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Original article

Transfusion transmissible infections among blood donors from a sub-Himalayan rural tertiary care centre in Darjeeling, India

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ABSTRACT

Background: In modern health services, blood transfusion is an essentially life-saving manoeuvre. With this situation healthy donor compilation is the cornerstone of transfusion medicine. Henceforth, a provision for strict criterion in recruitment and deferral of blood donors, particularly emphasizing transfusion transmissible infections (TTI), may improve safe transfusion practice.
Objectives: The present study was executed to assess the prevalence of TTIs within blood donors at a sub-Himalayan rural tertiary care institution in Darjeeling, India; which can ultimately aid in determination of the population subset to be targeted for enhancing donor pool.
Methods: The present study was a three-year (2010–2012) retrospective study. Data was accumulated and analysed from blood bank records, pertaining to all donors who were screened for various TTIs using respective immunological methods. Then the tabulated seropositive donors were correlated with relevant epidemiological profiles.
Results: Total 28,364 blood donors were examined, comprising of 25,517 (89.96%) males and 20,985 (73.98%) voluntary donors. Cumulative seroprevalence of HIV, HBV, HCV and syphilis were 0.42%, 1.24%, 0.62% and 0.65% respectively; with solitary malaria-infected donor. The overall seroreactivity in present study significantly diminished through successive years.
Conclusions: Deployment of implicit inclusion-exclusion criteria is high on demand for reducing the prevalence of TTIs, to increase the donor subpopulation strength and ultimately to institute a safe transfusion protocol.

1. Introduction

Transfusion therapy has been the mainstay of several medico-surgical therapeutics since 1930.[1] There are 3 types of blood donors: voluntary/unpaid, family/replacement, and paid.[2] A voluntary blood donor intentionally donates blood without pursuing any remuneration, whereas a replacement donor is requested to do so by the patient or his associates.[3]

According to World Health Organization (WHO) Global Database on Blood Safety (GDBS) 2008, total around 91.8 million blood donations are collected annually. But, approximately 48% of these emanate from high-income countries, astringent to 15% of earth's population. Ten nations vouch for 65% of blood collections worldwide, and India is the third highest bidder in this respect following United States and China.[2] With almost 9.8 million units of yearly collections and 84% voluntary donors, India is expected to bang on the WHO target of 100% voluntary donations by 2020, much before due date.[4]

Blood transfusion aggravates the risk of transfusion-transmissible infections (TTIs) like hepatitis B (HBV), hepatitis C (HCV), Human Immunodeficiency Virus (HIV), syphilis, and less commonly to malaria, toxoplasmosis, brucellosis, other viral infections.[5] As of 2009, around 2.5 million Indians were infected with HIV. Succumbing to a prevalence of 0.3%, India presently stands third on planet, in numerical terms of HIV-infected people.[6] However its prevalence among subcontinental donors fluctuates through literatures, from 0.02 to 8.5%.[7]

Globally, HBsAg (Hepatitis B surface antigen) prevalence varies between 0.1 and 11.7%.[7] Amongst Indian general population and

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blood donors, it lingers within 2–8%; and 1–2% respectively.[8–10] Universally around 3% people are infected with HCV.[11] Accordingly, worldwide 0.4–19.2% blood donors test positively for HCV. In contrast, a low cumulative HCV prevalence below 2% has been reported from this country.[9,10,12–14]

Darjeeling district in India, has a high HIV prevalence of >1%, much higher than national distribution.[15] Despite that, very little is learnt about the seroprevalence of HIV and other TTIs among blood donors here. The present study accomplished at the lone tertiary medical institution in rural sub-Himalayan belt of Darjeeling, West Bengal, India; was aimed at recollecting the donors' profile, particularly emphasizing the seroprevalence of TTIs amongst them and determination of the suitable population-module to be targeted for upscaling the voluntary blood donors' strength. Consequently, the overall knowledge about blood safety measurements and a rough estimate of the infection burden in rural community can be replenished.

2. Materials and methods

The presently discussed, institutional record-based retrospective study was executed in the Department of Blood bank, North Bengal Medical College & Hospital, Darjeeling, West Bengal, India. Data from three consecutive years of 2010–2012, was retrieved

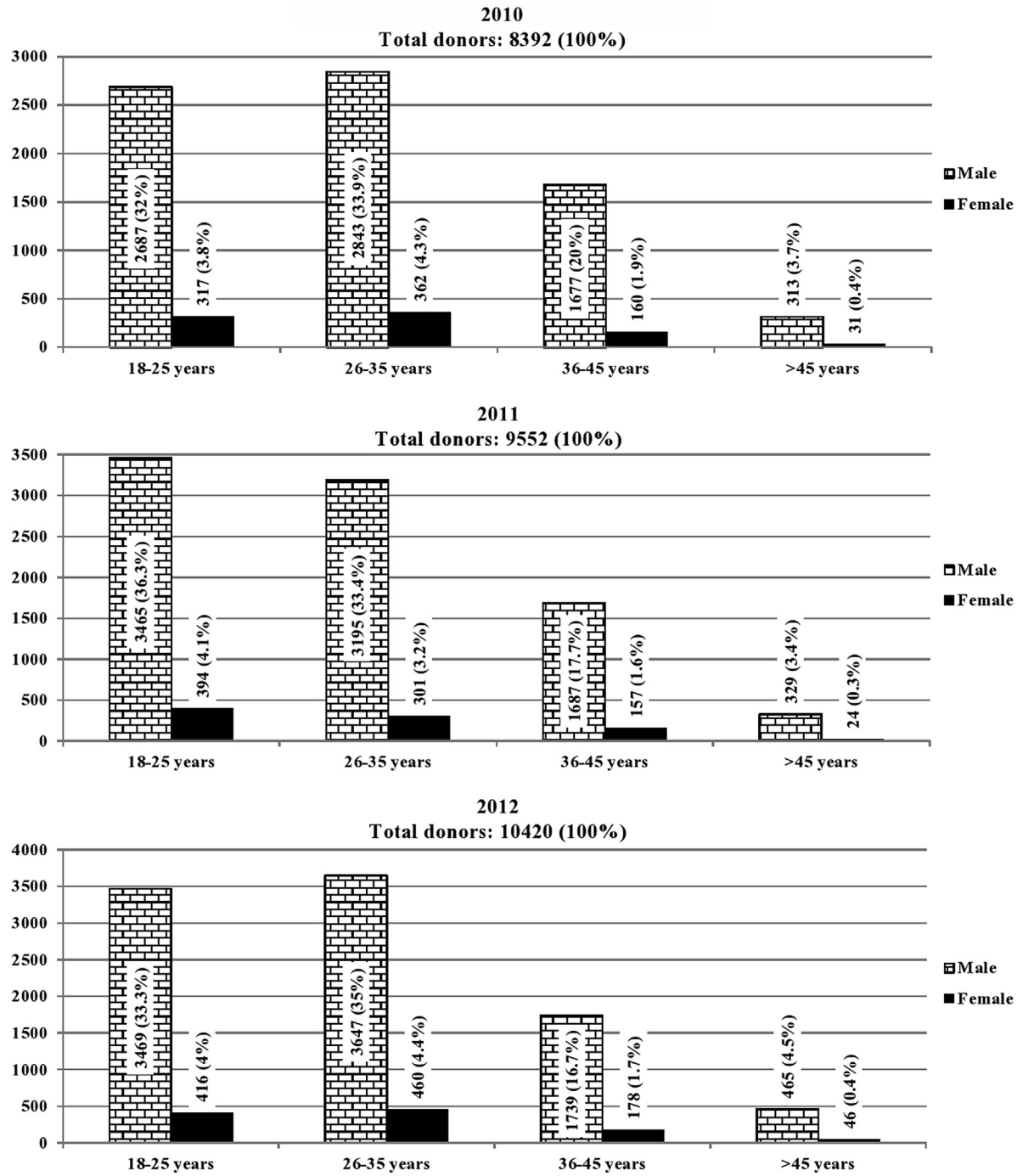

Fig. 1. Age and sex distribution of blood donors in three years (2010–12).

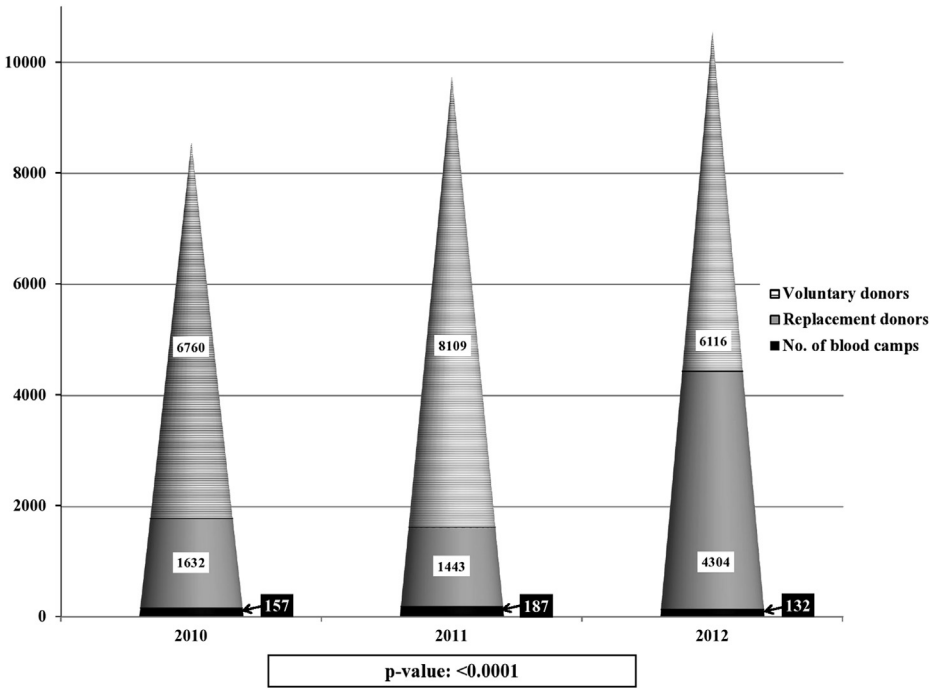

Fig. 2. Correlation of blood donation camps with types of donation.

from various documents maintained by blood bank authority. Hospital-based replacement donors alongside blood camp-based voluntary donors were tabulated. All these data was analysed by utilizing descriptive statistics included in SPSS version 16.0. Various immunological screening methods were performed on all donated samples for HIV-1 & 2, HBsAg, HCV (by enzyme-linked immunosorbent assay or ELISA), syphilis (by Venereal Disease Reference Laboratory or VDRL rapid card test from Transasia Biomedicals Limited) and malaria (by SD BIOLINE Malaria Antigen P.f./P.v. rapid diagnostic card test or RDT for pan-malarial antigens). Recommended donor exclusion criteria were: history of febrile or debilitating illness, weight loss, jaundice, hepatic or cardiovascular or pulmonary derangement, malignancy, epilepsy, bleeding diathesis, past blood transfusion, recent blood donation, consumption of prohibited drugs, surgical intervention, age under 18 or over 60 years, pregnancy or lactation.

3. Results

Total 28,364 donors were screened during the period of January 2010 to December 2012. Most of the donors were aged 35 years or less, and a mere 4.27% (1210) donors were living beyond their mid-forties. Males were the dominant cohort, while females constituted only 10.04% (2847) of the study population (Fig. 1). A sum of 476 blood donation camps were arranged, which collectively compiled 20,985 (73.98%) voluntary donations. Astonishingly, the voluntary donors' strength drastically declined in 2012 than its yesteryears, which actually reflected the reduction in donation camps instituted that year, with profound statistical significance ($p < 0.0001$) (Fig. 2).

As a whole 832 seropositive donors were identified corresponding to a summed-up seroprevalence of 2.93%. However, a statistically significant ($p = 0.0041$) downgrading trend in overall seroprevalence of TTIs, was elicited over observed three years. Seroprevalence of HIV, HBV, HCV and syphilis among studied donors were 0.42%, 1.24%, 0.62% and 0.65% respectively. More importantly, a downscaling tendency in seroprevalence of HBV ($p = 0.0126$) and syphilis ($p < 0.0001$), over the projected years was again derived with noteworthy statistical significance. In the final year, the only case of vivax malaria was encountered in a male voluntary donor (Table 1). None of the seropositive donors were co-infected with any additional TTI.

Apart from HCV ($p = 0.0256$) no significant difference between two principle donor categories could be deducted from their respective individual susceptibility to any other TTI. In addition, the overall seroprevalence of TTIs was significantly ($p = 0.0398$) more pronounced amongst replacement donors (3.28%) than their voluntary (2.81%) counterparts (Table 2).

Altogether the highest prevalence for each TTI was observed in the 26–35 years age group, followed by the 36–45 years age group. Seropositivity among discussed donors dipped lowest for the >45 years age group. Age variation of seroprevalence was statistically significant with the likes of HBV, HCV and syphilis particularly during the years of 2010–11, 2011–12 and 2012 respectively (Table 3). Gender-wise difference in seroprevalence with HBsAg ($p = 0.0064$) and VDRL (Venereal disease research laboratory test) ($p < 0.0001$) also attained statistical significance in this presently concluded study (Fig. 3).

Table 1
Prevalence of TTIs among blood donors.

Diseases	Years			Total (N = 28,364)	p-value
	2010 (N = 8392)	2011 (N = 9552)	2012 (N = 10,420)		
HIV	36 (0.43%)	42 (0.44%)	40 (0.38%)	118 (0.42%)	0.8446
HBsAg	112 (1.33%)	138 (1.44%)	103 (0.99%)	353 (1.24%)	0.0126*
HCV	43 (0.51%)	57 (0.6%)	75 (0.72%)	175 (0.62%)	0.1724
VDRL	95 (1.13%)	40 (0.42%)	50 (0.48%)	185 (0.65%)	<0.0001*
MP	00	00	1 (0.01%)	1 (0.004%)	0.4268
Total	286 (3.41%)	277 (2.90%)	269 (2.58%)	832 (2.93%)	0.0041*

* Statistically significant p-values.
HIV: Human immunodeficiency virus; HBsAg: Hepatitis B surface antigen; HCV: Hepatitis C Virus; VDRL: Venereal disease research laboratory; MP: Malarial parasites.

Table 2
Distribution of TTIs among blood donors according to their type of donation.

Diseases	Types of blood donation		Total (N = 28,364)	p-value
	Voluntary (N = 20,985)	Replacement (N = 7379)		
HIV	87 (0.41%)	31 (0.42%)	118 (0.42%)	1.000
HBsAg	255 (1.22%)	98 (1.33%)	353 (1.24%)	0.4669
HCV	116 (0.55%)	59 (0.80%)	175 (0.62%)	0.0256*
VDRL	131 (0.62%)	54 (0.73%)	185 (0.65%)	0.3142
MP	1 (0.005%)	00	1 (0.004%)	0.5431
Total	590 (2.81%)	242 (3.28%)	832 (2.93%)	0.0398*

* Statistically significant p-values.

4. Discussion

Blood transfusion is a life-saving integral remedy in current medical practices, but also carries contemporary risk of transmitting dreadful TTIs like HIV, hepatitis B and C.[16] Distressed with this disquiet fact, WHO indoctrinated a detailed strategy in transfusion protocol which potentiates well-orchestration of transfusion services, promotion of voluntary donation with uttermost priority, effective exemption of all seropositive samples particularly those with the four commonest TTIs, and establishment of an implicit quality control system.[7]

The overall seroprevalence of various TTIs among the studied donors figured out as 2.93% with a significant dwindling trend over successive years, which intimately stimulated previous observations by Mathai et al[17] (3.1%), Karmakar et al[18] (2.79%) and Koshy et al[7] (2.9%). However, contrasting evidences of significantly lower or higher seropositivity under subcontinental circumstances also prevails at large.[19–22]

The infectivity of HBV, HCV, HIV and syphilis amongst Indian donors has been documented as 0.66–12%, 0.5–1.5%, 0.084–3.87% and 0.85–3% respectively.[23] HBV was the most frequent (1.24%) TTI encountered in presently concluded study, recapitulating earlier Indian literatures accomplished in similar context.[7,16,18,20,23] On the other hand, Garg et al[13] and Sinha et al[22] reiterated much higher proportion of HBsAg seropositivity; as well as a lower seroprevalence reported by Adhikari et al[19] and Unnikrishnan et al[21], contradicts the current elaboration.

Moreover, Mathai et al[17], Gupta et al[8] and Koshy et al[7] encountered anti-HCV seroreactivity as the commonest TTI in their respective studies. On the contrary, around 0.62% subjects were tested reactive for anti-HCV antibody within the discussed donor population, which lagged third behind hepatitis B and syphilis in the list of TTIs. Chattoraj et al[23] also experienced identical order of seropredominance among their examined donors. Pertinent to present discussion, Giri et al[16] and Karmakar et al[18] identified 0.74% and 0.59% HCV-positive donors respectively; though opposing views are also quite obvious.[19–22]

Serological evidences for syphilis turned out to be affirmative in 0.65% of currently studied donations, which also featured a significantly progressive diminution over the years. Most of the previously published Indian literatures recorded a much lower incidence of VDRL reactivity.[13,16,18,24] But yet Gupta et al encountered about 0.85% syphilis patients in their observed group.[8]

Although HIV-prevalence in Darjeeling district (1%) is much higher than whole Indian (0.3%) scenario;[15] still HIV-seroprevalence in discussed donors was quantified as 0.42% only, least of the chief four TTIs and more comparable to national seroprevalence. Garg et al[13] (0.47%), Kaur et al[20] (0.6%), Sinha et al[22] (0.64%) and Karmakar et al[18] (0.6%) traced HIV-seropositivity to similar extent of present study; whereas Gupta et al[8] (0.08%), Agrawal et al[24] (0.1%) and Giri et al[16] (0.07%) identified much less number of HIV-infected donors.

According to National AIDS Control Organization (NACO) guidelines, donors affected with malaria should be temporarily deferred for next three months.[18] The lone malaria-infested donor was detected in the final year of present study. Dubey et al successfully detected 0.09% malaria-infected donors using RDT, while the prevalence flourished as high as 17.4% with serological assay for malarial antibody.[25] RDT is associated with high sensitivity and it promptly turns negative 2–3 days after effective eradication of parasites, in contrast the antibody against Plasmodia persists for days after successful therapy.[26] Likewise, the donors in the present study were efficaciously screened out for malaria using RDT.

In this on-going study most of the donors were males, which beautifully coincided with preceding Indian observations. Despite the overall seroprevalence hardly differed between genders, the seroreactivity for HBsAg and VDRL was found to be significantly higher among males, which is at par with already recommended articles.[16] Such gender variation in seroresponsiveness could be attributed to their heterogeneous risk-behaviour.

Koshy et al noted most of their studied seropositive donors to be aged between 18 and 30 years, followed by 31–40 years.[7] More than two-third seropositive donors belonged to 21–40 years age group in the study conducted by Karmakar et al.[18] Accordingly, most of the infected donors in present study were from 26 to 35

Table 3
Age distribution of TTIs among blood donors.

Diseases	Age groups				Total	p-value
	18–25 yrs	26–35 yrs	36–45 yrs	>45 yrs		
2010 (N = 8392)						
HIV	6 (0.07%)	16 (0.19%)	13 (0.15%)	1 (0.01%)	36 (0.43%)	0.0664
HBsAg	26 (0.31%)	48 (0.57%)	28 (0.33%)	10 (0.12%)	112 (1.33%)	0.0020*
HCV	11 (0.13%)	17 (0.20%)	12 (0.14%)	3 (0.04%)	43 (0.51%)	0.4634
VDRL	25 (0.30%)	41 (0.49%)	22 (0.26%)	7 (0.08%)	95 (1.13%)	0.1463
2011 (N = 9552)						
HIV	11 (0.12%)	18 (0.19%)	11 (0.12%)	2 (0.02%)	42 (0.44%)	0.2790
HBsAg	31 (0.32%)	57 (0.60%)	38 (0.40%)	12 (0.13%)	138 (1.44%)	<0.0001*
HCV	13 (0.14%)	19 (0.20%)	22 (0.23%)	3 (0.03%)	57 (0.60%)	0.0011*
VDRL	9 (0.09%)	18 (0.19%)	12 (0.13%)	1 (0.01%)	40 (0.42%)	0.1292
2012 (N = 10,420)						
HIV	8 (0.08%)	18 (0.17%)	11 (0.11%)	3 (0.03%)	40 (0.38%)	0.0978
HBsAg	27 (0.26%)	44 (0.42%)	25 (0.24%)	7 (0.07%)	103 (0.99%)	0.1069
HCV	17 (0.16%)	32 (0.31%)	21 (0.20%)	5 (0.05%)	75 (0.72%)	0.0257*
VDRL	9 (0.09%)	19 (0.18%)	18 (0.17%)	4 (0.04%)	50 (0.48%)	0.0010*

* Statistically significant p-values.

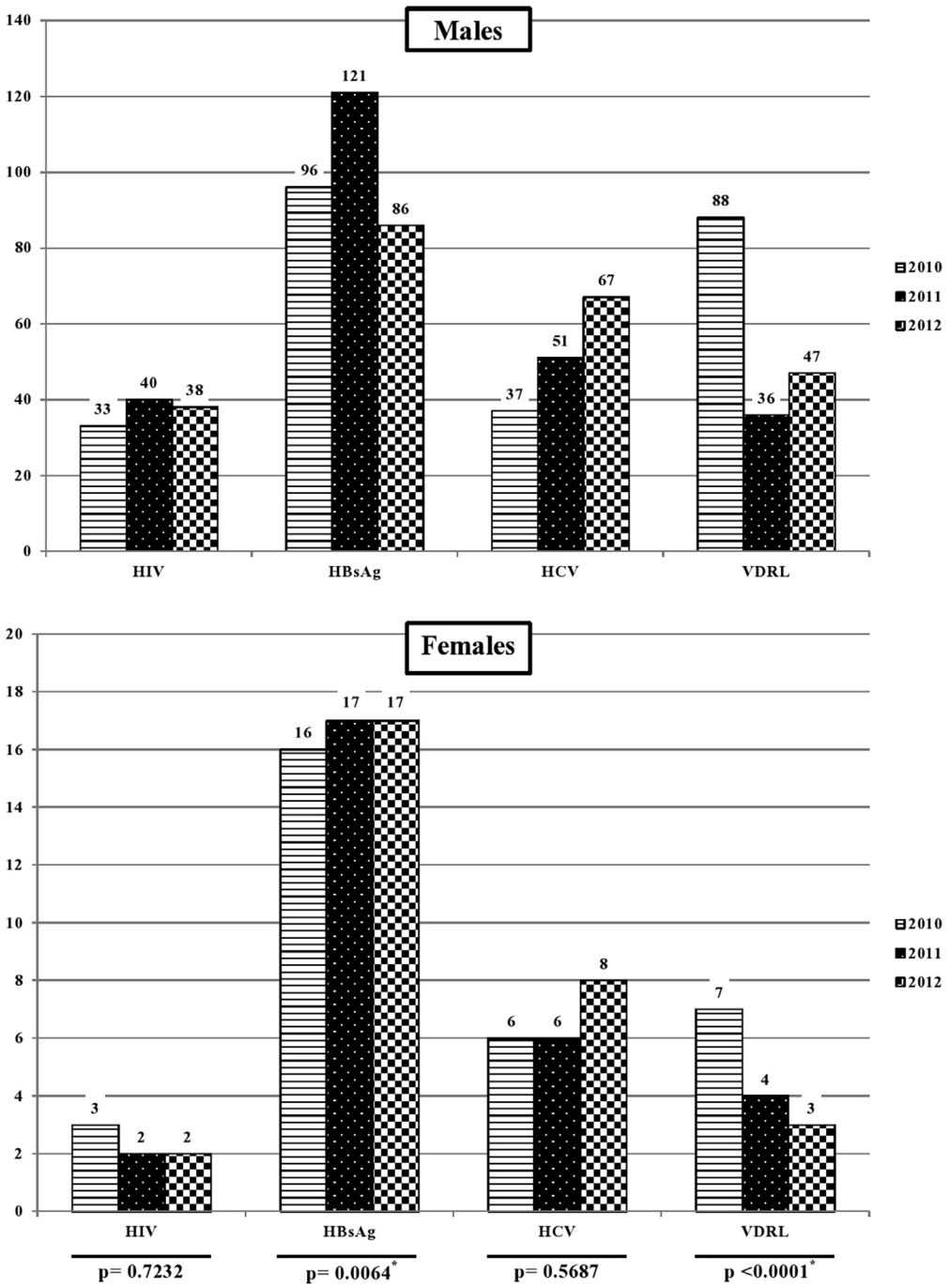

Fig. 3. Sex distribution of TTIs among blood donors.

years age-group. More so, the seroprevalences of HBsAg, HCV and syphilis were more prevalent among 26–45 years aged donors yielding distinct statistical significance.

In the earlier studies, replacement donors frequently outnumbered the voluntary ones.[13] Whatsoever in correspondence to existing worldwide trend, voluntary donors were profusely predominant in discussed study population. The overall serodominance among voluntary donors was overwhelmed by that of replacement donors, conquering a statistically significant difference. This above-mentioned difference in present study reciprocated the results obtained by Kaur et al[27] and Koshy et al.[7]

5. Conclusion

In conclusion, the latest study highlights that blood transfusion is one of the major modes to contact HIV, HBV, HCV and syphilis. Males as much as the voluntary donors overwhelmingly predominate the donor subpopulation in modern world. The voluntary donor strength intimately correlates with the number of blood camps. HBV is the most and HIV the least common TTI affecting blood donors, with a significant downhill tendency in overall seroprevalence through the years. Donors aged between 26 and 35 years are significantly associated with TTIs as good as the replacement donors do. Therefore some immaculate eligibility

criteria should be adopted while selecting blood donors to minimize the transmission of potentially fatal infections, to augment the pool of voluntary donors and to increase the feminine participation in nationalized donation campaigns.

Conflict of interest

None.

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None.

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