

TRANSFUSION TRANSMISSIBLE INFECTIONS (TTI) POSITIVITY IN BLOOD DONORS AT COMPONENT BLOOD CENTRE OF A TERTIARY CARE HOSPITAL IN EASTERN UTTAR PRADESH INDIA

Uma Shankar Gupta¹, Ajamal Singh Bhaya²

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Corresponding Author:

Dr. Uma Shankar Gupta,
Email: usgafmc@gmail.com

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¹Assistant Professor, Department of Pathology, Heritage Institute of Medical Sciences, NH-2 Bypass Road, Bhadwar, Varanasi, India

²Professor and HOD, Department of Pathology, Heritage Institute of Medical Sciences, NH-2 Bypass Road, Bhadwar, Varanasi, India

Abstract

Background: Blood transfusions are vital in modern medicine, providing essential support for patients in critical care. However, ensuring their safety requires rigorous screening for Transfusion Transmissible Infections (TTIs). In India, a diverse range of infectious diseases poses a continuous challenge to blood safety. National surveys have revealed fluctuating TTI prevalence rates, with HIV, HBV, and HCV being prominent concerns. This study, set in a Tertiary Care Hospital in Eastern Uttar Pradesh, aims to bridge knowledge gaps by assessing TTI prevalence among blood donors, offering insights for tailored safety measures and contributing to improved patient outcomes in this unique healthcare setting. **Materials and Methods:** This retrospective study, conducted at the Component Blood Centre of a Tertiary Care Hospital in Eastern Uttar Pradesh over three years (2021-23), analyzed Transfusion Transmissible Infections (TTIs) prevalence among blood donors. Eligible voluntary and replacement donors met specific criteria, and demographic, medical, and donation data were extracted. Laboratory records, utilizing methods like ELISA and NAT, were reviewed for TTI testing. Quality control measures ensured data reliability. Statistical analysis using SPSS summarized demographic characteristics and TTI prevalence, with Chi-square tests assessing associations ($p < 0.05$ considered significant). **Result:** The retrospective analysis at Eastern Uttar Pradesh's Component Blood Centre spanned three years (2021-23), involving 4434 donors. Replacement donations constituted 95.6%, with voluntary contributions at 4.4%. Infections included HBV (1.15%), HCV (0.52%), HIV (0.02%), Syphilis (1.01%), and Malaria (0.09%). Overall Transfusion Transmissible Infections (TTIs) prevalence was 2.80%. Gender-specific rates showed males with higher HBV, HCV, Syphilis, and Malaria, while females had higher HIV. The 21-30 age group exhibited the highest HBV and Syphilis prevalence, with >50 years showing significant association with Syphilis ($p = 0.001$). **Conclusion:** In conclusion, the study contributes valuable information regarding the prevalence and demographic associations of TTIs among blood donors in Eastern Uttar Pradesh. The relatively low overall prevalence of infectious diseases underscores the efficacy of existing screening protocols.

INTRODUCTION

Blood transfusions are integral to modern medical interventions, providing a lifeline for patients in need of critical care.^[1] Despite their undeniable benefits, the safety of blood transfusions is contingent on the rigorous screening and testing for Transfusion Transmissible Infections (TTIs).^[2] TTIs encompass a range of infectious agents, including

viruses, bacteria, and parasites, which can be transmitted through contaminated blood, posing a significant threat to both blood donors and recipients.^[3] In the Indian context, where a diverse array of infectious diseases prevails, ensuring the safety of the blood supply remains a persistent challenge.^[4] According to a national survey conducted by the National AIDS Control Organization (NACO), the overall prevalence of

TTIs among blood donors in India has shown fluctuations over the years.^[5-7] The prevalence rates vary for different infections, with HIV, HBV, and HCV being the primary focus of attention.^[8-10] For instance, a recent study reported an overall seroprevalence of 0.26% for HIV, 1.1% for HBV, and 0.9% for HCV among blood donors in India.^[10] In the context of the Tertiary Care Hospital in Eastern Uttar Pradesh, where the Component Blood Centre serves as a crucial lifeline for patients, understanding the local prevalence of TTIs among blood donors is paramount. Localized data on TTI prevalence can inform tailored strategies for screening, donor selection, and blood component processing, contributing to the overall safety and efficacy of blood transfusions in this unique healthcare setting. This study endeavoured to fill critical knowledge gaps by conducting a comprehensive assessment of TTI prevalence in blood donors within the Component Blood Centre of the Tertiary Care Hospital. Through meticulous data collection, analysis, and interpretation, this study aimed to provide valuable insights that can inform evidence-based policies and practices to enhance blood safety, ultimately contributing to improved patient outcomes and public health in Eastern Uttar Pradesh.

MATERIALS AND METHODS

Study Design: This retrospective, record-based study was conducted at the Component Blood Centre of a Tertiary Care Hospital in Eastern Uttar Pradesh. The study aimed to retrospectively analyze the prevalence of Transfusion Transmissible Infections (TTIs) among blood donors, focusing on viral, bacterial, and parasitic agents.

Study Setting: The study utilized records of 3 years (2021-23) from the Component Blood Centre, a key facility for the collection, processing, and distribution of blood and its components in the Tertiary Care Hospital.

Study Population: The study included data from blood donors (including voluntary and replacement) who had contributed to the Component Blood Centre during the retrospective study period. The criteria for donor eligibility were as follows: individuals between the ages of 18 and 60 years, with a minimum weight of 45 kg, and a haemoglobin level of at least 12.5 g percent. Additionally, prospective donors were required to have no history of hepatitis B, hepatitis C, or sexually transmitted infections, and they should not have experienced jaundice within the last 1 year. Both potential donors underwent thorough questioning regarding high-risk behaviors associated with HIV, hepatitis B, and syphilis. Records of donors with a history of TTIs, recent illnesses, or other disqualifying conditions were excluded.

Data Collection: Demographic information (age, gender) and relevant medical history were extracted

from retrospective records. Blood donation records included details on the type of blood components donated and any reported adverse events.

Laboratory Testing Data: Archived laboratory records containing results of tests for TTIs, including Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), syphilis, and Malaria were utilized. For HIV, serological screening was performed using Enzyme-Linked Immunosorbent Assay (ELISA), and positive samples underwent confirmatory test Immunofluorescence Assay (IFA). Nucleic Acid Testing (NAT), specifically Polymerase Chain Reaction (PCR), was employed for increased sensitivity to detect viral RNA or DNA. In the case of HBV, ELISA was used to identify Hepatitis B surface antigen (HBsAg), and additional markers like anti-HBc and anti-HBs were assessed for a comprehensive understanding of infection status. NAT was applied to detect viral DNA in HBV-positive samples. For HCV, ELISA was utilized for antibody screening, and positive samples underwent further testing, including HCV RNA testing using NAT methods (PCR). Malaria detection involved microscopic examination of blood smears and Rapid Diagnostic Tests (RDTs) targeting specific antigens. Syphilis screening included Rapid Diagnostic Tests (RDTs) for initial detection, followed by confirmatory tests Venereal Disease Research Laboratory (VDRL), with positive results validated using specific treponemal test [Treponema pallidum Particle Agglutination (TP-PA)].

Quality Control: Quality control measures implemented during the original laboratory testing were reviewed to ensure the accuracy and reliability of the results extracted for the retrospective analysis.

Statistical Analysis: Retrospective data analysis was conducted using statistical software SPSS version 20.0. Descriptive statistics were used to summarize demographic characteristics, donation patterns, and prevalence of TTIs among blood donors. The prevalence of TTIs was calculated from the retrospective data. Associations between demographic variables, donation patterns, and TTI positivity were assessed using Chi-square statistical test. A p-value < 0.05 was considered statistically significant.

Ethical Considerations: The study protocol adhered to the ethical guidelines approved by the Institutional Ethics Committee of the Tertiary Care Hospital. As this was a retrospective study utilizing de-identified records, the need for informed consent was waived. Confidentiality of personal information was strictly maintained throughout the data extraction and analysis.

Reporting Guidelines: The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for retrospective studies, ensuring transparency and completeness in reporting the findings from the analysis of historical records.

RESULTS

The three-year retrospective analysis of blood donation patterns at the Component Blood Centre in Eastern Uttar Pradesh revealed a total of 4434 donors. Replacement donations consistently dominated, accounting for 95.6% (4238 donors), while voluntary contributions constituted 4.4% (196 donors) of the overall donor pool. The yearly breakdown demonstrated a consistent trend, with replacement donations maintaining a substantial majority across the study period (92.6%–96.5%) [Table 1].

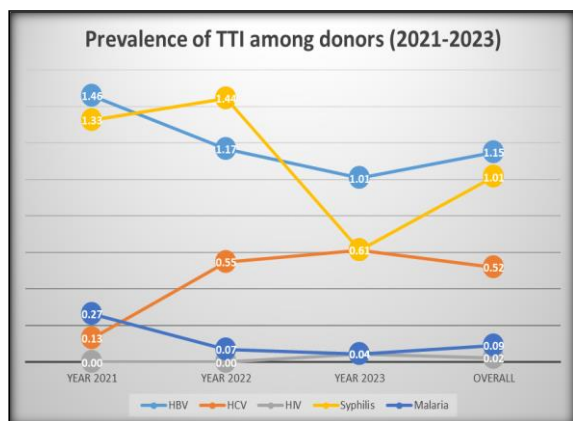


Figure 1: Prevalence of TTI among study participants

The analysis of infectious disease prevalence across different demographic variables at the Component Blood Centre in Eastern Uttar Pradesh revealed

noteworthy patterns. In terms of gender, males exhibited higher prevalence rates for Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Syphilis, and Malaria, with percentages of 98.0%, 95.7%, 100.0%, and 100.0%, respectively. Females, on the other hand, showed higher prevalence for Human Immunodeficiency Virus (HIV) at 100.0%. The observed differences in infection rates between genders were statistically insignificant except for HIV, with p-values of 0.781, 0.504, <0.0001, 0.185, and 0.748 for HBV, HCV, HIV, Syphilis, and Malaria, respectively (only one case of HIV being positive could be showing statistical significance due to random bias). Regarding age groups, individuals aged 21-30 years demonstrated the highest prevalence of HBV (54.9%) and Syphilis (22.2%). Notably, the age group >50 years exhibited a statistically significant association with Syphilis infection ($p = 0.001$) [Table 3].

Over the three-year study period at the Component Blood Centre in Eastern Uttar Pradesh, a total of 4434 donors were screened for infectious diseases. The prevalence of infections among donors was as follows: Hepatitis B Virus (HBV) - 1.15% (51 cases), Hepatitis C Virus (HCV) - 0.52% (23 cases), Human Immunodeficiency Virus (HIV) - 0.02% (1 case), Syphilis - 1.01% (45 cases), and Malaria - 0.09% (4 cases). The yearly breakdown highlighted a relatively consistent pattern, with the overall prevalence of infectious diseases remaining low across the study period [Table 2 and Figure 1]. Overall prevalence of TTI was 2.80% (124/4434).

Table 1: Characteristics of the donors (study participants)

Year	Total donors	Replacement	Voluntary
	Number	Number (%)	Number (%)
2021	754	698 (92.6)	56 (7.4)
2022	1454	1395 (95.9)	59 (4.1)
2023	2282	2201 (96.5)	81 (3.5)
Total	4434	4238 (95.6)	196 (4.4)

Table 2: Prevalence of TTI among study participants

Year	Total donors	HBV	HCV	HIV	Syphilis	Malaria
	Number	Number (Prevalence %)	Number (Prevalence %)	Number (Prevalence %)	Number (Prevalence %)	Number (Prevalence %)
2021	754	11 (1.46)	1 (0.13)	0 (0.0)	10 (1.33)	2 (0.27)
2022	1454	17 (1.17)	8 (0.55)	0 (0.0)	21 (1.44)	1 (0.07)
2023	2282	23 (1.01)	14 (0.61)	1 (0.04)	14 (0.61)	1 (0.04)
Total	4434	51 (1.15)	23 (0.52)	1 (0.02)	45 (1.01)	4 (0.09)

Table 3: Gender and Age wise distribution of TTI prevalence among study participants

Variables	HBV	HCV	HIV	Syphilis	Malaria
	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)
Gender					
Male	50 (98.0)	22 (95.7)	0 (0.0)	45 (100.0)	4 (100.0)
Female	1 (2.0)	1 (4.3)	1 (100.0)	0 (0.0)	0 (0.0)
P value	0.781	0.504	<0.0001	0.185	0.748
Age group					
<21 years	2 (3.9)	2 (8.7)	0 (0.0)	2 (4.4)	0 (0.0)
21-30 years	28 (54.9)	9 (39.1)	1 (100.0)	10 (22.2)	3 (75.0)
31-40 years	19 (37.3)	8 (34.8)	0 (0.0)	18 (40.0)	1 (25.0)
41-50 years	1 (2.0)	4 (17.4)	0 (0.0)	10 (22.2)	0 (0.0)
>50 years	1 (2.0)	0 (0.0)	0 (0.0)	5 (11.1)	0 (0.0)
P value	0.011	0.565	0.836	0.001	0.696

DISCUSSION

The findings of this retrospective study conducted at the Component Blood Centre of a Tertiary Care Hospital in Eastern Uttar Pradesh shed light on the prevalence and demographic associations of Transfusion Transmissible Infections (TTIs) among blood donors. The overall prevalence of infectious diseases, including Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Human Immunodeficiency Virus (HIV), Syphilis, and Malaria, remained relatively low across the three-year study period. This underscores the effectiveness of the blood screening protocols implemented at the blood centre, emphasizing the importance of continuous vigilance in maintaining a safe blood supply.

The overall prevalence of TTIs observed in our study aligns with the observed trends in other regions, including Bhopal, South Haryana, Karimnagar, Western UP, Jamnagar, and Uttarakhand.^[11-16] Notably, the prevalence rates varied across different regions, with Sawke et al., reporting 0.51% HIV, 2.9% HBsAg, 0.57% HCV, and 0.23% VDRL in Bhopal.^[11] Arora et al., found 0.3% HIV, 1.7% HBsAg, 1.0% HCV, and 0.9% VDRL in South Haryana.^[12] Leena et al., reported 0.27% HIV, 0.71% HBsAg, 0.14% HCV, 0.10% VDRL, and 0.129% Malaria in Karimnagar.^[13] Chaudhary et al., documented 0.27% HIV, 1.93% HBsAg, 1.02% HCV, and 0.16% VDRL in Western Uttar Pradesh.^[14] Mehta et al., found 0.3% HIV, 1.2% HBsAg, 0.26% HCV, and 0.5% VDRL in Jamnagar.^[15] Negi et al., reported 0.2% HIV, 1.2% HBsAg, 0.9% HCV, 0.3% VDRL, and 0.002% Malaria in Uttarakhand.^[16]

However, regional variations are evident, emphasizing the need for localized data to inform targeted interventions.

In comparison to international studies, the observed prevalence rate of TTI (2.80%) in our study is generally lower than those reported in resource-limited settings such as Nigeria (14.96%) Albania (7.4%), Ethiopia (11.5%), and Sudan (20.1%).^[17-20] These variations may be attributed to differences in healthcare infrastructure, socio-economic factors, and the implementation of stringent blood screening measures. The gender-based analysis revealed interesting patterns in infection rates. While males exhibited higher prevalence rates for HBV, HCV, Syphilis, and Malaria, females demonstrated a higher prevalence for HIV. However, statistical analyses indicated that these gender-based differences were not significant. The higher prevalence of HIV among females warrants further exploration and may reflect the need for targeted awareness and prevention strategies within this demographic group. The gender-based analysis in our study is consistent with previous studies by Jain et al., Patel et al., Fernandes et al., and Bagga et al.,

highlighting no significant gender-based differences in TTI prevalence.^[21-24]

While males exhibited higher prevalence rates for certain infections, the lack of statistical significance emphasizes the need for gender-neutral blood safety interventions.

Age emerged as a significant factor influencing infection rates, with individuals aged 21-30 years exhibiting higher prevalence rates for HBV and Syphilis. Notably, the age group >50 years showed a statistically significant association with Syphilis infection. Age-related variations observed in our study align with studies by Pallavi et al., Pahuja et al., Chaurasia et al., and Dewan et al., indicating that certain age groups may be more susceptible to specific infections.^[25-28]

These age-related variations underscore the dynamic nature of infection risks within different age cohorts and suggest the importance of age-specific interventions and health education campaigns. The observed high prevalence of Syphilis among older donors may be indicative of long-term exposure or reactivation of latent infections. This finding emphasizes the need for comprehensive health assessments and specific screening measures tailored to the unique risks associated with different age groups.

CONCLUSION

In conclusion, the study contributes valuable information regarding the prevalence and demographic associations of TTIs among blood donors in Eastern Uttar Pradesh. The relatively low overall prevalence of infectious diseases underscores the efficacy of existing screening protocols.

The gender and age-related variations observed highlight the importance of targeted interventions and ongoing surveillance to ensure the safety of the blood supply. Future research should explore additional factors influencing TTI prevalence and consider broader geographic representation for more comprehensive insights. These findings collectively contribute to the ongoing efforts to enhance blood safety and public health in the region.

Limitations: While the study provides valuable insights into the prevalence of TTIs, it is essential to acknowledge certain limitations. The retrospective nature of the study relies on historical records, potentially introducing biases or incomplete data. Furthermore, the study's focus on a specific geographic region may limit the generalizability of findings to other populations.

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