI was 1.19% over a period of five years. The individual TTI seroprevalence for the five-year duration was 0.09% for HIV, 0.76% for HBV, 0.14% for HCV, and 0.20% for syphilis, with HBV having the highest seroprevalence. In order to curtail this and ensure blood safety, an immaculate implementation of stringent donor selection criteria, utilisation of sensitive screening tests, and judicious use of blood products should be emphasised. Furthermore, the general population should be educated about the advantages of donation, and the associated myths should be clarified. Also, public awareness, motivational programs, and mass immunisation for HBV infection should be organised to considerably lessen the TTI prevalence in an otherwise healthy population.

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