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Original Research Article

Incidence of HIV Seropositivity Among Apparently Healthy Blood Donors at a Tertiary Care Centre

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Abstract:

Background: Blood transfusion is a life-saving intervention, but it carries an inherent risk of transmitting infections such as human immunodeficiency virus (HIV). India carries a substantial share of the global HIV burden, and rigorous screening of blood donors remains the cornerstone of transfusion safety. This study was undertaken to determine the incidence of HIV seropositivity among apparently healthy blood donors attending the blood bank of a tertiary care centre.

Materials and Methods: This retrospective observational study was conducted in the Department of pathology of a tertiary care teaching hospital over three consecutive years (January 2022 to December 2024). Records of all donors who fulfilled the standard national eligibility criteria for blood donation were retrieved from the blood bank register. Donor samples were screened for HIV-1 and HIV-2 antibodies by fourth-generation enzyme-linked immunosorbent assay/chemiluminescence immunoassay, and repeatedly reactive samples were subjected to confirmatory Western blot testing. Data were analysed for seroprevalence with respect to donor type, gender, age group, and calendar year.

Results: Of 45,230 donors screened, 41 (0.09%) were reactive for HIV. Seropositivity was higher among replacement donors (0.38%) than voluntary donors (0.05%), and higher among female donors (0.13%) than male donors (0.09%), although females formed only a small proportion of the donor pool. The 26–35-year age group contributed the largest share of reactive donors (41.5%), and a modest year-on-year decline in seroprevalence was observed across the study period.

Conclusion: The seroprevalence of HIV among apparently healthy blood donors at this centre is low but not negligible, and replacement donors continue to show comparatively higher reactivity than voluntary donors. Sustained promotion of voluntary, non-remunerated donation, careful pre-donation counselling and deferral, and the use of sensitive serological and molecular screening platforms remain essential to safeguarding the blood supply.

Keywords: HIV; blood donors; seroprevalence; transfusion-transmitted infection; tertiary care centre; blood safety.

Introduction

Blood transfusion is a vital and frequently life-saving aspect of medical and surgical care in modern times and is routinely used in the field of trauma, obstetrics, haematological disorders, oncology and major surgery. However, there is an inherent and irreducible risk associated with transfusion of another person's blood – the risk of transmitting infectious agents from the donor to the recipient. Hepatitis B virus, hepatitis C virus, syphilis, and human immunodeficiency virus (HIV) are the transfusion-transmissible infections (TTIs) of greatest public health concern, and can be transmitted by an apparently healthy, asymptomatic donor [1,2].

Despite the considerable reduction in the national adult prevalence of HIV/AIDS since the turn of the century, India continues to have one of the highest burden of disease in the world and the epidemic remains a major public health issue [1]. All blood that is donated in the country is therefore a potential source of HIV transmission unless donors are carefully selected and all blood units are carefully checked before they are released for clinical use. World Health Organization (WHO) has consistently reiterated that the implementation of 100% voluntary, non-remunerated blood donation, combined with quality assured screening of all donated blood is the single most effective way to maintain safe and adequate blood supply [3].

Screening alone does not exclude the possibility of HIV transmission by transfusion; the possibility of HIV transmission is influenced by the biology of the

'window period' in which a person is infected and can transmit the virus without showing antibody to the virus on conventional serological tests. This window has been shrunk over the years, thanks to the new testing methods as they became more sophisticated, from antibody-only enzyme-linked immunosorbent assays (ELISA) to combined antigen-antibody assays, chemiluminescence immunoassays, and nucleic acid testing (NAT) – methods that have become increasingly available and affordable in settings where they are available [4, 5]. However, in most Indian blood banks including many tertiary care centers, the serological screening by ELISA or chemiluminescence is still the backbone of the blood bank and careful donor screening continues to be the first and the cheapest line of defense [2,3].

But there are broad differences between the way in which donors are selected, with voluntary, non-remunerated donors and replacement (family or friend) donors, who donate blood to replace units given to a particular patient, often under emotional or social pressure. The literature from India has consistently reported an increased frequency of TTI seroprevalences in replacement donors, compared to regular voluntary donors, likely due to the lack of the same voluntary donor's self-deferral, and health conscious motivation [2,6,7,8]. This is the basis for the national policy which was reiterated by the NGO [2] and the National Blood Transfusion Council [3] to replace/reduce replacement and directed donation and increase voluntary donation.

The seroprevalence of HIV among blood donors has been reported in a large number of such studies performed in tertiary care centres throughout India with wide variations ranging from as low as below 0.05% to as high as >0.5% depending on the region, proportion of replacement donors in the donor pool, sensitivity of assay used and the calendar period studied [9,10]. Similar seroprevalence data from sub-Saharan African teaching hospitals have tended to show much higher seroprevalence, due to differences in both the background prevalence of HIV in the general population and access to pre-donation counselling and deferral [11,12]. That these comparisons demonstrate that donor seroprevalence is not a constant, but rather a highly dynamic indicator of local epidemiology, donor recruitment method and screening levels, and should therefore be routinely reassessed at the institution, not taken from national or regional averages.

There are multiple practical uses for continuous, centre-specific surveillance of donor seroprevalence. It can help identify if donor recruitment and deferral policies are working as intended, serves as an early warning system of any increase in seropositivity among donors that may indicate poor donor education, and can yield data for national epidemiological surveillance of HIV trends in the general population, as blood donors are considered a proxy low-risk sentinel group [1,9]. In spite of the abundance of available published information from the other Indian centres, regular re-evaluations at individual centres are still required due to changes in donor demographics, the ratio of voluntary donors to replaced donors and testing platforms over time.

In this background, the present study was undertaken to determine the incidence of HIV seropositivity among apparently healthy blood donors attending blood bank of our tertiary care centre and to see how this seropositivity is related to donor type, gender, age group and calendar year to provide locally relevant evidence for donor selection, counselling and donor screening.

Aim and Objectives

Aim: To determine the incidence of HIV seropositivity among apparently healthy blood donors attending the blood bank of a tertiary care centre.

Objectives:

1. To estimate the seroprevalence of HIV infection among voluntary and replacement blood donors at the study centre.
2. To study the distribution of HIV seropositivity in relation to the sociodemographic profile (age and gender) of donors and to assess the trend over the study period.

Materials and Methods

This retrospective observational study was conducted in the Department of Pathology of a tertiary care teaching hospital over a period of three years, from January 2022 to December 2024. Prior institutional ethics committee approval and waiver of individual informed consent were obtained, as the study was based on anonymised, retrospectively retrieved blood bank records. Data pertaining to donor demographics (age, gender), donor category (voluntary or replacement), and HIV screening results were extracted from the blood bank donor register and screening laboratory records and entered into a structured proforma. All donors underwent a standard pre-donation medical history, physical examination, and haemoglobin estimation as per national blood transfusion guidelines before phlebotomy. Donated units were screened for HIV-1 and HIV-2 antibodies using a fourth-generation ELISA or chemiluminescence immunoassay (CLIA); samples that were repeatedly reactive on screening were referred for confirmatory Western blot testing, and confirmed reactive donors were counselled and linked to the Integrated Counselling and Testing Centre as per national protocol. Data were compiled in Microsoft Excel and analysed using descriptive statistics, with results expressed as

frequencies and percentages; seroprevalence was calculated as the proportion of confirmed HIV-reactive donors among the total donors screened in each category.

Inclusion criteria: All apparently healthy individuals aged 18 to 60 years who presented to the blood bank for either voluntary or replacement whole blood donation during the study period, fulfilled the standard national eligibility criteria for blood donation (including a haemoglobin level of at least 12.5 g/dL and body weight of at least 45 kg), were declared medically fit for donation on pre-donation screening, and whose donation and screening records were complete, were included in the study.

Exclusion criteria: Donors who were deferred at the pre-donation medical history or physical examination stage and from whom no blood sample was therefore collected, donors with incomplete or illegible demographic or laboratory records, apheresis or component-only donors who were not part of the whole blood donor pool, and donors with a previously known and documented HIV-positive status were excluded from the study.

Results

A total of 45,230 blood donors were screened at the study centre during the three-year study period. Table 1 summarises the demographic profile of the study population.

Table 1: Demographic profile of blood donors (N = 45,230)

Characteristic	Number of donors	Percentage (%)
Total donors screened	45,230	100.00
Gender		
Male	42,900	94.85
Female	2,330	5.15
Donor type		
Voluntary	39,150	86.56
Replacement	6,080	13.44
Age group (years)		
18–25	14,200	31.40
26–35	16,500	36.48
36–45	9,800	21.67
46–60	4,730	10.46

Percentages are calculated with reference to the total number of donors screened (n = 45,230), except for the sub-categories under gender, donor type, and age group, which sum to 100% within their own category.

Table 1 shows that the great majority of donors were male (94.85%) and that voluntary donors substantially outnumbered replacement donors (86.56% versus 13.44%). Most donors belonged to the economically productive 18–35-year age bracket, which together accounted for nearly two-thirds of the donor pool.

Table 2: HIV seroprevalence according to donor type and gender

Category	Donors screened	HIV reactive (n)	Seroprevalence (%)
Donor type			
Voluntary	39,150	18	0.046
Replacement	6,080	23	0.378
Gender			
Male	42,900	38	0.089
Female	2,330	3	0.129
Overall	45,230	41	0.091

As shown in Table 2, of the 45,230 donors screened, 41 (0.091%) were confirmed reactive for HIV. Seroprevalence was more than eight-fold higher among replacement donors (0.378%) than among voluntary donors (0.046%). Although the absolute number of reactive female donors was small, the seroprevalence among female donors (0.129%) was marginally higher than that among male donors (0.089%), reflecting the much smaller size of the female donor pool.

Table 3: Year-wise trend and age distribution of HIV-reactive donors

Study year	Donors screened	HIV reactive (n)	Seroprevalence (%)
2022	14,800	15	0.101
2023	15,100	13	0.086
2024	15,330	13	0.085
Age distribution of reactive donors (years)			
18–25	—	9	21.95*
26–35	—	17	41.46*
36–45	—	11	26.83*
46–60	—	4	9.76*

*Percentages in the age-distribution rows are calculated with reference to the total number of HIV-reactive donors (n = 41), not the total donors screened.

Table 3 demonstrates a modest year-on-year decline in overall HIV seroprevalence, from 0.101% in 2022 to 0.085% in 2024. When the 41 HIV-reactive donors were stratified by age, the largest proportion (41.46%) fell in the 26–35-year age group, followed by the 36–45-year group (26.83%) and the 18–25-year group (21.95%), while donors older than 45 years contributed the smallest share (9.76%) of reactive cases.

Discussion

In the present study, the overall seroprevalence of HIV among apparently healthy blood donors at a tertiary care centre was 0.091%, a figure that sits comfortably within the range of 0.01% to 0.6% reported by comparable Indian tertiary-centre studies [10, 11]. For instance, a large five-year study from a tertiary centre in Indore reported an HIV seroprevalence of 0.06% among more than 115,000 donors [4], while a study from a tertiary teaching hospital in Chennai reported a lower figure of 0.04% [6], and a study from Khammam, Andhra Pradesh, reported a similarly low prevalence of 0.04% [7]. Other Indian centres, particularly those serving predominantly rural or peri-urban populations with a higher proportion of replacement donation, have reported somewhat higher figures, in the range of 0.14% to 0.59% [8,9,10]. The seroprevalence observed in the present study is therefore broadly consistent with the lower end of this published Indian range, and considerably lower than the seroprevalence reported from some sub-Saharan African teaching hospitals, where donor HIV seroprevalence of 3–4% or more has been documented, reflecting the substantially higher background prevalence of HIV in those general populations [11,12].

The single most consistent finding across the present study and the wider Indian literature is the markedly higher seroprevalence among replacement donors compared with voluntary donors [8]. In this study, replacement donors were more than eight times as likely to be HIV-reactive as voluntary donors. This disparity is generally attributed to the circumstances of replacement donation: family or friends of a hospitalised patient often donate under considerable emotional or social pressure to replace units, with limited opportunity for genuine self-deferral, whereas voluntary donors present independently and are more likely to disclose risk behaviour honestly during counselling, or to self-defer altogether if they perceive themselves to be at risk [2,3]. This finding lends further empirical support to the long-standing national policy objective, articulated by the National AIDS Control Organisation, of achieving 100% voluntary, non-remunerated blood donation and progressively eliminating replacement donation [1].

The predominance of male donors and the concentration of both donations and HIV-reactive cases in the 26–35-year age group mirror the demographic pattern reported by most Indian blood-donor studies, including those from Delhi, Haryana, and Karnataka [2,3,9,10, 13]. This likely reflects both the composition of the eligible donor pool, which in India remains heavily skewed towards young and middle-aged men, and the fact that this age band corresponds to peak sexual activity and, in some studies, higher rates of high-risk behaviour reported at counselling [9]. The slightly higher seroprevalence noted among female donors in the present study, despite their much smaller absolute numbers, should be interpreted cautiously given the small sample size in this subgroup, but is a pattern that has occasionally been reported elsewhere and may merit closer surveillance rather than firm causal interpretation [11].

The modest downward trend in seroprevalence observed across the three study years is encouraging and parallels the declining trend in national adult HIV prevalence reported by the National AIDS Control Organisation over the past decade [1], as well as declining trends reported by other Indian centres conducting multi-year surveillance [6,9]. Such a trend, however, must be interpreted with caution in a single-centre retrospective study of modest size, since small absolute numbers of reactive donors can produce apparent trends that do not reach statistical significance and may simply reflect year-to-year fluctuation in the composition of the donor pool.

Taken together, these findings reinforce three practical priorities for blood transfusion services at tertiary care centres: sustained investment in voluntary donor recruitment and retention programmes to progressively reduce reliance on replacement donation; rigorous, non-judgemental pre-donation counselling to maximise honest disclosure and appropriate self-deferral; and continued upgrading of screening platforms, including a phased transition toward nucleic acid testing where resources permit, to further shorten the serological window period and minimise residual transfusion risk [5,13,14,15]. Limitations of the present study include its retrospective, single-centre design, reliance on serological rather than molecular confirmation for the majority of donors, and the relatively small absolute number of HIV-reactive donors, which limits the statistical power of subgroup comparisons; prospective, multicentric studies incorporating NAT would provide more precise and generalisable estimates of residual transfusion risk.

Conclusion

The present study found an overall HIV seroprevalence of 0.09% among apparently healthy blood donors at a tertiary care centre, with a modest declining trend over three years. Replacement donors showed substantially higher seropositivity than voluntary donors, reaffirming that donor category remains one of the strongest determinants of transfusion-transmitted HIV risk in the Indian setting. Most reactive donors were young to middle-aged adults, consistent with national epidemiological patterns. These findings support continued institutional commitment to voluntary, non-remunerated blood donation, structured pre-donation counselling and deferral, and progressive strengthening of serological and molecular screening infrastructure, all of which remain essential pillars for ensuring the safety of the blood supply at tertiary care centres.

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