

Role of Demographic Factors on Seroprevalence of Transfusion Transmitted Infections among Blood Donors in Delhi, India - A Four Years Retrospective Study.

Pawan Singh¹, Manju Daiya², S K Tandon³, Puja¹, Ashok Sangwaiya⁴, Shivani Kalhan⁵

¹Associate Professor, Department of Pathology, SHKM Govt Medical College, Nalhar, Nuh, Haryana, India, 122107.

²Assistant Blood Transfusion Officer, Sant Parmanand Hospital, Civil Lines, Delhi 54.

³Blood Transfusion Officer, Sant Parmanand Hospital, Civil Lines, Delhi 54.

⁴Assistant Professor, Department of Pathology, SHKM Govt Medical College, Nalhar, Nuh, Haryana, India, 122107.

⁵Professor, Department of Pathology, SHKM Govt Medical College, Nalhar, Nuh, Haryana, India, 122107.

Received: January 2018

Accepted: January 2018

Copyright: © the author(s), publisher. It is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Blood donors belong to a heterogeneous group of people in society, differing in their demographic characteristics and the psychological factors that motivate their behavior. It is important to analyze the various blood donor characteristics in order to manage blood donor programmes. Blood safety and blood supply are profoundly impacted by method of recruitment, specific health history taking and blood screening. Objective: The present study was conducted to determine the role of various demographic factors like age, sex and occupation on the seroprevalence of transfusion transmitted infections (TTIs) among the blood donors at a tertiary care hospital in Delhi over a period of 4 years. **Methods:** A 4 year retrospective study was conducted at the blood bank of a tertiary care hospital. All data were collected from blood bank records and included records of 1347 voluntary and 7451 replacement donors from January 2014 to December 2017. Screening of blood units was done by enzyme-linked immune sorbent assay (ELISA) method for Human Immune Deficiency Virus (HIV), and hepatitis B virus (HBV) and hepatitis C virus (HCV). Syphilis was tested by rapid plasma resin (RPR) card test. Malaria was tested by antigen rapid diagnostic test. Any sample found reactive was retested for confirmation. **Results:** Total 8798 blood donor's samples were analyzed. 4.27% were female and 95.73% were male. Among the 8798 blood donors, 128 blood donors were positive, prevalence of TTIs was at 1.45%. The overall positivity rates of anti-HIV, HBsAg, anti-HCV, anti-TP and MP were 0.19%, 0.80%, 0.40%, 0.06% and 0.01% respectively. The prevalence of TTIs was 1.47% for male and 1.06% for female in the donation population, the prevalence of TTI positive donations was highest in age group of 51-60 years. Regarding occupation, farmers showed the highest incidence (3.36%) of TTIs while businessmen (1.16%) ranked as the bottom. **Conclusion:** Overall prevalence of TTI is more in voluntary blood donors as compared to replacement donors. Women are safer donors as compared to males. The prevalence of TTI positive donations was highest in age group of 51-60 years. Farmers showed the highest incidence (3.36%) of TTIs while businessmen (1.16%) ranked as the bottom

Keywords: age, sex, occupation, Blood donor, Seroprevalence, Transfusion transmitted infections.

INTRODUCTION

Blood transfusion and component therapies are well-established and essential medical practices. These therapies, however, are not without risks and may lead to the transmissions of infectious agents from donor to recipient. Common infectious agents include hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV) and syphilis-causing *T. pallidum*.^[1]

In pursuit of global blood safety, the World Health Organization (WHO) recommends that all blood donations should be screened for evidence of infection prior to the release of blood and blood components for clinical or manufacturing use.^[2]

Nevertheless, there are still risks of TTIs due to the limitations of virus detection techniques. The median prevalence rate of TTIs in blood donations in middle- and low-income countries is much higher than that in high-income countries.^[3]

Blood safety remains an issue of major concern in transfusion medicine because of high prevalence of HIV, HCV and HBV, low percentage of voluntary donors and lack of standardization of screening procedures among the multitude of blood collection centers.^[4,5] India is the largest country of this region with a population of more than 1.2 billion, which

Name & Address of Corresponding Author

Dr Pawan Singh,
Associate Professor,
Department of Pathology,
SHKM Govt Medical College,
Nalhar, Nuh, Haryana, India 122107.

include about 2.5 million HIV (National AIDS Control Organization), 43 million HBV,^[6] and 15 million HCV.^[7]

TTIs remain a significant threat to blood safety, causing grave concerns in many developing countries. The prevalence of viral infections in blood donations can be used as a valuable indicator to assess the safety of blood supply and the potential risk of TTIs. Changes in this prevalence may also reflect trends in the infections of interests among the general population.

In this study, we analyzed the data of screening tests on blood donations at a tertiary care institute, examined the presence of hepatitis B virus surface antigen (HBsAg), anti-HCV, anti-HIV, anti-TP (marker for syphilis infection) and malaria parasite among blood donors, and explored the influencing factors like replacement and voluntary donors, age, sex and occupation of the detected results. Based on the findings, measures to improve blood safety through TTI prevention and control were suggested for policy-makers' consideration to minimize the risks of TTIs and safeguard public health.

MATERIALS AND METHODS

All donors at the tertiary care institute blood bank were volunteers and replacement, prior to blood donations, had to be verified for eligibility according to the current national blood donation criteria. Only those aged between 18 and 65 years, having a body weight above 45 kg for males and females, as well as physically and mentally fit would be accepted as eligible donors.

A four year retrospective study was performed from January 2014 to December 2017. The test results of these donations underwent anonymizations with the resultant information showing only donor demographic characteristics and TTI screening results among the donors.

At this tertiary care institute, all potential donors first went through the pre-donation procedures for screening for high risk donors. Then, all donor samples underwent two rounds of enzyme immunoassays (EIA) using two different reagents to test for anti-HIV-1, anti-HIV-2, anti-HCV and HBsAg. Syphilis antibody was also tested with Rapid Plasma Reagin (RPR) method. Malaria parasite were detected by card tests method. All kits were approved and licensed by the licensing authority of Govt. of India. Blood samples were considered positive for TTI if any screening test showed positive results.

Data were analyzed and positivity rates of HBsAg, anti-HCV, anti-HIV, anti-TP and MP were expressed in percentages for the entire study group and groups with different demographic characteristics. The comparisons between/among groups were performed.

RESULTS

In our study, total 8798 blood donors samples were analyzed. Total voluntary blood donors were 1347(15.31%) and replacement donors were 7451(84.68%). Among the 8798 blood donors, 128 blood donors were positive, prevalence of TTIs was at 1.45 %. The overall positivity rates of anti-HIV, HBsAg, anti-HCV, anti-TP and MP were 0.19%, 0.80%, 0.40%, 0.06 % and 0.01% respectively [Table 1]. Seropositivity of HIV, syphilis and malaria was seen more in replacement donors as compared to voluntary blood donors. However seropositivity of HBV and HCV was seen more in voluntary blood donors (97%, 0.51%) as compared to replacement donors (0.76%, 0.38%) respectively.

Over this 4-year period, trend analysis for risks of TTIs showed a decrease from 1.98 % to 1.24%. Decrease was noted in the prevalence of HCV infections after 2014. The prevalence of HIV varied in a range between 0% to 0.30 % from 2014 to 2017. The prevalence of HBV varied in a range between 0.54 % and 1.09 % from 2014 to 2017. Overall, HBsAg was the most prevalent pathogen in the four years [Table 2].

Their ages (in years) ranged from 18 to 65, with 21–30 years as the largest age group contributing to 4136 donations (47.01% of donors). The prevalence of TTI seropositive donations was highest in age group of >50 years. HIV seropositivity was nil in <20 and > 60 years age group and highest in 51-60 years age group. HBV seropositivity was lowest in <20 and highest in > 50 years age group. HCV seropositivity highest in age group <20 years followed 41-50 years age group [Table 3].

Total 4.27% were female and 95.73% were male. The prevalence of TTIs was 1.47% for male and 1.06 % for female in the donation population, HBV infection was more prevalent among the females whereas HCV and HIV infections were more prevalent among the males [Table 4].

Table 1: Seropositivity of different TTIs in voluntary donors (VD) and replacement donors(RD).

Year	HI V %	HBSA G %	HC V %	VDR L %	M P %	TOT AL %
RD TOTAL=7 451 84.68 %	16 .21	57 .76	28 .38	5 .07	1 .01	107 1.43
VD TOTAL=1 347 15.31 %	1 .07	13 .97	7 .51	NIL	NI L	21 1.56
TOTAL=8 798	17 0.1 9	70 .80	35 .40	5 .06	1 .01	128 1.45

Regarding occupation, farmers showed the highest incidence (3.36%) of TTIs while businessmen (1.16%) ranked as the bottom. It was due to higher

seropositivity of HBV (1.68%) and HCV (1.68%) in farmers [Table 5].

Table 2: Year-wise prevalence of different TTIs.

Year	Total donors	HI V %	HBSA G %	HC V %	VDR L %	M P %	Total %
2014	2116	6 0.28	20 0.94	13 0.61	2 0.09	1 0.04	42 1.98
2015	2590	8 0.30	14 0.54	15 0.57	0	0	37 1.42
2016	1998	3 0.15	13 0.65	6 0.30	1 0.05	0	23 1.15
2017	2094	Nil	23 1.09	1 0.04	2 0.09	0	26 1.24
Total	8798	17 0.19	97	35 .40	5 .06	1 .01	128 1.45

Table 3: Age-wise distribution of HIV, HBV, HCV, Syphilis and Malaria seropositive blood donors

Age groups in years	HI V %	HBSA G %	HC V %	VDR L %	M P %	TOTAL %
0-20 Total =442 5.02 %	0	3 0.67	4 0.90	0	0	7 1.58
21-30 Total =4136 47.01 %	9 0.21	35 0.84	13 0.31	3 0.07	0	60 1.45
31-40 Total =2734 31.07 %	5 0.18	20 0.73	8 0.29	1 0.03	1 0.03	35 1.28
41-50 Total =1144 13.00 %	1 0.08	8 0.69	9 0.78	1 0.08	0	19 1.66
51-60 Total =311 3.53 %	2 0.64	3 0.96	1 0.32	0	0	6 1.92
>60 Total =31 0.35 %	0	1 3.22	0	0	0	1 3.22
Total =8798						128

Table 4: Sex-wise distribution of HIV, HBV, HCV, Syphilis and Malaria seropositive blood donors

Sex	HI V %	HBSA G %	HC V %	VDR L %	M P %	TOTAL %
MALE TOTAL=8422 (95.73)	17 .20	66 .78	35 .41	5 .06	1 .01	124 1.47
FEMALES TOTAL=376 (4.27%)	0	4 1.06	0	0	0	4 1.06
TOTAL=8798	17	70	35	5	1	128

Table 5: occupation-wise distribution of HIV, HBV, HCV, Syphilis and Malaria seropositive blood donors

Occupation	HI V %	HBSA G %	HC V %	VD RL %	M P %	TOTAL %
AGRICULTURE Total =119	NIL	2 1.68	2 1.68	NIL	NIL	4 3.36
BUSSINESS MEN Total =2913	3 0.10	20 0.68	8 0.27	3 0.10	NIL	34 1.16
STUDENTS Total =1258	NIL	13 1.03	9 0.71	NIL	NIL	22 1.74
DRIVERS Total =139	NIL	2 1.43	NIL	NIL	1 0.71	3 2.18
OTHERS total=4369	14 0.32	33 0.75	16 0.36	2 0.04	NIL	65 1.48
Total 8798						128

DISCUSSION

TTIs continue to be a big threat to the safety of blood supply more so in the developing and under developed countries. Viral infections are the major cause of morbidity and mortality in blood recipients.^[8] The national policy for blood transfusion services in our country is of recent origin and the transfusion services are hospital based and fragmented.^[9]

Blood donors belong to a heterogeneous group of people in society, differing in their demographic characteristics and the psychological factors that motivate their behavior.^[10] It is important to analyze the various blood donor characteristics in order to manage blood donor programmes. Blood safety and blood supply are profoundly impacted by method of recruitment, specific health history taking and blood screening.

The majority (95.73%) of the blood donors in our study were males which is comparable to the studies done by others. These are Rao and Annapurna et al in Pune,^[11] Rose et al in Vellore,^[12] Singh K et al,^[13] in coastal Karnataka, Pahuja et al,^[14] in Delhi and Singh B et al noting more than 90 % of the male donors.^[15]

The seropositivity of HIV, HCV, syphilis and malaria in male donors was higher than the female blood donors in our study. There is a need to increase the number of female blood donors to ensure more blood safety. Most of the studies have reported higher prevalence of HBV among males, but in our study HBV infection was more in females as compared to males. In the West, the proportion of male and female one time whole blood donors is reported to be almost equal.^[16] There is need to sought full cooperation of women in donating blood, when they are equally capable to donate blood. This is not an impossible task as there is large population of females, with high number of school and college going girl students and also increased level of

education. This will also increase the inventory of blood to meet the deficit in blood banks as well as safety of blood transfusion.

In the present study, overall seropositivity in replacement donors is less than voluntary blood donors, as well as higher incidence of HBV and HCV in voluntary blood donors as compared to replacement donors. Voluntary donors are motivated blood donors who donates blood at regular intervals and replacement donors are usually one time blood donors who donates blood only when a relative is in need of blood.^[17]

In the present study, out of the total blood donors, voluntary donors constituted 15.31 % while replacement donors were 84.68 %. It is shown that replacement donors constitute the largest group of blood donors in India,^[18] reflecting the lack of awareness amongst the general population. Studies revealed high seropositivity in replacement donors compared to voluntary donors;^[13-15] a similar finding was noted in our study for HIV, syphilis and malaria infections.

Blood donors of age group of 31-40 years have lowest overall seropositivity followed by 21-30 years age group in our study. This difference gains significance if viewed together with the occupation and transfusion transmissible infections status. College going students are naturally younger and the risk of transfusion transmissible infections is also less. Young college going students are therefore the best and appropriate target group for voluntary donations. This finding has been reported previously.^[19]

Murphy et al,^[20] who observed that age-specific HCV seroprevalence rose from 0.5 per 1000 donors younger than 20 years to a maximum of 6.9 per 1000 in donors aged 30 to 39 years. Tanaka et al,^[21] also observed that the prevalence of anti-HCV increased with age both in men and women. However HCV seropositivity in < 20 years age group was highest in our study as compared to other age groups.

The present study shows that the businessman blood donors showed lowest seroprevalence as compared to other occupational group. HIV seropositivity in our study was lowest in students, agriculturists and drivers. HBsAg and HCV seropositivity was higher in agriculturists group as compared to others. Seropositivity in college going students in Pakistan was 0.0% for HIV, 1.12% for HBsAg and 0.70% for HCV which is comparable to our study. Young college going students in the age group 20- 25 are the safest group of blood donors. Recruitment programmes must reach out and appeal to this group of donors.^[22] Steps should be taken to meet increasing demand through repeat donations from this group.

The blood donors with lower level of education and socio-economic status have higher frequency of HBV and markedly high frequency of HCV seropositivity. The financial burdens, low wages in

these groups and increasing age force such group people to seek cheap health care. The re-use of disposable syringes, unsterilized or improperly sterilized medical and dental instruments, beard shaving by barbers with razors are only some of reasons to explain these findings. It has been observed that not only occupation, but education and socio-economic status also influence the risk of TTIs. This group of people may be our voluntary donors in which higher seropositivity of HBV and HCV was found in our study.^[22]

Sexually transmitted infections are wide spread in developing countries and constitute a major health problem. Seropositivity of syphilis was lower in students and highest among businessmen in our study. Syphilis has also acquired a new potential for morbidity and mortality through association with increased risk of HIV infection, thus making safe blood more difficult to get. Therefore serological screening for syphilis serves as a surrogate test for HIV infected donors. A strict selection criteria for blood donors to exclude those with multiple sexual partners is recommended and all the affected donors should be treated appropriately.^[23]

It is increasingly being realized that refinement in the testing methodologies will be an ongoing exercise and new methodologies have to be tried, refined and reconfigured to increase blood safety. With the introduction of higher sensitivity tests, the cost of transfusion are soaring and investment to such an extent in screening methodologies may not be the best way to use limited resources devoted to blood safety.^[24] This is even more relevant to developing countries where a lot can be done by simpler and cheaper proactive approaches.^[25]

There is a need to target younger people, students and females in recruitment and retention programmes for blood donations. Incentives like free hepatitis B vaccination should be given to preserve the existing repeat donor pool. Obviously increased awareness of factors associated with increased risk of infections and voluntary deferral by potential high risk donors, improvement in donor recruitment, retention and donation screening and deferral is required to reduce seroprevalence in blood donors which have showed higher incidence of different infections. Steps should be taken to meet increasing demand through repeat donations from the safer donor group considering age, occupation and sex.

CONCLUSION

The major concern in transfusion services today is increased seropositivity among voluntary Donors for HCV, HIV, HBsAg and syphilis. A noticeable number of voluntary donors harbour HIV, HBV, HCV, Malaria and Syphilis infections. So strict selection of donors and proper testing of donor's blood by using standard method is highly recommended to ensure safety for recipient. With

the advent of nucleic acid amplification techniques (NAT), western countries have decreased the risk of TTI to a major extent. But the cost-effectiveness of NAT is poor. The NAT has added benefits but its high financial cost is of concern, especially in underdeveloped countries like India.

Apart from NAT for donor screening, other factors such as public awareness, vigilance of errors, educational and motivational programs is sure to help in decreasing the infections. Efforts should be made to increase the number of voluntary donors and reduce replacement donations to a minimum. Motivation of potential local blood donor population would help in effective implementing of voluntary blood donation program in the community.

REFERENCES

- Schreiber GB, Busch MP, Kleinman SH, Korelitz JJ. The risk of transfusion-transmitted viral infections. The Retrovirus Epidemiology Donor Study. *N Engl J Med.*1996; 334: 1685–1690.
- WHO. Screening donated blood for transfusion-transmissible infections: recommendations. Geneva: WHO.2009.
- WHO. 100% Voluntary Non-Remunerated Donation of Blood and Blood Components. Melbourne, Australia.2009.
- Bhatia R. Blood transfusion services in developing countries of South-East Asia. *Transfusion Today.*2005; 65: 4-5.
- Kapoor D, Saxena R, Sood B, Sarin SK. Blood transfusion practices in India: Results of a national survey. *Indian J Gastroenterol.*2000; 19: 64-7.
- Dodd RY, Notary EP 4th, Stramer SL. Current prevalence and incidence of infectious disease markers and estimated window-period risk in the American Red Cross Blood Donors Population. *Transfusion.*2002; 42: 975-9.
- Garg S, Mathur DR, Garg DK. Comparison of seropositivity of HIV, HBV, HCV and syphilis in replacement and voluntary blood donors in western India. *Indian J Pathol Microbiol.*2001; 44: 409-12.
- Siddiqui FA, Akhtar K, Sherwani RK, Rehman K, Alam F, Ansari A: Prevalence of Hepatitis C virus in Aligarh: A seven year experience. *Indian J Comm Med.*2009; 34:264-5.
- Gupta PK, Kumar H, Basannar DR, Jaiprakash M: Transfusion transmitted infections in armed forces: prevalence and trends. *MJAFI.*2006; 62: 348-350.
- Davey RJ: The safe blood donor and the national blood supply: is there a new interface (Editorial). *Transfusion.*1998; 38: 323-6.
- Rao P, Annapurna K: HIV status of blood donors and patients admitted in KEM hospital, Pune. *Ind J Hemat Blood Transf.*1994; 12: 174-176.
- Dolly R, Annie S, Thaiyanayaki P, George PB, Jacob TH: Increasing prevalence of HIV antibody among blood donors monitored over 9 years in blood bank. *Indian J Med Res.*1998; 108: 42-44.
- Singh K, Bhat S, Shastry S: Trend in seroprevalence of Hepatitis B virus infection among blood donors of coastal Karnataka, India. *J Infect Dev Ctries.*2009; 3: 376-379.
- Pahuja S, Sharma M, Baitha B, Jain M: Prevalence and trends of markers of hepatitis C virus, hepatitis B virus and human immunodeficiency virus in Delhi blood donors. A hospital based study. *Jpn J Inf dis.*2007; 60: 389-391.
- Singh B, Verma M, Kotru M, Verma K, Batra M: Prevalence of HIV and VDRL seropositivity in blood donors of Delhi. *Indian J Med Res.*2005; 122: 234-236.
- Thomson RA, Bethel J, Lo AY, Own by HE, Nass CC, and Williams AE :for the Retrovirus Epidemiology Donor Study. Retention of “safe” blood donors. *Transfusion.*1998; 38: 359-367.
- Matee MJ, Magesa PM, Yamuna E: Seroprevalence of human immunodeficiency virus, hepatitis B and C viruses and syphilis infections among blood donors at Muhimbili National Hospital in Dar ES Salem, Tanzania. *BMC–Public Health.*2006; 6:21.doi:10.1186/1471-2458-6-21.
- Makroo RN, Salil P, Vashist RP, Lal S: Trends of HIV infection in blood donors of Delhi. *Indian J Pathol Microbiol.*1996; 39: 139-142.
- Mujeeb SA, Aamir K, Mehmood K: Seroprevalence of HBV, HCV and HIV infections among college going first time voluntary blood donors. *JPMA.*2000; 50(8):269-70.
- Murphy EL, Bryzman S, Williams AE et al: Demographic determinants of hepatitis C virus seroprevalence among blood donors. *JAMA.*1996; 275(13): 995-1000.
- Tanaka J, Kumagai J, Katayama K, Komiya Y, Mizui M, Yamanaka R,Suzuki K.Miyakawa Y,Yoshizawa H: Sex-and Age –Specific carriers of Hepatitis B and C viruses in Japan estimated by the prevalence in the 3,485,648 First time blood donors during 1995-2000.*Intervirology.*2004; 47:32-40.
- Rahman MU, Akhtar GN, Qadeer M, Shams T, Usmani A, Iodhi Y: Safe blood begins with safe donors. *Pak J Med Sci .*2003; 19(3): 161-8.
- Olokoba AB, Olokoba LB, Salawu FK et al: Syphilis in voluntary blood donors in North-Eastern Nigeria. *Eur J Sci Res.*2009; 31:335-340.
- Arora D, Arora B, Khettarpal A: Seroprevalence of HIV, HBV, HCV and Syphilis in blood donors in Southern Haryana. *Indian J Pathol Microbiol.*2010; 53:308-309.
- Fiebig EW, Busch MP: Emerging infections in transfusion medicine. *Clin lab med.*2004; 27:797-823.

How to cite this article: Singh P, Daiya M, Tandon SK, Puja, Sangwaiya A, Kalhan S. Role of Demographic Factors on Seroprevalence of Transfusion Transmitted Infections among Blood Donors in Delhi, India - A Four Years Retrospective Study. *Ann. Int. Med. Den. Res.* 2018; 4(2): PT41-PT45.

Source of Support: Nil, **Conflict of Interest:** None declared