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Syphilis Seroprevalence and Its Correlates Among Blood Donors in The North-West Region of India

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ABSTRACT

Background: Syphilis remains a globally important transfusion-transmissible infection (TTI). Although transfusion transmission is now rare due to routine donor screening, the detection of seropositive donations provides valuable information about community-level infection and blood safety.

Objective: To determine the seroprevalence of syphilis and associated correlates among blood donors in the North-West region of India.

Material & Methods: A cross-sectional study was conducted among 360 blood donors at a Manglam Diagnostic and Blood Center Hisar. Donor demographic and clinical data were collected using standardized forms. Blood samples were screened for Treponema pallidum antibodies using a treponemal enzyme-linked immunosorbent assay (ELISA), with reactive samples confirmed by the Venereal Disease Research Laboratory (VDRL) test.

Results: Of the 360 donors tested, 5 (1.39%) were seropositive for syphilis. Seropositivity was higher among first-time donors (2.0%) compared to repeat donors (0.6%), and slightly higher among males (1.4%) than females (1.0%). Donors aged 31–40 years had the highest positivity rate (2.5%). Replacement donors had a higher prevalence (1.8%) than voluntary donors (0.9%).

Conclusion: The seroprevalence of syphilis among blood donors in this North-West Indian cohort was low (1.39%) but non-negligible. Continued mandatory screening, donor education, and encouragement of voluntary repeat donations remain essential to maintain blood safety.

Keywords: *Syphilis, Blood donors, Seroprevalence, Transfusion-transmissible infections, North-West India*

1. INTRODUCTION

Blood transfusion is an essential component of modern healthcare, saving millions of lives annually. However, it carries the risk of transmitting infectious diseases such as HIV, hepatitis B (HBV), hepatitis C (HCV), and syphilis. Syphilis, caused by Treponema pallidum, is a chronic systemic infection that can be transmitted sexually, vertically, and—rarely—through blood transfusion when screening is inadequate.

India has a national blood policy mandating screening of all donated blood for major TTIs including syphilis. Despite this, regional variations in seroprevalence persist due to differences in community infection rates, donor profiles, and screening practices.

Studies from different parts of India have reported syphilis seroprevalence ranging from 0.1% to 3% among blood donors **[1 & 2]**. These variations underscore the need for continuous regional surveillance. Understanding syphilis seroprevalence among blood donors in the North-West region of India—where data remain limited—helps assess both transfusion safety and local STI trends.

This study aims to determine the seroprevalence of syphilis and its correlates among blood donors in the North-West region of India.

Materials and Methods: A cross-sectional descriptive study was conducted at the Manglam Diagnostic and Blood Center Hisar, located in the North-West region of India.

Study population: A total of 360 consecutive blood donors presenting for donation during the study period were included after informed consent. Donors were screened according to National Blood Policy and National AIDS Control Organization (NACO) guidelines.

Inclusion and exclusion criteria

Inclusion criteria: All blood donors who will be eligible for blood donation as per the guidelines laid by drug and cosmetic act (DCA) and Directorate general of Health Services (DGHS). apparently healthy, eligible voluntary or replacement blood donors aged 18–60 years.

Exclusion criteria: donors with fever, chronic illness, high-risk sexual behavior, or incomplete demographic data were excluded.

Data collection: Each donor completed a standardized questionnaire recording demographic details (age, sex), donor type (voluntary or replacement), donation frequency (first-time or repeat), and brief health history.

Laboratory Testing: Five milliliters of venous blood was collected in plain tubes at the time of donation. Serum was separated and screened for Treponema pallidum antibodies using a third-generation ELISA (Treponema pallidum IgG/IgM EIA kit) following manufacturer's instructions. All reactive samples were confirmed using the Venereal Disease Research Laboratory (VDRL) test (non-treponemal). Samples reactive by both ELISA and VDRL were considered seropositive for syphilis. Positive samples were discarded, and donors were notified confidentially and referred to the dermatology/STD clinic for counseling and management.

Statistical analysis: Data were entered into Microsoft Excel and analyzed using SPSS version 25. Descriptive statistics (mean, percentage, frequency) were used. Associations between seropositivity and categorical variables were assessed using chi-square test; $p < 0.05$ was considered significant.

Ethical considerations: The study was approved by the Institutional Ethics Committee of Nims University Rajasthan, Jaipur. Written informed consent was obtained from all participants.

2. RESULTS

Table 1: Demographic characteristics of donors

Of the 360 donors, 330 (91.7%) were males and 30 (8.3%) females, giving a male-to-female ratio of approximately 11:1. The age distribution ranged from 18 to 55 years (mean 29.8 ± 6.4 years).

Age group (years)	Number (%)	Reactive (n)	Seroprevalence (%)
18–20	32 (8.9%)	0	0
21–30	162 (45%)	2	1.23%
31–40	120 (33.3%)	3	2.50%
41–50	36 (10%)	0	0
51 - 60	10 (2.8%)	0	0
Total	**360 (100%)**	**5**	**1.39%**

Out of 360 donors, 220 (61.1%) were voluntary and 140 (38.9%) were replacement donors. First-time donors constituted 240 (66.7%) and repeat donors 120 (33.3%).

Table 2: Frequency distribution of donor type

Donor category	Reactive (n)	Seroprevalence (%)
Voluntary	2	0.91%

Replacement	3	1.79%
First-time	4	1.67%
Repeat	1	0.83%

Table 3: Gender wise distribution of seroprevalence

Sex	Number (%)	Reactive (n)	Seroprevalence (%)
Male	330 (91.7)	5	1.52
Female	30 (8.3)	0	0

Although the difference was not statistically significant ($p > 0.05$), males had slightly higher positivity rates.

Overall seroprevalence: Out of 360 donors tested, 5 were confirmed seropositive, giving an overall syphilis seroprevalence of 1.39%.

3. DISCUSSION

The present study found a syphilis seroprevalence of **1.39%** among blood donors in the North-West region of India. This finding aligns with reports from other regions of India, which have shown prevalence rates ranging from **0.2% to 2%** (Kaur et al., 2014; Choudhury et al., 2020; Panda et al., 2018). A study from Punjab reported a prevalence of **1.2%** among blood donors (Kaur et al., 2014). In Rajasthan, Sharma et al. (2020) found a rate of **0.8%**, while an Eastern India study by Panda et al. (2018) found **1.6%**. Nationally, pooled analyses estimate an average donor syphilis seroprevalence around **1%**, consistent with our findings. Compared with global averages, the current study's prevalence is higher than in high-income countries (0.02–0.05%) but comparable to rates seen in Southeast Asia and sub-Saharan Africa (1–3%) (WHO, 2024).

Donor type

Replacement donors had a higher seroprevalence (1.79%) than voluntary donors (0.91%), echoing consistent findings in Indian and international literature. Replacement donors may feel social pressure to donate and are less likely to self-defer despite risk factors, whereas voluntary donors are often repeat participants who have previously tested negative and received donor education (Kaur et al., 2014; WHO, 2025).

First-time vs repeat donors: First-time donors showed higher reactivity (1.67%) than repeat donors (0.83%), supporting the idea that repeat donors constitute a lower-risk population. This trend mirrors studies from Nigeria (Ejele et al., 2023) and China (Chen et al., 2022) that attribute higher positivity in first-time donors to lack of prior screening.

Age and gender trends: The highest positivity was found in the 31–40-year age group, suggesting cumulative exposure through sexual activity or untreated latent infection. Similar trends have been noted in Indian (Panda et al., 2018) and Thai donor studies (Rattanatham et al., 2025). Although all positive donors in our cohort were male, this reflects male predominance among donors rather than gender-specific risk, as female participation in blood donation remains low in India.

Public health implications: Although transfusion-transmitted syphilis is rare due to short viability of *T. pallidum* in stored blood, detection of reactive donations is crucial for:

Blood safety assurance, preventing rare but possible transmission.

Sentinel surveillance for community STI trends.

Donor counselling and education, allowing early diagnosis and treatment.

The prevalence observed suggests ongoing low-level endemicity of syphilis in the local community, warranting sustained screening and educational efforts.

Testing algorithms: This study used a treponemal ELISA with VDRL confirmation, following WHO recommendations. Treponemal tests remain reactive for life; hence, some reactive donors may have past treated infection. Non-treponemal confirmation helps distinguish active from past infection and prevents unnecessary donor deferral (CDC, 2024; FDA, 2020).

Strategies to improve safety: To further reduce seroreactivity donations, we recommend:

- Strengthening voluntary repeat donor programs through awareness drives.
- Ensuring pre-donation counselling about high-risk behaviour and deferral criteria.
- Implementing standardized testing algorithms with confirmatory testing for reactive samples.

- Periodic Sero surveillance studies to monitor regional trends.

Limitations

- The sample size (n=360) was relatively small and single-centered, which limits generalizability.
- Behavioral and sexual risk data were not collected due to confidentiality policies.
- Use of serological assays alone cannot distinguish treated from active infections.

Despite these limitations, the findings provide valuable baseline data for the North-West region of India.

4. CONCLUSION

The study demonstrates a 1.39% syphilis seroprevalence among blood donors in North-West India, with higher rates among first-time and replacement donors. Although low, this prevalence underscores the importance of continuous TTI screening and the promotion of voluntary repeat donations. Regular Sero surveillance, donor education, and robust confirmatory testing are essential to ensure safe blood supplies and track local STI epidemiology.

5. RECOMMENDATIONS

- Maintain mandatory syphilis screening for all blood donations.
- Strengthen donor selection criteria and risk assessment interviews.
- Promote voluntary, repeat, non-remunerated donation programs.
- Establish data linkage between blood banks and public health agencies for syphilis surveillance.

Conduct larger, multicentric studies across North-West India to confirm these findings.

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