

Seroprevalence of Transfusion Transmitted Infections Among Blood Donors in a Tertiary Care Centre: A Five-Year Retrospective Study

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Abstract

Background: Blood transfusion is an essential lifesaving medical intervention. However, transfusion carries the risk of transmitting infectious diseases known as transfusion transmitted infections (TTIs). Screening of donated blood for infections such as Human Immunodeficiency Virus (HIV), Hepatitis B virus (HBV), Hepatitis C virus (HCV), syphilis, and malaria is mandatory to ensure blood safety. The aim is to determine the seroprevalence and trends of transfusion-transmitted infections (TTIs) among blood donors at a tertiary care centre over a five-year period. **Material and Methods:** This retrospective study analyzed blood donor screening records from 2021 to 2025. All donated blood units were screened for human immunodeficiency virus types 1 and 2, hepatitis B, hepatitis C, syphilis, and malaria. Blood donors were screened for HIV (4th-generation ELISA), HBsAg and HCV (3rd-generation ELISA), syphilis (Rapid Plasma Reagin test), and malaria (antigen-based rapid diagnostic test). Descriptive statistical analysis was performed to evaluate the annual seroprevalence and trends of transfusion-transmitted infections among blood donors. **Results:** A total of 189,761 blood donors were included, comprising 139,613 voluntary donors and 50,148 replacement donors. The overall prevalence of TTIs among blood donors was 3.14%. HIV prevalence ranged from 0.32% to 0.36%, HBsAg from 0.91% to 1.16%, HCV from 1.00% to 1.33%, and syphilis (RPR) from 0.45% to 0.72%. Only one malaria-positive case was detected during the study period. **Conclusion:** The study demonstrates that TTIs continue to be present among blood donors, highlighting the importance of strict donor screening and continuous surveillance to maintain blood safety. Strategies to ensure a safe blood supply should be strengthened through stringent donor selection and the implementation of highly sensitive screening methods, including nucleic acid testing (NAT).

Keywords: Transfusion-transmitted infections, Blood donors, Seroprevalence, HIV, Hepatitis B, Hepatitis C, Syphilis, Malaria, Blood safety.

Received: 05 August 2026

Revised: 20 August 2026

Accepted: 09 September 2026

Published: 16 September 2026

INTRODUCTION

Blood transfusion is a vital part of modern healthcare and plays a crucial role in saving lives in various clinical situations. Patients suffering from severe anemia, trauma, obstetric complications, malignancies, and those undergoing major surgical procedures frequently require blood transfusions as part of their treatment. Despite its lifesaving benefits, blood transfusion carries potential risks, one of the most important being the transmission of infectious diseases from donor to recipient.^[1]

Transfusion-transmitted infections (TTIs) are infections that can be transmitted through transfusion of blood or blood components. Major TTIs include human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), syphilis caused by *Treponema pallidum*, and malaria caused by *Plasmodium* species.^[2] These infections can cause serious health complications in recipients, including chronic liver disease, immunodeficiency, systemic infections, and long-term morbidity.^[3]

Ensuring the safety of the blood supply is therefore one of the primary responsibilities of blood centre and transfusion services. To minimize the risk of TTIs, several strategies are implemented, including strict donor selection criteria, detailed medical history evaluation, pre-donation counselling, and mandatory laboratory screening of donated

blood units.^[4]

In India, screening of all donated blood units for HIV, HBV, HCV, syphilis, and malaria is mandatory.^[5] These screening measures have substantially improved blood safety; however, residual risk persists, particularly because infections may be undetectable during the diagnostic window period.^[6]

Monitoring the prevalence of TTIs among blood donors is essential for assessing the safety of the blood supply and understanding the epidemiological trends of these infections in the population. Blood donors generally represent a relatively healthy segment of the population; therefore, the prevalence of infections among donors can provide indirect insight into the burden of infectious diseases in the community.^[7]

Several studies conducted in different regions of India have reported varying prevalence rates of TTIs among blood donors.

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DOI:
10.21276/amt.2026.v13.i3.1044

How to cite this article: Singh G, Gupta A, Vaishali. Seroprevalence of Transfusion Transmitted Infections Among Blood Donors in a Tertiary Care Centre: A Five-Year Retrospective Study. *Acta Med Int.* 2026;13(3):206-209.

Differences in prevalence may be influenced by factors such as geographic location, donor demographics, level of awareness, and the proportion of voluntary versus replacement donors.^[8]

Continuous monitoring of seroprevalence trends helps evaluate the effectiveness of donor selection strategies and screening protocols. Such data are also useful for policymakers and healthcare authorities in designing public health interventions aimed at reducing the burden of infectious diseases.^[9]

The present study was conducted to determine the seroprevalence and trends of transfusion-transmitted infections among blood donors in a tertiary care centre over a five-year period from 2021 to 2025.

MATERIALS AND METHODS

This retrospective observational study was conducted in the Department of Immunohematology and Blood Transfusion PGIMS Rohtak, Haryana from January 2021 to December 2025.

Blood donations were collected from both voluntary and replacement donors during the study period, in accordance with the Drugs and Cosmetics Act, 1940 and Rules, 1945. Prior to donation, every donor completed a donor questionnaire and informed consent form documenting personal and relevant medical history details. This was followed by pre-donation counselling, during which the donor was educated regarding the donation procedure, post-donation care, the importance of screening for transfusion-transmitted infections (TTIs), and the need for honest disclosure of any high-risk behaviour to ensure blood safety. Only donors who satisfied all eligibility criteria were

allowed to donate blood.

All donated blood units were screened for human immunodeficiency virus types 1 and 2, hepatitis B, hepatitis C, syphilis, and malaria. Screening for human immunodeficiency virus was performed using fourth generation enzyme-linked immunosorbent assay kits based on the principle of simultaneous detection of p24 antigen and antibodies to human immunodeficiency virus types 1 and 2. Hepatitis B surface antigen was detected using third-generation enzyme-linked immunosorbent assay kits based on the sandwich immunoassay principle. Hepatitis C virus antibodies were detected using third generation enzyme-linked immunosorbent assay kits based on antigen-antibody reaction. Screening for syphilis was carried out using the Rapid Plasma Reagin test, a non-treponemal flocculation assay detecting antibodies against cardiolipin antigen. Malaria screening was performed using antigen-based rapid diagnostic tests detecting Plasmodium-specific antigens such as histidine rich protein 2 or parasite lactate dehydrogenase.

Data collected from the blood centre records included the total number of blood units tested each year and the number of reactive samples for each infection. These data were compiled year-wise and analyzed to determine the prevalence of each transfusion-transmitted infection.

Seroprevalence was calculated using the formula:

Seroprevalence (%) =

$(\text{Number of reactive samples} \div \text{Total units tested}) \times 100$

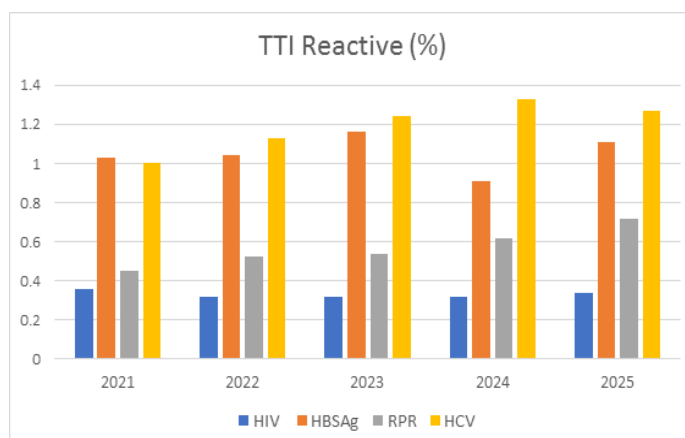
Descriptive statistical analysis was performed to evaluate the annual seroprevalence and trends of transfusion-transmitted infections among blood donors.

RESULTS

Table 1:

Year	Units Tested	Reactive units
2021	36,721	1044
2022	38,760	1169
2023	38,872	1266
2024	37,810	1203
2025	37,598	1284

A total of 189,761 blood donors were included during the study period, of whom 139,613 (73.6%) were voluntary donors and 50,148 (26.4%) were replacement donors. Overall, 5,966 donations were reactive for one or more transfusion-transmitted infections (TTIs), corresponding to an overall seroreactivity of 3.14%. The annual number of reactive donations was 1,044 in 2021, 1,169 in 2022, 1,266 in 2023, 1,203 in 2024, and 1,284 in 2025. Female donors accounted for a very small proportion of reactive donations, with 5 reactive female donors in 2021, 5 in 2022, 3 in 2023, 3 in 2024, and 8 in 2025, giving a total of 24 reactive female donors during the study period. The year-wise distribution of blood donations and TTI seroreactivity is presented in [Table 1 and Figure 1], respectively.



Among the infections screened, HBsAg and HCV showed the highest prevalence among blood donors.

HIV: HIV seroprevalence ranged from 0.32% to 0.36% during the study period. It was 0.36% in 2021, 0.32% in 2022, 2023, 2024, and 0.34% in 2025.

Hepatitis B (HBsAg): HBsAg seroprevalence ranged from 0.91% to 1.16% during the study period, with the highest prevalence observed in 2023 (1.16%).

Hepatitis C (HCV): HCV seroprevalence showed an overall increasing trend, rising from 1.00% in 2021 to a peak of 1.33% in 2024, followed by a slight decline to 1.27% in 2025.

Syphilis (RPR): Syphilis seroreactivity detected by RPR showed an overall increasing trend during the study period, rising from 0.45% in 2021 to 0.72% in 2025.

Malaria: Only one malaria positive donor was detected during the entire study period, which may be due to hiding the history by the donor.

DISCUSSION

Monitoring the prevalence of transfusion-transmitted infections (TTIs) among blood donors is an important component of blood safety programs. The present study evaluated the prevalence and trends of TTIs over a five-year period at a tertiary care centre.

The findings of this study indicate that HBV and HCV were the most frequently detected viral TTIs among blood donors. Comparable Indian studies have also reported HBV and HCV as important contributors to TTI seroreactivity.^[6-8,10,11]

HBV remains a major public health problem because of its potential to cause chronic hepatitis, cirrhosis, and hepatocellular carcinoma. HBsAg seroprevalence in the present study ranged from 0.91% to 1.16%. This is broadly comparable with reports from Indian blood-donor studies, although prevalence varies by region, donor profile, and study period.^[6-8,10,11] These findings support continued stringent donor selection and sensitive screening strategies.

HCV seroprevalence increased from 1.00% in 2021 to 1.33% in 2024 and then declined slightly to 1.27% in 2025. HCV infection may remain asymptomatic, which reinforces the importance of effective donor selection and laboratory screening. Indian studies have reported substantial geographic variation in HCV seroprevalence among blood donors.^[6,7,10,11] The relatively high HCV seroreactivity observed in the present study warrants continued surveillance and evaluation of local epidemiological factors. HIV seroprevalence remained relatively stable at 0.32%–0.36% during the study period. Comparable prevalence has been reported in other Indian donor populations; for example, Rawat et al. reported an overall HIV seroprevalence of 0.32%.^[11] Continued donor education, counselling, and sensitive screening remain important for maintaining blood safety.

Syphilis seroreactivity increased from 0.45% in 2021 to 0.72% in 2025. This upward trend warrants continued surveillance. Published Indian studies show variation in syphilis seroreactivity according to setting and testing strategy.^[6,8,11] Routine screening remains essential for blood safety.

Malaria seroreactivity was extremely rare in the present study, with only one reactive donation during the five-year period. Other Indian studies have likewise reported very low malaria reactivity among blood donors.^[11] This may be due to hiding of history by the donors. Nevertheless, continued malaria screening remains important in endemic settings because transfusion-transmitted malaria can have serious consequences in susceptible recipients.

The observed TTI pattern may be influenced by donor selection criteria, pre-donation counselling, awareness regarding safe blood donation practices, and the high proportion of voluntary donors in the study population.^[4,11]

Advanced screening technologies such as nucleic acid testing (NAT) can further improve blood safety by shortening the diagnostic window period and detecting some HBV, HCV, and HIV infections that may be missed by serological screening.^[12] Continuous surveillance of transfusion-transmitted infections is therefore essential for ensuring the safety and reliability of blood transfusion services.

CONCLUSION

The present study demonstrates that transfusion-transmitted infections continue to be detected among blood donors, although the overall prevalence remains relatively low. Among the infections studied, Hepatitis B and Hepatitis C showed the highest prevalence.

Overall, the findings of this study emphasize the importance of continuous surveillance of transfusion-transmitted infections in order to maintain the safety of blood transfusion services.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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