

Seroprevalence of Syphilis among Blood Donors in Pakistan: A Study of Healthy Volunteers in Rawalpindi District

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Abstract

Background: Blood transfusion, a prevalent practice in Pakistan with 3.5 million donors annually, carries a 1% risk of transfusion-transmitted infections, contributing to the transmission of infectious diseases. Syphilis, specifically, demonstrates an increasing seroprevalence.

Objective: To assess the seroprevalence of syphilis among healthy volunteer blood donors in Rawalpindi.

Study type, settings & duration: This prospective cross-sectional study was conducted at Railway General Hospital, Rawalpindi from July to December 2023.

Methodology: After acquiring informed consent, blood samples were collected for screening using the immunochromatographic assay (ICT) to detect specific *Treponema pallidum* antibodies in human serum. The Healgen Syphilis detection Kits (GCSYP-402) were employed for this purpose, offering a rapid qualitative screening for syphilis.

Results: A total of 1710 blood samples were screened using the immunochromatographic assay for detecting of *Treponema pallidum* antibodies. The syphilis seropositivity among donors revealed 16 (0.93%) reactive samples and 1,694 (99.07%) non-reactive samples. Males comprised 1,531 (89.54%) of the participants, with 179 (10.46%) being females. Among donors, 1,209 (70.71%) were single, and 587 (34.33%) had up to matric education. The majority of donors, 1,320 (77.20%), resided in urban areas. Statistical analysis showed no significant associations between syphilis seropositivity and age ($p > 0.902$), gender ($p > 0.579$), educational level ($p > 0.725$), or residence ($p > 0.697$). These findings provide valuable insights into the prevalence and demographic factors of syphilis among blood donors in the study.

Conclusion: Enhanced donor evaluation and screening for blood donation can boost recipient safety and curb syphilis transmission.

Key words: *Treponema pallidum*, syphilis, Rawalpindi, prevalence, blood donors.

Introduction

Blood transfusions have undeniably saved countless lives, they also bear a 1% risk of

transfusion-transmitted infections (TTIs) are pathogens transmitted via blood transfusions, such as viruses or bacteria. They are a concern in healthy blood donors because they can unknowingly carry these infections, posing risks to recipients,¹ making blood donation a crucial act of solidarity, particularly vital for females with obstetric complications, children with severe anemia, severely injured accident victims, and patients undergoing complex surgeries.²

Frequent blood donations from healthy individuals help maintain a sufficient blood supply in emergencies, as a healthy donor typically replenishes their blood within eight to twelve weeks, thus it's advised to donate every two to three months.^{3,4} Globally, approximately 118.54 million

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Authors Contribution

AIS, MA, OU & JM conceptualized the project. FIA & AIS did the data collection. FIA, MA, OU & YR did the literature search. MA, OU, JM & YR performed the statistical analysis. Drafting, revision & writing of manuscript were done by FIA, MA & UA

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blood donations are collected, with 40% originating from developed nations, reflecting a significant contrast in blood donation rates, where developing countries have 31.5 donations per 1000 population. In Pakistan, about 3.5 million people donate blood annually.⁵

In Pakistan, ensuring safe and healthy blood transfusions, a fundamental universal right and a critical healthcare system indicator, faces significant challenges, primarily the absence of WHO-recommended services, compounded by poverty and limited resources in rural areas, underscoring the need for immediate infrastructure improvements, staff training, and adequate resources in blood banks.⁶

Syphilis, primarily a sexually transmitted disease caused by *Treponema pallidum*, poses a significant risk when transmitted through blood and from mother to child. With various stages and the potential to affect multiple organs and systems, including the heart, bones, and hearing, neurosyphilis is the most perilous form, leading to sudden blindness, paralysis, and death if untreated. Proper blood screening is crucial to prevent transmission from healthy donors to recipients due to its asymptomatic nature.⁷

Our search for literature on the prevalence of syphilis among healthy blood donors in Pakistan revealed recent studies conducted in Faisalabad in 2023, and northern Pakistan 2023, reporting overall prevalence rates of 0.7% and 0.9%, respectively.^{8,9} Similar trends were observed in other major cities like Karachi 2.1%¹⁰ and Lahore 1.55%¹¹ emphasizing the need for annual evaluation of syphilis prevalence among blood donors. Our study, conducted in Rawalpindi, aimed to evaluate the prevalence of syphilis among healthy volunteer blood donors in Rawalpindi, Pakistan. It underscores the increasing burden of the disease and emphasizes the importance of improving donor evaluation and screening protocols.

Methodology

The present study was a prospective cross-sectional study performed at the Railway General Hospital, Rawalpindi for a period of six months (from July to December 2023). To determine the appropriate sample size for our survey, we used a confidence level measure of 2.17, a margin of error of 0.03, a baseline indicator level of 0.0072, a design effect of 1.5, an expected response rate of 0.262, and eight age/sex estimates. Initially, we calculated the sample size to be approximately 37.40 using these parameters. After adjusting for the design effect and age/sex estimates, the sample

size increased to approximately 448.80. Finally, accounting for the expected non-response rate, we determined the final sample size to be approximately 1713, which we rounded to 1710.

Non-probability consecutive sampling technique was used to collect the blood samples of 1710 healthy blood donors, revealing a syphilis sero-positivity rate of 16 (0.93%). The study included individuals of both genders, aged between 18 and 60 years, weighing over 50 kilograms, with hemoglobin levels of $\geq 14.0\text{gm/dl}$ and $\geq 12.0\text{gm/dl}$ for males and females, respectively. Those who had donated blood at least three months prior were selected for the study. Blood donors were excluded if they were under 18 years or above 60 years, weighed $< 45\text{ kg}$, hemoglobin $< 12\text{g/dl}$, (had a history of syphilis) engaged in high-risk behavior (i.e., unsafe sexual practices, drug abuse). The questionnaire covered sociodemographic details (age, gender, marital status, residence, education), and health history was obtained with prior consent for blood donation. Standard blood collection and storage procedures were followed. Donors were stratified by sociodemographic features and seropositivity status.

The donor's blood was collected using two vacutainers. One vacutainer with ethylenediamine tetra-acetic acid (EDTA) anticoagulant was used for analyzing hemoglobin, hematocrit, platelet levels, and blood groups. The other vacutainer without anticoagulant was used to obtain serum for *Treponema pallidum* screening. The study was based on immune chromatographic assay (ICT) of antibodies to *Treponema Pallidum* in human serum using Healgen Syphilis detection Kits provides rapid screening for syphilis in blood donors.

Data was analyzed using SPSS version 22.0. Employing post-stratification Chi Square tests significant differences between groups were identified, with a significance threshold set at a p-value of 0.05 or lower.

The ethical approval was obtained from the Research Ethical Committee of Riphah International University, Islamabad vide letter no. Riphah/RCRAHS-ISB/REC/BS-MLT-B/980.

Results

A total of 1710 blood donors meeting the inclusion criteria participated in the study. Syphilis sero-positivity was detected in 16 individuals, representing a rate of 0.93% in (Figure). Analysis of age distribution revealed 573 (33.51%) were aged 18-25 years, 502 (29.36%) were 26-35 years, 342 (20%) were 36-45 years, and 293 (17.13%) were 46-60 years. Gender-wise, 1531 (89.54%) were male,

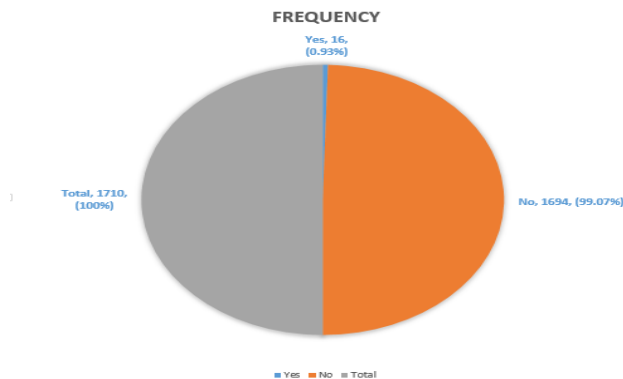


Figure: Frequency of syphilis in blood donors.

Table 1: Sociodemographic characteristics of blood donors. (n=1710)

Sero-positivity	F	%
Yes	16	0.93
No	1694	99.07
Total	1710	100
Age group		
18–25	573	33.51
26–35	502	29.36
36–45	342	20
46–60	293	17.13
Total	1710	100
Sex		
Male	1531	89.54
Female	179	10.46
Total	1710	100
Education		
No formal education	255	14.91
Primary school	493	28.83
Secondary school	587	34.33
Graduation & postgraduate	375	21.93
Total	1710	100
Occupation		
Student	648	37.90
Farmer	381	22.28
Government employees	206	12.04
Doctors	205	11.99
Others	270	15.79
Total	1710	100
Marital Status		
Single	1209	70.71
Married	501	29.29
Total	1710	100
Residence		
Urban area	1320	77.20
Rural area	390	22.80
Total	1710	100
Donor history		
First time	1308	76.50
Repeated and Regular	402	23.50
Total	1710	100

and 179 (10.46%) were female. Marital status indicated that a majority 1209 (70.71%) of blood donors were single, underscoring the diverse demographic representation in the study, providing a comprehensive understanding of the

characteristics of the donor population contributing to the research. Among the study subjects, (34.33%) 587 of blood donors had up to matric education, and a majority (77.20%) 1320 resided in urban areas shown in (Table-1).

Syphilis seropositivity was detected in 0.93% (16 subjects), with cross-tabulation analysis indicating non-significant associations with age ($p \geq 0.902$), gender ($p \geq 0.579$), educational level ($p \geq 0.725$), and residence ($p \geq 0.697$) shown in (Table-2). These findings highlight the diverse educational backgrounds and urban residency of donors, while highlighting the limited impact of these factors on the seropositivity of syphilis in the studied population.

Discussion

Unsafe blood transfusions incur significant costs, both in terms of finances and human lives. Transfusion-transmitted infections (TTIs) have enduring impacts on recipients, families, and communities, as the infected individual serves as a reservoir for bacteria, perpetuating the disease. Essential screening for blood borne infections is imperative to safeguard the well-being of transfusion recipients.

The study included 1710 blood donors fulfilling inclusion criteria, with a syphilis seroprevalence of 0.93% among blood donors. This result aligns favorably with local studies in Pakistan, specifically in Khyber Pakhtunkhwa (0.91%)¹² and Karachi (0.89%).¹³ Nevertheless, our finding contrasts with higher syphilis prevalence reported in other studies, such as in Malawi, East Africa (2.1%)¹, Lahore (1.1%)¹⁴, and another study in Lahore (1.55%).¹¹ This comparison highlights regional variations in syphilis prevalence and emphasizes the need for context-specific understanding and interventions.

The age distribution analysis indicated that 573 (33.51%) of respondents within the 18 to 25 years age group, while the gender distribution of blood donors revealed that 1,531 (89.54%) of participants in the study were male.

These results align with a study conducted in Jamshoro, Hyderabad, where a significant proportion of blood donors were below the age of twenty-five, and the predominant contributors were males.¹⁵ Similarly, a study in Peshawar observed that the majority of syphilis-reactive donors fell within the age ranges of 18-27 and 28-37, with all reported cases being among males.¹⁶

The study participants marital status revealed that the majority of blood donors 1,209

Table 3: Cross tabulation Socio-Demographic variable of Syphilis sero-prevalence among blood donors.

Socio-demographic Variables	Syphilis		Total	Chi square	p value
	No Positive	No Negative			
Age group					
18–25	06 (37.5%)	567 (33.48%)	573	0.57	0.902
26–35	05 (31.25%)	497 (29.33%)	502		
36–45	02 (12.5%)	340 (20.07%)	342		
46–60	03 (18.75%)	290 (17.12%)	293		
Total	16 (100%)	1,694	1710		
Sex					
Male	15 (93.75%)	1516 (89.50%)	1531	0.30	0.579
Female	01 (6.25%)	178 (10.50%)	179		
Total	16 (100%)	1,694	1710		
Education					
No formal education	03 (18.75%)	252 (14.87%)	255	1.31	0.725
Primary school	04 (25%)	489 (28.88%)	493		
Secondary school	07 (43.75%)	580 (34.24%)	587		
Graduation & postgraduate	02 (12.5%)	373 (22.01%)	375		
Total	16 (100%)	1,694	1710		
Occupation					
Student	08 (50%)	640 (37.78%)	648	1.27	0.866
Farmer	03 (18.75%)	378 (22.31%)	381		
Government employees	02 (12.5%)	204 (12.04%)	206		
Doctors	01 (6.25%)	204 (12.04%)	205		
Others	02 (12.5%)	268 (15.82%)	270		
Total	16 (100%)	1694	1710		
Marital Status					
Single	11 (68.75%)	1198 (70.72%)	1209	0.029	0.863
Married	05 (31.25%)	496 (29.28%)	501		
Total	16 (100%)	1694	1710		
Residence					
Urban area	13 (81.25%)	1307 (77.15%)	1320	0.15	0.697
Rural area	03 (18.75%)	387 (22.85%)	390		
Total	16(100%)	1694	1710		
Donor history					
First time	10 (62.5%)	1298 (76.62%)	1308	1.75	0.184
Repeated and Regular	06 (37.5%)	396 (23.38%)	402		
Total	16(100%)	1694	1710		

(70.71%) were single, and the educational level analysis showed that approximately 587 (34.33%) had up to matriculated education. These sociodemographic findings align with a study by Latif et al., where a higher percentage of single individuals donated blood, and donors tended to have lower educational levels.¹⁷ Similarly, a study in China identified male blood donors with a middle school education as being at high risk of syphilis.¹⁸ The majority of the 1320 blood donors (77.20%) resided in urban areas. Our study findings were consistent with a study in India where 70% of donors were also urban residents.¹⁹ The higher representation of urban blood donors may be attributed to the prevalence of healthy individuals in urban areas accessing the blood bank of a tertiary care hospital in Rawalpindi city. In contrast, the rural population typically seeks healthcare at primary (BHU, RHC) and secondary healthcare levels.

In accordance with blood safety legislation in Pakistan²⁰ mandatory syphilis screening is

required for all blood donors. This imperative underscores the necessity for employing highly sensitive and specific laboratory procedures during blood testing to mitigate the risk of syphilis transmission.

To enhance blood safety and minimize the risk of transfusion-transmission infections (TTIs), the implementation of molecular-based techniques nucleic acid testing (NAT) for screening is crucial. These methods reduce the window period, contributing to a safer blood transfusion process and ensuring that patients in need receive blood with minimal risk of disease transmission.

The limited number of participation of female donors in the study population hinders the generalizability of our findings to the broader context of Pakistan. Encouraging female blood donation is essential not only to address the current shortfalls in blood supply in healthcare departments but also to promote inclusivity and meet the growing demand for diverse donor contributions.

It was concluded that 0.93% blood donors had the potential to transmit syphilis more commonly. It is mandatory to improve the procedure and sequence of events involved in the order of selection of blood donors so that the spread of TTIs can be controlled, maintaining increased recipient safety.

Conflict of interest: None declared.

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