Seroprevalence & changing trends of transfusion-transmitted infections amongst blood donors in a Regional Blood Transfusion Centre in north India

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Background & objectives: Transfusion-transmitted infections (TTIs) are the major problem associated with blood transfusion. Accurate estimates of risk of TTIs are essential for monitoring the safety of blood supply. The present study was undertaken to determine the percentage of voluntary donors (VDs) and replacement donors (RDs) and also, to estimate and compare the seroprevalence and changing trends of TTIs amongst VDs and RDs in a regional blood transfusion centre in north India.

Methods: This retrospective study was based on the records of all voluntary and replacement donations which were collected from January 2008 to December 2014 in a Regional Blood Transfusion Centre placed in a tertiary care hospital in Delhi, India.

Results: Of the total 220,482 donations, 163,540 (74.17%) were voluntary and 56,942 (25.83%) were replacement donation. The overall seroprevalence of human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), syphilis and malaria were 0.32, 1.61, 0.73, 1.62 and 0.06 per cent, respectively. Furthermore, the TTIs were more frequently encountered in RDs in comparison to VDs.

Interpretation & conclusions: The increase in public awareness regarding voluntary blood donation, meticulous donor screening, counselling and use of highly sensitive tests can help in reducing the risk of TTIs.

Key words: Hepatitis B virus - hepatitis C virus - human immunodeficiency virus - replacement donors - syphilis and malaria - transfusion-transmitted infections - voluntary donors
(VDs and RDs) and also, to estimate and compare the seroprevalence and changing trends of TTIs amongst VDs and RDs during a 7-yr period (2008-2014) in a Regional Blood Transfusion Centre in north India.

**Material & Methods**

This retrospective study was based on the records of all donations done in the Regional Blood Transfusion Centre (East Delhi), Guru Teg Bahadur Hospital, Delhi, India, from January 2008 to December 2014. The completely filled donor forms which included the type of donation (voluntary/replacement), the patient’s details, pre-donation questionnaire, counselling details and medical examination findings available for each case were analyzed along with the TTI records. The samples from all blood donations were screened for HIV 1-2, HBsAg, HCV, syphilis and malaria. Samples were collected in vacutainers at the time of blood donation and screened for HIV 1-2, HBsAg and HCV using fourth-generation enzyme-linked immunosorbent assay (ELISA) technique. HIV was tested using kits manufactured by Avantor (BeneSphera, USA), hepatitis B and hepatitis C viruses were tested using kits manufactured by Bio-Rad, USA, following the standard protocol for each according to the kit inserts. Syphilis was tested by *Treponema pallidum* hemagglutination assay (Bio-Rad) and malaria was tested using Malarial antigen Sure Test kit (Oscar Medicare Pvt. Ltd., India). All samples with reactive results were repeated in duplicate before labelling as reactive.

**Results**

A total of 220,482 donations were collected during the study period of seven years (January 2008-December 2014) and comprised 163,540 (74.17%) voluntary and 56,942 (25.83%) replacement donations (Table I). The total number of donors, who were found positive for TTIs, was 9622 (4.36%). The HIV, HBV, HCV, syphilis and malaria infections were found to be in 0.32, 1.61, 0.73, 1.62 and 0.06 per cent donors, respectively (Table II). The trends in seroprevalence of HIV, HBV, HCV, syphilis and malaria during 2008-2014 are shown in Table II. Further subdivision amongst VDs and RDs is shown in Table III. Amongst donors, HBV turned out to be the most prevalent life-threatening TTI. The seropositivity for HIV has decreased overall in both VD and RD over the study period. The seroprevalence of HBV and HCV also showed decline in the VD; however, an increase was seen in the RDs. The seroprevalence of syphilis decreased considerably over the past seven years in both VDs and RDs. Malaria was found to be the least prevalent TTI during the study period.

**Discussion**

Safe blood transfusion services are a cornerstone of an effective, high-quality healthcare system. However, contaminated blood transfusion is a potential source of TTIs and can be fatal instead of saving life. The prevalence of TTIs amongst blood donors in a well-structured healthcare system with good blood bank services can be used as a reliable tool for

| Year  | Total donation | Total voluntary donations, n (%) | Total replacement donations, n (%) |
|-------|----------------|----------------------------------|-----------------------------------|
| 2008  | 27,859         | 19,736 (70.84)                  | 8123 (29.16)                      |
| 2009  | 29,790         | 21,440 (71.97)                  | 8350 (28.03)                      |
| 2010  | 32,553         | 22,844 (70.17)                  | 9709 (29.83)                      |
| 2011  | 32,021         | 24,074 (75.18)                  | 7947 (24.82)                      |
| 2012  | 32,902         | 25,018 (76.03)                  | 7947 (24.82)                      |
| 2013  | 33,046         | 25,117 (74.00)                  | 7929 (24.00)                      |
| 2014  | 32,311         | 25,311 (78.33)                  | 7000 (21.66)                      |
| Total | 220,482        | 163,540 (74.17)                 | 56,942 (25.83)                    |

Table II. Prevalence of human immunodeficiency virus, hepatitis B virus, hepatitis C virus, syphilis and malaria in donors

| Year  | Total donation | HIV, T (%) | HBsAg, T (%) | HCV, T (%) | Syphilis, T (%) | Malaria, T (%) |
|-------|----------------|------------|--------------|------------|----------------|----------------|
| 2008  | 27,859         | 149 (0.53) | 478 (1.71)   | 194 (0.69) | 814 (2.92)     | 13 (0.04)      |
| 2009  | 29,790         | 101 (0.33) | 460 (1.54)   | 177 (0.59) | 648 (2.17)     | Nil            |
| 2010  | 32,553         | 97 (0.29)  | 531 (1.63)   | 221 (0.67) | 574 (1.76)     | 16 (0.04)      |
| 2011  | 32,021         | 95 (0.29)  | 505 (1.57)   | 202 (0.63) | 464 (1.44)     | 39 (0.12)      |
| 2012  | 32,902         | 96 (0.29)  | 594 (1.80)   | 266 (0.80) | 368 (1.11)     | 34 (0.10)      |
| 2013  | 33,046         | 101 (0.30) | 482 (1.45)   | 285 (0.86) | 392 (1.18)     | 17 (0.05)      |
| 2014  | 32,311         | 81 (0.25)  | 519 (1.60)   | 268 (0.82) | 320 (0.99)     | 21 (0.06)      |
| Total | 220,482        | 720 (0.32) | 3569 (1.61)  | 1613 (0.73)| 3580 (1.62)    | 140 (0.06)     |

T, total number of seroreactive units; HIV, human immunodeficiency virus; HCV, hepatitis C virus; HBsAg, hepatitis B virus surface antigen
statistical estimations of these infectious agents in the
general population\textsuperscript{8}.

In the present study, VDs constituted 74.17 per
cent of all donors, and a shift towards the voluntary
donation was noted during the study period as has been
reported earlier\textsuperscript{9,10}. However, preponderance of RDs
was noted in many other studies from India\textsuperscript{11-14} which
could possibly be due to lack of understanding amongst
general population about voluntary blood donation.

In our study, HIV seropositivity was seen in
0.32 per cent donors which was comparable to other
studies\textsuperscript{15,16} from India, whereas some studies reported
a lower prevalence of 0.1\textsuperscript{17} and 0.08 per cent\textsuperscript{18}.
Fasola \textit{et al}\textsuperscript{19} showed a significantly high prevalence of 13.2
per cent in Nigeria. A similar study conducted at the
same institution in 1999 showed 0.8 per cent HIV
seropositivity\textsuperscript{20}. The seroprevalence of HBV has also
reduced from over a decade in comparison to the
previous study conducted at the same institution\textsuperscript{20}.
The HBV seroprevalence ranging from 1.25 to 1.96 per cent
has been reported in other studies\textsuperscript{10,16,17}; however, two
studies from central and north India reported a high
prevalence of 2.63 and 2.90 per cent, respectively\textsuperscript{21,22}.
Jain \textit{et al}\textsuperscript{23} used enhanced chemiluminescence
immunoassay and nucleic acid amplification testing
(NAT) and found that HBV NAT yield was much
higher than studies done in Europe and the USA and
emphasized that in a country like India where there are
a significant number of window period donations, NAT
must be judiciously introduced. In our study, HBV
was the most prevalent life-threatening TTI indicating
a need for an organized programme for hepatitis B
vaccination and use of a highly sensitive technique for
its detection like NAT.

Hepatitis C showed an increase in seroprevalence
over the seven year period with overall seroprevalence
of 0.73 per cent. There was wide variation in
prevalence reported in various studies ranging from
0.16 to 1.57 per cent\textsuperscript{13,16,24}. The wide variations of
HCV seroprevalence in different studies from India
might be due to the use of different methods for
testing and use of different generation of ELISA test
kits, having different sensitivities and specificities.
Syphilis was found in 1.62 per cent donors. Other
studies showed prevalence ranging from 0.01 to
0.90 per cent\textsuperscript{10,16,18,25}. Seropositivity for malaria was
found to be low at 0.06 per cent. Many other Indian
studies\textsuperscript{10,16,17} including our previous study\textsuperscript{20} did not
include malarial antigen positivity in their studies.
Negi and Gaur\textsuperscript{14} reported very low seroprevalence of
malaria (0.002\textperthousand).

In conclusion, our results showed that though TTIs
were seen in both types of donors, their seropositivity
was higher in RDs as compared to the VDs. Thus,
there is a need to increase public awareness regarding
voluntary donation and its benefits. Meticulous donor
screening and use of highly sensitive techniques for
detection of TTIs may help reduce the risk of TTIs.

\textbf{Conflicts of Interest}: None.

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