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Research Article

SEROPREVALENCE OF TRANSFUSION TRANSMISSIBLE INFECTIONS IN BLOOD DONORS OF A NEWLY ESTABLISHED TERTIARY CARE TEACHING HOSPITAL NEAR SUNDARBAN REGION OF WEST BENGAL

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Abstract: *The present study was aimed to explore the socio-demographic profile of blood donors and to ascertain the seroprevalence of transfusion-transmissible infections (TTIs) among them. A three year retrospective cross-sectional study was conducted from January 2020 to December 2022. Blood donors' records were obtained from a tertiary care teaching hospital's blood bank and analysed through Epi Info7. A total of 32946 donors were screened; out of them, 22991 (69.78%) were voluntary donors and the remaining 9955 (30.22%) were replacement donors. The majority of the donors were male (76.74%) and 1.22% of them were seropositive for TTIs. Hepatitis B had the highest seroprevalence (0.72%), followed by hepatitis C (0.18%), syphilis (0.13%), and human immunodeficiency virus (0.08%). Malaria was not detected in any donor. We found the highest seropositivity among the age group of 31-40 years (47.12%). It was concluded that, the risk of TTIs can be further minimized through increased community awareness regarding voluntary blood donation, meticulous donor screening, and continuous use of more sensitive testing.*

Keywords*: Blood bank, Blood donors, Seroprevalence, Transfusion-transmissible infections.*

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1. Introduction

Transfusion of blood is an important treatment modality in the modern healthcare system which is essential to survive the patients who have suffered blood loss. But unfortunately, blood is an ideal medium for transmitting infective agents that might exist in donors blood who apparently appear healthy and asymptomatic [1].

An infection that can transmit from one individual to another through parenteral administration of blood or its components is referred as transfusion-transmissible infection (TTI), such as human immunodeficiency virus (HIV), hepatitis B (HBV), hepatitis C (HCV), syphilis, malaria, toxoplasmosis, brucellosis, and other viral infections [2].

It's a matter of great concern that, the infected individual serves as a reservoir for the infectious agents that might spread during its asymptomatic stage; thus, TTI-induced diseases have prolonged impacts on transfusion recipients, their family members, and communities [3,4].

Apart from HIV, the serosurveillance for HBV, HCV or syphilis is not routinely conducted in the Indian adult population. Therefore, the seroprevalence of the blood donors can be utilised to track the trend of these TTIs in the community's healthy appearing adult population [5,6].

As per the guidelines of the National AIDS Control Organization (NACO), each blood sample must be tested for HBV, HCV, HIV1 and 2, syphilis and malaria. Blood donation should be permanently prohibited for the donors with a history of HIV, hepatitis B surface antigen (HBsAg) or hepatitis C virus antibody positivity; however, those with a history of malaria should be accepted after three months of asymptomatic period [7].

The high incidence of infectious pathogens among the asymptomatic blood donors makes transfusion of blood and its components a significant problem in developing nations like India [8]. The HIV prevalence rate in Indian adults was 0.2– 0.3% [9], HBsAg was 1-3%, while HCV infection affected 4-19.2% of blood donors [10].

Even with effective strategies, transmission of TTIs is still occurring due to incapability of routine investigations to identify the infection in the window period, the high cost of advanced screening tests, a lack of trained staff and funds, and laboratory testing errors [11].

Our medical college is a newly established tertiary care referral institute near the Sundarban region of West Bengal that serves patients from both rural and urban areas. In this part of West Bengal, no prior research has been conducted on the blood donors to assess their seroprevalence of TTIs. In this context, the current research has been planned among the blood donors to study the socio-demographic profile and their TTI seroprevalence. This study will also help us to roughly estimate the TTIs prevalence in the general asymptomatic people of the region.

2. Materials and methods

We conducted a retrospective record-based cross-sectional study at the blood bank of Diamond Harbour Govt. Medical College and Hospital, West Bengal. Data were obtained from the blood bank records for a period of three years, from January 2020 to December 2022, for analysis. During this period, a total of 32946 blood units were collected by conducting blood donation camps in different areas of South 24-Parganas and also through in-house replacement donations from relatives and friends of patients of this institution.

All blood units were obtained from non-remunerative donors, who were selected according to national standards and NACO guidelines. During recruitment, they were interviewed and screened to assess their high-risk behaviors for hepatitis B, hepatitis C, HIV and syphilis. A registration form was also filled out, which contained information on the donors' personal, demographic and medical history.

2.1. Study population

All blood donors, whether voluntary or replacement, throughout the research period.

2.2. Donor inclusion criteria

Age limit of 18 to 60 years, body weight 45 kg or more, hemoglobin 12.5g% or higher, no preceding record of HIV, hepatitis B, hepatitis C, or syphilis, and absence of jaundice within last twelve months were strictly adhered.

2.3. Exclusion criteria

We excluded the blood units that were not tested for TTIs due to haemolysis, insufficient volume, or other factors.

2.4. Techniques

- HIV status was detected by using PAREEKSHAK HIV 1/2 ELISA (enzyme-linked immunosorbent assay) to estimate antibodies of HIV1 and HIV2.

- Hepatitis B was detected by using VOXEL HBsAg ELISA (3.0) to detect HBsAg.
- Hepatitis C status was detected by using HEPA-SCAN ELISA to detect antibodies to HCV.
- Syphilis status was detected by Rapid Plasma Reagin kit test (IMMUNOPAK). ELISA procedure was used to confirm positive samples.
- Malaria was tested by a rapid diagnostic kit (MALERISCAN). Peripheral blood smear examination was performed for confirmation.

According to the manufacturer's instructions, all tests were conducted. Each reactive sample was reassessed before being labeled as seropositive and discarded, maintaining the standard biomedical waste disposal procedure. All seroreactive donors were turned away from blood donation and transferred to the proper departments for therapy.

2.5. Data evaluation

Data were collected in an Excel sheet and analyzed with Epi Info7. Numbers and percentages were utilized to denote the statistical variables.

2.6. Ethical statement

The ethical review committee of Diamond Harbour Govt. Medical College and Hospital, West Bengal, India, has approved the study vide letter no. DHGMC/2023/427 dated March 14, 2023.

3. Results

We evaluated total of 32946 donors over the span of 3 years, from January 2020 to December 2022. Out of them, 22991 (69.78%) were voluntary donors, leaving 9955 (30.22%) as replacement donors (Table 1).

Table 1. Total blood donations through voluntary and replacement donors

Year	Total donation	Voluntary n (%)	Replacement n (%)
2020	11782	6078 (51.59)	5704 (48.41)
2021	10388	7794 (75.03)	2594 (24.97)
2022	10776	9119 (84.62)	1657 (15.38)
Total	32946	22991 (69.78)	9955 (30.22)

When the gender-wise distribution of the donors and their seropositivity were studied, it was found that male donors were 76.74% and 1.22% of them were seropositive, whereas female donors were 23.26% and 0.74% of them were seropositive (Table 2).

Table 2. Distribution of blood donors and seroreactivity by gender

Year	Total donation	Male		Female	
		Donors n (%)	Reactive n (%)	Donors n (%)	Reactive n (%)
2020	11782	9595 (81.44)	111 (1.16)	2187 (18.56)	20 (0.91)
2021	10388	7814 (75.22)	103 (1.32)	2574 (24.78)	15 (0.58)
2022	10776	7873 (73.06)	94 (1.19)	2903 (26.94)	22 (0.76)
Total	32946	25282 (76.74)	308 (1.22)	7664 (23.26)	57 (0.74)

Over the years, the prevalence of different TTIs in blood donors has been depicted in Table 3. The overall prevalence of all the TTIs during these 3 years was 1.11%. Regarding specific TTI, we observed that, the majority of the donors (n=237, 0.72%) were seroreactive for HBV infection, followed by 58 (0.18%) donors for HCV, 43 (0.13%) donors for Syphilis and 27 (0.08%) donors for HIV

infection. We did not find any seropositivity for malarial parasites among the donors. The highest prevalence of HBV infection (n=87, 0.74%) and Syphilis (n=17, 0.14%) were seen in 2020, whereas HCV prevalence was highest (n=24, 0.23%) in 2021.

Table 4 displays the age-based distribution of different TTIs within the donors. Most of the HBV, HCV and syphilis-reactive donors belonged to 31-40 years of age, while the majority of HIV-reactive donors were between the ages of 18-30 years.

Table 3. TTI prevalence in blood donors

Year	Total Donors	HIV (%)	HBV (%)	HCV (%)	Syphilis (%)	Malaria (%)	Reactive Donors (%)
2020	11782	12 (0.10)	87 (0.74)	15 (0.13)	17 (0.14)	0	131 (1.11)
2021	10388	5 (0.05)	76 (0.73)	24 (0.23)	13 (0.13)	0	118 (1.14)
2022	10776	10 (0.09)	74 (0.69)	19 (0.18)	13 (0.12)	0	116 (1.08)
Total	32946	27 (0.08)	237 (0.72)	58 (0.18)	43 (0.13)	0	365 (1.11)

Table 4. TTI prevalence in blood donors by age (year) (n =32946).

TTIs	18 – 30	31 - 40	41 - 50	≥ 51	Total n (%)
HIV	14	12	1	0	27 (0.08)
HBV	90	109	28	10	237 (0.72)
HCV	19	30	4	5	58 (0.18)
Syphilis	11	21	8	3	43 (0.13)
Malaria	0	0	0	0	0 (0.0)
Total	134 (36.71%)	172 (47.12%)	41 (11.23%)	18 (4.93%)	365 (1.11)

4. Discussion

Transfusion of blood is an essential part of the present healthcare system to save lives, but unfortunately, it comes with the potential hazards of contracting various TTIs that can exist in the blood obtained from apparently healthy-appearing donors [12]. Strategies should be implemented for the meticulous screening of donors prior to blood donation and the use of sensitive screening tests that can reduce or to some extent can eliminate the probability of acquiring TTIs [13].

Non-remunerated voluntary blood donation (VBD) is the cornerstone for a safe and adequate blood supply. Our investigations revealed that, the majority (69.78%) were voluntary donors, whereas replacement donors constituted 30.22% (Table 1) and this finding is equivalent to other studies [1,11]. The proportion of VBD in the present research was higher than in other Indian studies by Bhawani *et al.*[14] (41.64%), Kaur *et al.*[15] (45%) and Adhikary *et al.*[16] (61.24%), but it was less, compared to Bhaumik *et al.*[17] (91.8%). These regional variations in VBD can be reduced by raising public awareness regarding its necessity [18]. We found a mild increase in replacement donors (48.41%) in 2020 as compared to the proportion of the remaining two years, which might be due to the COVID-19 pandemic and resultant lockdown, leading to a decrease in blood donation camps and voluntary donors.

In this research, male and female donors were respectively 76.74% and 23.26% (Table 2) and this finding was nearly equivalent to that of Karmakar *et al.* [19] but there are other Indian studies [11,20] where the proportion of female donors (2.2-2.6%) was very low, which may be due to social misbelieves regarding blood donation and increased deferral of female donors on medical grounds. In the present study, the seropositivity among male and female donors was respectively 1.22% and 0.74%, which is less as compared to other studies [4,19] and this lower proportion might be the result of meticulous pre-donation screening of the donors.

Among the various TTIs, HBV seroprevalence (0.72%) was the highest in our study, which was similar to other studies [11,21]. There are many Indian research where the HBV prevalence was variable,

ranging from 0.28-8.1% [16,19,20,22] and this may be due to the clustering of HBV infection in different regions and population heterogeneity.

HCV prevalence in our research was 0.18%, which was almost similar to other studies [16,21]. But this proportion was also varying (ranging from 0.06-8.7%) in different research [6,11,19,22], which might be the result of variations in socioeconomic status, cultural practices, different healthcare systems, disparities in the donor populations investigated or the test kit used for screening.

In this research, syphilis prevalence was 0.13%, which is equivalent to Leena *et al*.[21], but some variations were observed in previous reports (ranging from 0.004 - 2%) by several authors [11,16,19] and this might be due to population diverseness, socioeconomic factors and behavioral differences.

HIV prevalence in our research was 0.08%, which is less than previous reports of other authors [19,21] and this lower prevalence rate might be the result of rejection of the high-risk donors through strict pre-donation screening, socio-demographic variables and the false-negative donors who were in the 'window period'. Transmissions of various infectious agents are possible during the window period, which can be lowered by rejecting the high-risk donors through meticulous screening and using more sensitive screening tests such as the nucleic acid amplification test (NAT).

In our investigation, no donor was found positive for malarial parasites, which matches the finding of Adhikary *et al*.[16].

In the present research, the age range of 31-40 years showed the highest seroprevalence (47.12%), followed by 36.71% in 18-30 years of age [Table 4]. Seroprevalence was lowest (4.93%) in the age range of 51-60 years, which was equivalent to other studies [19,24].

The limitation of our study is that TTIs due to emerging infectious agents like the Ebola virus, SARS coronavirus, chikungunya, dengue, leishmaniasis, toxoplasmosis, etc. have not been covered.

5. Conclusion

Blood donation is a noble social work and people need to be motivated to undertake it. However, the participants should be acquainted with transfusion-transmissible diseases through continuous awareness and education so that diseased individuals can detect themselves through periodic screening tests and opt-out of blood donation. Although the pattern of TTIs fluctuates from year to year and varies in the general population, it can be utilized as a monitoring tool that might be beneficial in the formulation and implementation of public health policies. High prevalence necessitates additional sensitive screening tests, including NAT, to reduce the risk of TTI.

Ethical statement

The ethical review committee of Diamond Harbour Govt. Medical College and Hospital, West Bengal, India, had approved the study vide letter no. DHGMC/2023/427 dated March 14, 2023.

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Conflict of interest

None of the authors have any type of conflict of interest regarding this study.

Authors' Contributions:

S.M.: Conceptualization, methodology, data collection, analysis, revisions, and finalization of the manuscript.

S.D.: Data collection, formal analysis, and preparation of the manuscript.

S.S.: Conceptualization, revisions, and finalization of the manuscript.

The final manuscript was read and approved by all authors.

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