The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 4, Issue 6, 2026

SEROPREVALENCE OF TRANSFUSION-TRANSMITTED INFECTIONS (TTIS) AMONG BLOOD DONORS: A SEROLOGICAL STUDY

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DOI: https://doi.org/10.5281/zenodo.20773923

Keywords
Blood donors, TTIs, Screening, HIV

Article History
Received on 20 May 2026
Accepted on 16 June2026
Published on 20 June 2026

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Abstract

Background: The risks of blood transfusion include the possibility of contracting infections called transfusion-transmissible infections (TTIs) such as Hepatitis B, Hepatitis C, HIV, malaria, and Syphilis. It is important to screen all donated blood for these infections before transfusion to reduce these risks. This study was conducted to evaluate the prevalence of HIV, HCV, HBV, malaria, and syphilis infection among HIV, HCV, and HBV-positive donors with positive serology who turned up for donation. Materials and methods: This is a cross-sectional study conducted to find the seroprevalence of transfusion transmissible infections (TTIs) in all blood donors who appeared in the blood bank Chughtai Lab in 6 months period (December 2025 to May 2026). It comprised 18- to 60-year-old donors (excluding medically deferred donors). Anti-HCV, anti-HIV, and HBsAg were determined by CLIA, and syphilis and malaria were screened by the RPR test and rapid immunochromatographic card, respectively. Results: Overall, 2,809 blood donors were screened for transfusion-transmissible infections (TTIs). Out of these, 115 donors (4.1%) were positive for one or more infections, all of whom were male. The most common infections among them were HCV (42.6%), syphilis (32.17%), HBV (21.7%), and HIV (3.47%), with no cases of malaria found. Conclusion: Transfusion-transmissible infections (TTIs) are important blood safety concerns. There is a need to improve donor selection, screening, and voluntary low-risk donation to ensure the blood supply.

INTRODUCTION:

Blood transfusion is one of the most critical medical interventions, and plays a crucial role in the survival and recovery of millions of patients worldwide annually. Though significant, it has some risks, such as immediate and long-term consequences, and the risk of infection transmission. A total of over 81 million blood donations are collected worldwide each year. [1] The new era in transfusion protocols began with the recognition of infections that are transmitted via blood transfusion, and the importance of human safety and life. [2] Generally, transfusion-transmitted infections are classified into three groups: viral, bacterial, and parasitic. Of these, viral infections are the most common in transfusion-related cases. [1]

Transfusion Transmissible Infections (TTIs) are infections that can be transmitted from one person to another through contaminated blood or blood products during transfusion. These infections remain a major challenge in healthcare, especially in blood transfusion services, because they can lead to severe health complications in recipients. The most commonly reported TTIs include Hepatitis B virus (HBV), Hepatitis C virus (HCV), Human Immunodeficiency Virus (HIV-I/II), and syphilis. A study carried out in Pakistan reported a prevalence of 6.7% for Hepatitis B and 14.3% for Hepatitis C, indicating that HCV was more common among the screened population. The study also observed notable co-infection trends, where 80% of co-infected individuals had both HIV and HCV, while 20% showed co-infection with HBV and HCV. [3] In frequently, infections like cytomegalovirus, herpes virus, Epstein–Barr virus, toxoplasmosis, and brucellosis can also be transmitted. [4]

The World Health Organization (WHO) suggests that every unit of donated blood undergoes thorough screening for infectious diseases before it is approved for medical use or processing. This measure is a key step in enhancing global blood safety and decreasing the risk of transmitting infections through transfusion. Regardless of improvements in diagnostic technologies, transfusion-transmissible infections (TTIs) continue to pose a risk due to limitations in virus detection. In general, the rate of TTIs in donated blood is higher in low- and middle-income countries than in high-income countries. [5]

3rd and 4th generation ELISA test kits are recommended by the National AIDS Control Organization (NACO) for HIV 1 & 2 screening in blood banks because of their 100% sensitivity and improvement in blood safety. [10]. A large number of infected people in the latent period are asymptomatic, and thus are less likely to go for blood tests. This is because of the existence of transfusion transmissible infections (TTIs), which result in the annual disposal of about 1.6 million units of blood. This, in turn, reduces the safe blood available to health care providers. [7]

Most of the countries in the region have developed national hemovigilance protocols according to WHO guidelines, but the blood transfusion procedure still has risks for both the health care providers and transfusion recipients. [6]

A well-organized blood transfusion system is available only in the province Punjab of Pakistan. Available data shows that only 77.42% of the total blood donors in Punjab were screened for HIV and 86.84% were screened for Hepatitis B. In addition, UNAIDS estimates that only half of the 1.5 million blood donation units collected in the country each year are properly screened. In recent times, authorities have closed at least 91 blood banks in the biggest city of the country, Karachi, for lack of compliance with the safety protocol. Situations are cited as being even worse in smaller towns. [9]

Screening of blood for Transfusion-Transmissible Infections (TTIs) is an important aspect of providing safe blood transfusion. Useful for screening to prevent the spread of serious infections like HIV, Hepatitis, Syphilis, Malaria. Ensuring that everyone can have access to fully test and safe blood is an integral part of fair and responsible healthcare. An assessment of the prevalence of TTIs in blood donors allows for a more accurate estimation of the risk of infection for the donor and provides an effective long-term public health strategy to estimate the risk of transmission of the disease in the community. [8]

Blood Transfusion Services (BTS) are an essential part of the healthcare system and have a vital role

in it. They provide their main job is to ensure that the blood supply is safe, adequate, available and well managed at every level. Therefore, the purpose of the present study was to measure the Seroprevalence of HIV, Hepatitis B virus (HBV), Hepatitis C virus (HCV), Malaria and Syphilis among healthy blood donors at the blood bank Chughtai Lab, Lahore, Pakistan.

MATERIALS AND METHODS:

This was a cross-sectional study conducted in the Blood Bank Department of Chughtai Institute of Pathology, Lahore. The data were gathered during six months (December 2025 – May 2026). A total of 2,809 people approached for blood donation were screened during this period, and 115 blood donors were reactive to at least one transfusion-transmitted infection (TTI). The study population consisted of people aged 18 to 60 years old of both sexes. Donors who were within the eligibility criteria, including hemoglobin level > 12.5 g/dl and body weight > 50 kg, were included. Discussors who had a history of chronic diseases or infectious diseases symptoms, or who had been temporarily or permanently deferred due to medical or behavioral risk factors, were excluded. The results and analysis were conducted using the latest version of the Statistical Package for the Social Sciences (SPSS), and the findings were presented in tables, graphs, and descriptive statistics (percentages). Consecutive convenience sampling was used to select blood donors, and screening for Hepatitis B, C, and HIV was performed using Chemiluminescent immunoassay (CLIA). Additionally, screening for syphilis was done by the Rapid Plasma Reagin (RPR) test, and for malaria, the rapid immunochromatographic card method was used.

RESULTS:

This study was conducted at Chughtai Institute of Pathology, the blood center, to find the seroprevalence of TTIs among blood donors. 2,809 blood donors were tested for transfusion transmissible infections (TTIs): Hepatitis B virus (HBV), Hepatitis C virus (HCV), Human immunodeficiency virus (HIV), syphilis, and malaria. Of these, 115 donors (4.1%) were seropositive for one or more of the infectious markers. All seropositive donors were males; none of the female donors were found to be seropositive. In seropositive donors, the most common infection was HCV (42.6%), followed by syphilis (32.17%), HBV (21.7%), and HIV (3.47%), with no case of malaria noted. As can be seen in Figure 01. The age group of 18-30 years was found to have the highest prevalence of transfusion transmissible infections (TTIs), and the lowest prevalence was in donors above 50 years of age. The age distribution of each infection is summarized in Table 1.

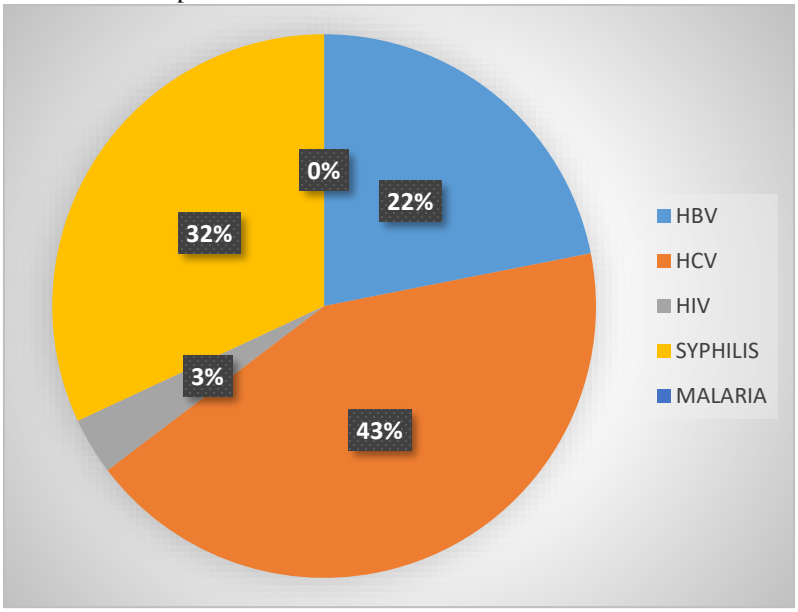

Figure 1. Pie chart showing the frequency distribution of seropositive infections.

Table No 1: ***Age-wise distribution of different TTIs.***

TTI	Age (Years), n (%)				Total Positive (%)
	18-30 years	31-40 years	41-50 years	>50 years	
HBV	18(72%)	4(16%)	2(8%)	1(4%)	25(21.7%)
HIV	4(100%)	0	0	0	4(3.47%)
HCV	28(57.14%)	18(36.73%)	2(4.08%)	1(2.04%)	49(42.6%)
Syphilis	20(54.05%)	11(29.7%)	6(16.2%)	0	37(32.17%)
Malaria	0	0	0	0	0
Total	70 (60.9%)	33 (28.7%)	10 (8.7%)	2 (1.7%)	115 (100%)

Table 2 presents the prevalence of transfusion-transmissible infections (TTIs) across various regions of Pakistan. The data indicate regional variations, with Karachi reporting the highest rates of HBV, HCV, and syphilis, while Lahore showed relatively lower prevalence, particularly with zero malaria cases. [11, 12, 13]

Table No 2: ***Prevalence of TTIs in different Regions of Pakistan.***

Region	HBV%	HIV%	HCV%	Syphilis%	Malaria%
The study (Lahore)	0.89%	0.14%	1.74%	1.32%	0.00%
Karachi (Dow University Hospital)	2.9%	0.5%	3.0%	2.0%	0.02%
Peshawar (regional blood center)	1.95%	0.23%	1.38%	0.91%	0.14%
Northern Pakistan (multiple Centers)	2.07%	0.07%	1.50%	0.16%	0.16%

Most infections occurred among the donors aged 18–30 years (about 60.9%). Figure 02 shows the distribution of infections like TTIs, such as HBV, HIV, HCV, Syphilis, and Malaria among the blood donors with respect to age groups and the prevalence of the infections in different age groups.

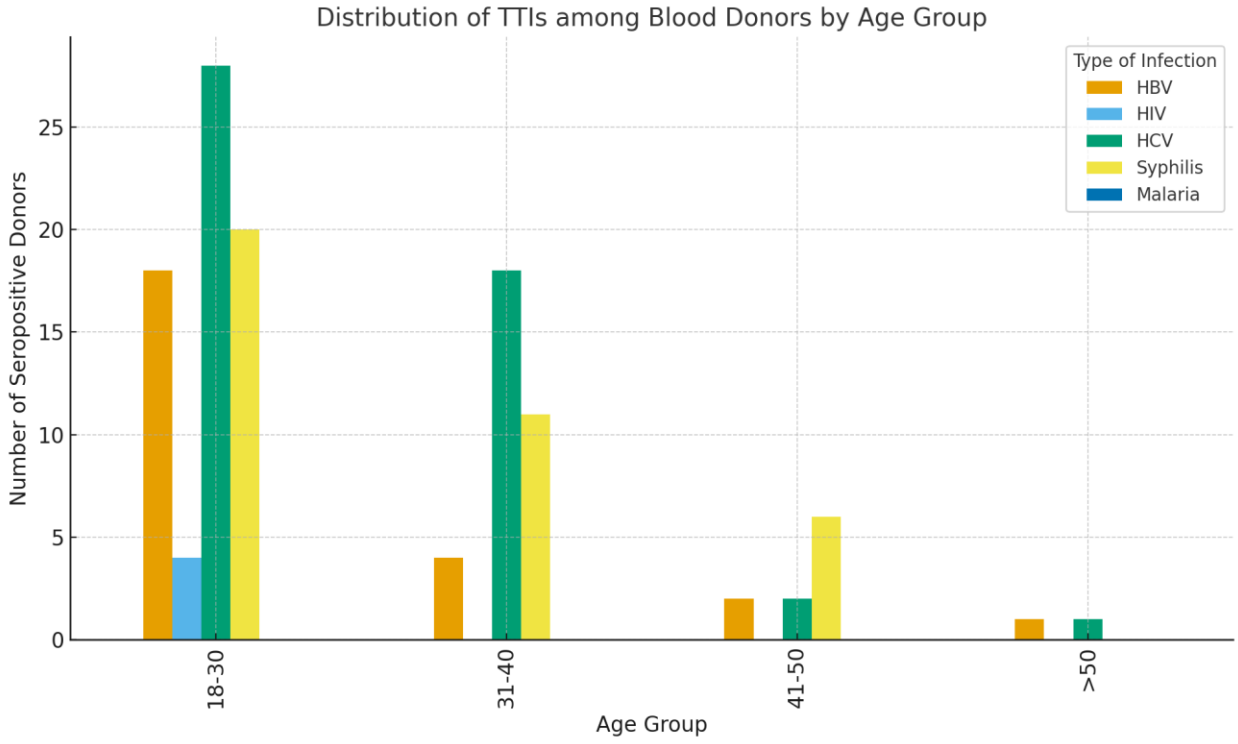

Figure 2. Bar chart showing the distribution of TTIs into different Age groups.

Overall, the seroprevalence rate of **4.1**% among blood donors indicates a persistent risk of TTIs, emphasizing the importance of stringent donor selection and effective screening strategies to ensure blood safety.

DISCUSSION:

The whole blood transfusion or its components play an important role in contemporary medical practice. While transfusions are lifesaving, they can also be a risk of infections via contaminated blood. Various microorganisms can cause such transfusion-transmitted infections (TTIs). The most frequently seen TTIs around the world include the human immunodeficiency virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Treponema pallidum (syphilis), and the malaria parasite. [14]

Despite the significant efforts undertaken in Pakistan for blood safety via system reform and implementation of hemovigilance practices in recent epidemiological studies, there is still a risk for TTIs. The detection of prevalence patterns in these infections in blood donors is a useful tool to assess the effectiveness of existing preventive and screening measures. This study is conducted to determine the seroprevalence of TTIs among the blood donors and to help continue the efforts to reduce the spread of blood-borne infections via transfusion practices. [12]

A similar study was conducted at a regional blood centre in Pakistan, and it revealed that the overall prevalence of transfusion-transmitted infections (TTIs) among blood units was 5.22%, and all seropositive blood donors were males. In the study mentioned above, the prevalence of individual infections was 2.2% Hepatitis B, 0.9% Hepatitis C, 0.3% HIV, 1.9% syphilis, and 0.1% malaria [13]. The overall prevalence of the infections in the present study was slightly lower at 4.1%, with HCV being the most prevalent (1.74%), followed by syphilis (1.32%), HBV (0.89%), and HIV (0.14%). No cases of malaria were recorded. There was also variability in the seroprevalence and trends of individual TTIs, with hepatitis C being the most common infection in our study, compared to previous studies, which reported a greater prevalence of hepatitis B.

Based on a study conducted in Rawalpindi, Pakistan, the overall seroprevalence of BBI was 3.54% (7897 cases). The prevalence of HBV, HCV, HIV, syphilis, and malaria was found to be 1.08%, 1.39%, 0%, 0.93%, and 0.17%, respectively. [15]

In the western world, the risk of blood transfusion to the transmission of infectious diseases like HIV, HBV, HCV, and syphilis has been substantially lowered with the development of screening measures. The estimated transmission risks are 1/2-5 million for HIV, 1/0.5-1 million for HBV, 1/2-4 million for HCV, and 6/1 million for syphilis. [14]

Previous studies in Pakistan in Karachi, Islamabad, and Faisalabad reported seroprevalence of 5.8%, 14.34%, and 6.55%, respectively. Blood-borne infections through infected blood are still a major concern in blood transfusion systems, particularly in developing countries like Pakistan. [17]

The overall seroprevalence was found to be 13.4% for HBV, 6.9% for HCV, 2.1% for HIV, and 2.4% for syphilis, respectively, among first-time blood donors in West Africa. [20]

The risk of transmitting syphilis through transfusion is closely related to the behavior of donors, particularly sexual behaviors. According to the survey conducted in 2004 by the National AIDS Control Program, the prevalence of syphilis amongst transgender (Hijra) and male sex workers (MSM) was 60% and 36%, respectively. [18]

The findings from the tertiary care hospital of Assam showed seroprevalence of 3.1% for TTIs overall. The most common were HCV (1.14%), followed by syphilis (1.0%), HBV (0.54%), HIV (0.41%), and malaria (0.01%). [19]

A recent study in Khyber Pakhtunkhwa (KPK), Pakistan, has revealed TTIs to be present in 4.61% of blood donors. Studies conducted in Nigeria (14.96%), Albania (7.4%), Ethiopia (11.5%), and Sudan (20.1%) indicated a high overall prevalence of TTI compared to other parts of the world. Studies from Qatar (1.85 %), India (0.6 %), Eritrea (3.6 %), Saudi Arabia (0.80 %), and Iran (0.25 %) reported a lower prevalence rate as compared to our results. [12]

The studies reviewed in the SADC region identified four key themes: improvement of laboratory screening, optimization of transfusion systems and prevention measures, optimization of screening of donors and deferral criteria, and modelling of TTI risk. [16]

But the prevalence of clinically relevant transfusion-transmitted infections (TTIs) has

significantly decreased in the last few decades. This decrease is due to improvements and developments in blood collection, processing, and screening. Additionally, the World Health Organization (WHO) calls for a comprehensive national blood policy as part of the overall national health policy in all countries. It also underscores the need for the development and maintenance of well-organized blood transfusion services to ensure that an adequate supply of safe blood and blood products is available to meet the needs of the population. [21]

CONCLUSION:

In conclusion, transfusion-transmissible infections (TTIs) are still a public health problem for blood donors. The prevalence of infections (hepatitis B, hepatitis C, syphilis, HIV, and malaria) was relatively low, but it does indicate a need for ongoing surveillance and tight screening. The results emphasize the need to continue to follow effective donor selection and deferral criteria, to continue using sensitive screening assays, and to encourage voluntary, frequent, and safer blood donation. Ongoing education and awareness among donors and healthcare personnel are critical to further reduce the risk of TTI transmission and enhance the general safety of the blood supply system.

LIMITATIONS:

This was a single-center study; however, data from a multicenter, larger study group may provide better insight into the deferrals in our populations.

SUGGESTIONS:

It is possible to greatly reduce seroprevalence through government efforts to improve blood screening, increase the number of low-risk donors who give blood voluntarily, and improve public health efforts, including HBV vaccination and infection control.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

AUTHOR CONTRIBUTION

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the study's integrity.

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