

# Seroprevalence of Human Immunodeficiency Virus, Hepatitis B Virus, Hepatitis C Virus, and Syphilis in Blood Donors at District Level Blood Bank in a Teaching Hospital, Mandya, Karnataka

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## ABSTRACT

**Introduction:** Blood transfusion although saving millions of people worldwide each year, transfusion transmitted infections (TTI) posing a great problem in developing countries such as India. With every unit of blood, there is 1% chance of transfusion-associated problems including transfusion-transmitted diseases. Viral infections cause the major part of mortality and morbidity in blood recipients. According to WHO estimate, the lack of effective screening of blood donors results in up to 16 million new infections with hepatitis B virus (HBV), 5 million new infections with hepatitis C virus (HCV), and 160,000 new cases of human immunodeficiency virus (HIV) infections every year. Screening of the blood donors is, therefore, very essential in preventing TTI's.

**Purpose:** Study aims to know the prevalence of serological markers for HIV, HBV, HCV, and Syphilis among the voluntary and replacement blood donors. Furthermore, to know the high risk age group among the blood donors infected with TTI and their sex distribution.

**Materials and Methods:** After obtaining written consent, all the blood samples collected from donors with sterile aseptic precautions. Blood samples were screened for HIV, HBV, HCV by ELISA, and for syphilis by rapid plasma regain test. All the positive samples were retested by rapid Card method. Any sample found to be positive was discarded.

**Results:** Out of total 14520 blood donors, 12432 (85.6%) were voluntary donors and 2088 (14.4%) were replacement donors. A total of 212 samples found to be positive for TTI. Study demonstrated prevalence of HBV infections as 1.06%, followed by HIV as 0.2%, HCV infections as 0.14%, and Syphilis as 0.05%.

**Conclusion:** The study demonstrated overall seroprevalence of TTI to be low, i.e. 1.4%.

**Key words:** Blood donor, Human immunodeficiency virus infection, Hepatitis B, Hepatitis C, Prevalence, Syphilis, Transfusion

## INTRODUCTION

Blood transfusion history dates back about 200 years. The credit of first successful human to human blood transfusion

goes to Dr. James Blundell, an obstetrician, who successfully transfused 8 oz (227 ml) of blood to a patient of postpartum hemorrhage in 1818.<sup>1</sup> In developing countries, the prevalence of transfusion-transmitted disease is much higher and far from attaining a “zero risk” level at the present moment. With every unit of blood, there is 1% chance of transfusion-associated problems including transfusion-transmitted diseases.<sup>2</sup> Viral infections cause the major part of mortality and morbidity in blood recipients. The majority of known cases of post-transfusion hepatitis has been caused by hepatitis B (HBV) or hepatitis C virus (HCV).<sup>1</sup>

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**Month of Submission :** 08-2015  
**Month of Peer Review :** 09-2015  
**Month of Acceptance :** 10-2015  
**Month of Publishing :** 10-2015

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According to WHO estimate, the lack of effective screening of blood donors' results in up to 16 million new infections with HBV, 5 million new infections with HCV, and 160,000 new cases of HIV infections every year. India is the second most populous nation in the world. The Indian subcontinent is classified as an intermediate HBV endemic (HBs Ag carriage 2-7%) zone and has the second largest global pool of chronic HBV infections. India has a population of more than 1.2 billion with 5.7 (reduced to 2.5) million HIV positive, 43 million HBV positive, and 15 million HCV positive persons.

A recent study by Pahuja *et al.* in 2007, revealed alarming high seroprevalence of HIV, anti-HCV, and HBs Ag (0.56%, 0.6%, and 2.23%, respectively) among blood donors of a metropolitan city like Delhi.<sup>3</sup>

The improved screening and testing of blood donors has significantly reduced transfusion-transmitted diseases in most developed countries. This has not been so in developing nations. Poor health education and lack of awareness result in the reservoir of infections in the population.

Only continuous improvement and implementation of donor selection, sensitive screening tests, and effective inactivation procedures can ensure the elimination or at least reduction of the risk of acquiring transfusion transmitted infections (TTIs).

### Purpose of the Study

1. To know the prevalence of serological markers for HIV, HBV, HCV, and Syphilis in blood donors in Mandya District
2. To know the high risk age group among the blood donors infected with TTI
3. To know the percentage distribution of male and female sex among positive screened samples.

## MATERIALS AND METHODS

All apparently healthy adult voluntary donors at blood camps organized by Blood Bank, District Hospital Mandya, Karnataka and replacement donors were taken into the study. Written informed consent was taken. Each donor's name, age, sex, date of birth, permanent address, and contact number were recorded.

A detailed history collected and general physical examination was done. Pulse, blood pressure, Weight, and temperature were recorded for each donor. Any donor with a history of any acute illness in the recent past, tuberculosis, uncontrolled diarrhea, pulmonary disease, recent jaundice, liver disease, cardiovascular disease, and malignancy was noted and excluded.

Any donor with the history of epilepsy, malaria, significant weight loss, unusual, or excessive bleeding and who has recently donated blood within 3 months was excluded. Donors on anti-platelet, anti-epileptic drugs, or anti diabetic drugs were excluded.

Donors below 18 years and above 60 years and women who were menstruating also excluded. Detailed immunization history was also noted. All donors were screened for anemia and for any marks of drug abuse, any skin lesions or active infections at the venipuncture site was also recorded.

Blood was collected with standard aseptic precautions and stored.

A total of 14,520 blood units collected from healthy voluntary and replacement donors during the period from January 2013 to December 2014.

All donor samples were screened for:

- Hepatitis B surface antigen,
- HIV and
- HCV by ELISA, Microlisa-J. Mitra & Co.),
- RPR test for Syphilis by Span Diagnostics Ltd. and
- Malaria by rapid card test (Meriscreen by Meril Diagnostics)
  - All the tests performed according to the manufacturer's guidelines
  - All the reactive samples were repeated in different test with different principle before labeling them seropositive
  - The donated blood discarded whenever the donor sample was found positive for any TTI
  - The statistical analysis was done using the  $\chi^2$  test.

## RESULTS

Following screening of all blood donors results were Table 1.

Table 1 shows year-wise distribution of voluntary blood donors and replacement donors.

Out of total (14520) blood donors, majority, i.e. 85.6% (12432) were voluntary donors and 14.4% (2088) were replacement donors.

**Table 1: Year-wise distribution of blood donors**

| Year  | Total blood donors | Voluntary donors (%) | Replacement donors (%) |
|-------|--------------------|----------------------|------------------------|
| 2013  | 7398               | 5908 (79.9)          | 1490 (20.1)            |
| 2014  | 7122               | 6524 (91.6)          | 598 (8.4)              |
| Total | 14520              | 12432 (85.6)         | 2088 (14.4)            |

Table 2 shows the distribution of TTI in various age groups. Figure 1 shows distribution of TTI in different age group blood donors.

Of the total 14520 blood samples screened, 212 (1.4%) samples were positive for TTI. Overall percentage was 1.4%.

The majority of donors, i.e. 48 (69.8%) positive samples were from the age group 18-30 years. Next common age group was 31-45 years which were 60 (28.3%). Among both the age groups, hepatitis B infection was predominant.

Figure 2 shows percentage distribution of blood donors by sex. 98% were males, and 2% were females.

Figure 3 shows number-wise distribution of various TTIs in positive samples among blood donors.

Table 3 shows percentage distribution of TTI in voluntary blood donors and replacement donors.

Figure 4 shows percentage prevalence of TTI in voluntary donors

Figure 5 shows percentage distribution of TTI in replacement donors

**Table 2: Age-wise distribution of TTI in blood donors**

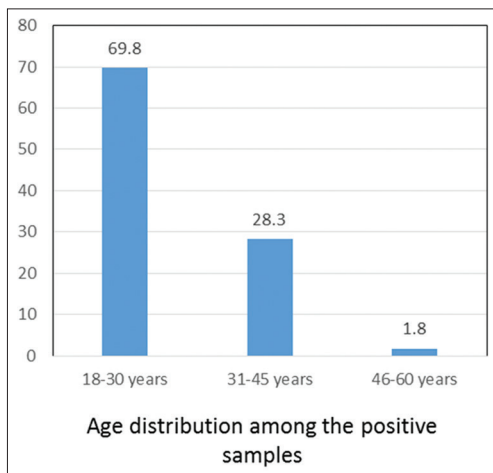
| Age group (years) | HIV (%)          | HBV (%)           | HCV (%)        | RPR (%)        | Total      |
|-------------------|------------------|-------------------|----------------|----------------|------------|
| 18-30             | 23               | 108               | 13             | 4              | 148 (69.8) |
| 31-45             | 6                | 42                | 8              | 4              | 60 (28.3)  |
| 46-60             | -                | 4                 | -              | -              | 4 (1.8)    |
| <b>Total</b>      | <b>29 (13.6)</b> | <b>154 (72.6)</b> | <b>21 (10)</b> | <b>8 (3.8)</b> | <b>212</b> |

TTI: Transfusion transmitted infections, HBV: Hepatitis B virus, HCV: Hepatitis C virus, HIV: Human immunodeficiency virus

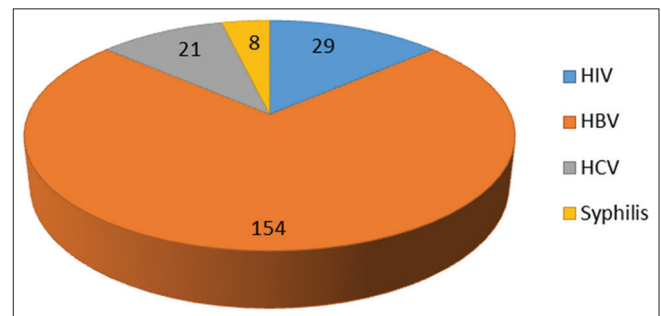
**Table 3: Percentage distribution of TTI in voluntary blood donors and replacement donors**

| TTI          | Number of voluntary donors (%) | Number of replacement donors (%) | Total (%)  |
|--------------|--------------------------------|----------------------------------|------------|
| HIV          | 27 (14.8)                      | 2 (6.9)                          | 29         |
| HBV          | 129 (70.5)                     | 25 (86.2)                        | 154        |
| HCV          | 19 (10.4)                      | 2 (6.9)                          | 21         |
| Syphilis     | 8 (4.3)                        | 0                                | 8          |
| <b>Total</b> | <b>183 (100)</b>               | <b>29 (100)</b>                  | <b>212</b> |

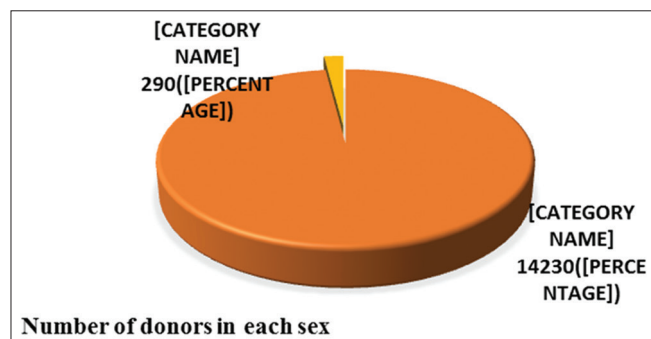
TTI: Transfusion transmitted infections, HBV: Hepatitis B virus, HCV: Hepatitis C virus, HIV: Human immunodeficiency virus



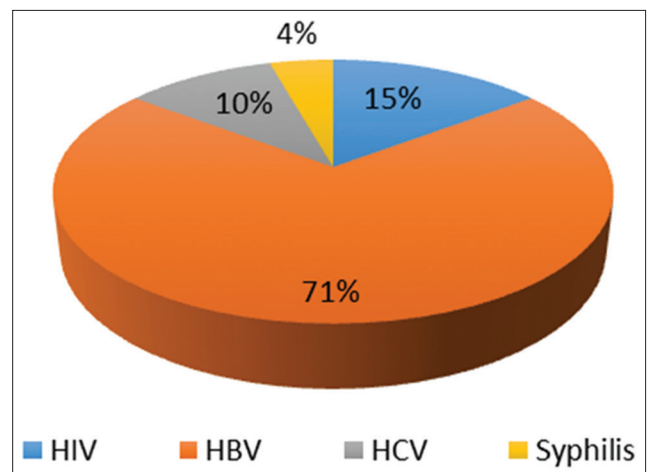
**Figure 1: Percentage distribution positive samples among age groups**



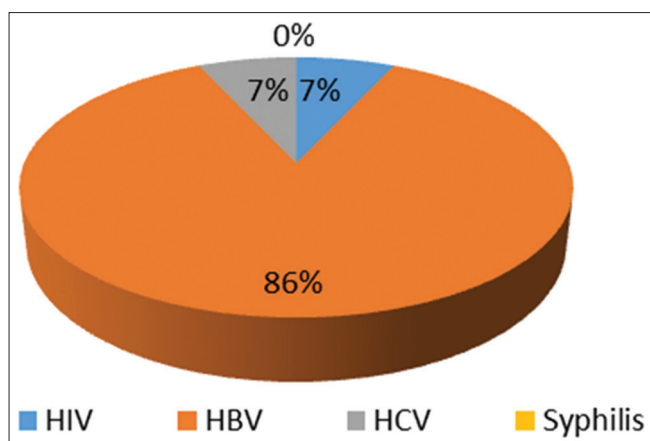
**Figure 3: Distribution of various transfusion transmitted infections in positive samples among blood donors**



**Figure 2: Percentage distribution of blood donors by sex**



**Figure 4: Percentage prevalence of transfusion transmitted infections in voluntary donors**



**Figure 5: Percentage distribution of transfusion transmitted infections in replacement donors**

In our study, the majority of samples were positive for hepatitis B infections 154 (72.6%), followed by HIV infection 29 (13.6%), HCV infections 21 (10%), and Syphilis 8 (3.8%) in that order, out of total 212 positive samples.

In our study, overall prevalence of hepatitis B infections was 1.06%, followed by HIV 0.2%, HCV 0.14%, and Syphilis 0.05%, respectively, out of total 212 positive samples.

Voluntary donors were positive in 183 (86.3%) cases, and replacement donors were positive in 29 (13.7%) cases.

Prevalence of HBV infection was more (86.2%) among replacement donors compared to 70.5% in voluntary donors.

## DISCUSSION

Blood-borne infections are serious problems encountered in blood transfusion. Transfusion related infections have been averted in developed countries by reducing unnecessary transfusions. By using only regular voluntary donors and excluding donors with specific risk factors, this problem can be minimized. Systematic screening of all donated blood for infection also helps in addressing TTI. In contrast, in many developed countries, these interventions are applied uniformly, and the risk of TTI found to be low.

In our study, out of 14520 blood donors, 85.6% (12432) were voluntary donors and 14.4% (2088) were replacement donors, which is similar to the study done by Dr. Shah, *et al.*<sup>4</sup>

We can attribute the increase in voluntary donors to the increasing public awareness and involvement of government bodies like National AIDS Control Organization (NACO) who actively propagate voluntary donation in our country.

However, in a study by Makroo, *et al.*<sup>4</sup> and Arora, *et al.*<sup>5</sup> replacement donors constitute the largest group of blood donors in India, similar findings were reported by other studies.<sup>7-11</sup>

In our study, 98% donors were males, and 2% were females which are similar to other studies. In our study, among the positive samples 69.8% belong to the age group of 18-30 years, and 28.3% belong to 31-45 years age group, which was similar to other studies.

In our study, of the 14520 blood samples screened, 212(1.4%) samples were positive for TTIs, but in a study by Lathamani, *et al.* it was found to be 0.82%.<sup>12</sup>

In our study, the overall prevalence of HBV, HIV, HCV, and Syphilis was 1.06%, 0.2%, 0.14%, and 0.05%, respectively, of total 212 positive samples. Seroprevalence of hepatitis was commonest among the TTI, 70.5% in voluntary and 86.2% in replacement donors.

In a study by Shah, *et al.*, seroprevalence of HIV, HBV, HCV, and syphilis was found to be 0.15%, 0.9%, 0.1%, and 0.2%, respectively. Overall seroprevalence was more in replacement blood donors than that in voluntary blood donors.<sup>4</sup>

In a study in Haryana by Arora, *et al.*, seroprevalence of HIV, HBs Ag, HCV, and syphilis was 0.3%, 1.7%, 1.0%, and 0.9%, respectively. No voluntary donor was found to be HIV positive. The seroprevalence of hepatitis and syphilis were more in replacement donors as compared to voluntary donors.<sup>6</sup>

A study by Singh, *et al.* showed the prevalence of HBs Ag and anti-HCV antibodies was 1.8% and 0.5%, respectively. 83.6% were replacement donors. The prevalence of HBs Ag and anti HCV antibodies ranged between 1.7-2.2% and 0.25-0.9%, respectively, among the donors.<sup>7</sup>

In a study by Pahuja, *et al.*, prevalence of HIV, HBV, and HCV was found to be 0.56%, 2.23%, and 0.66%, respectively. Of all the TTIs, they found a significant decreasing trend for HCV, but not for HIV and HBV infections.<sup>8</sup>

Thakral, *et al.* in her study of seroprevalence of HCV in blood donors, found it to be 0.44%. Interestingly, there was no history of blood transfusion in any of these donors. They concluded that HCV-positive donors should be informed about their disease, counseled and referred to hepatologist, and prevented for future donations permanently.<sup>9</sup>

In their study of HIV infections in blood donors, by Makroo, *et al.* prevalence of HIV was 0.25%. Of the donors

that were tested positive for HIV, 97.4% were males and 2.6% were females. A high rate of HIV positivity, 54.9% was seen in the age group of 18-30 years and 31-40 years age group showed the second highest rate of HIV positives (27.7%).<sup>10</sup>

Lathamani, *et al.* in their study found prevalence of HIV as 0.08%, HBV as 0.5%, HCV as 0.098%, and syphilis as 0.09%.<sup>12</sup>

Garg, *et al.* in their study found prevalence of HIV as 0.44%, HBV as 3.44%, HCV as 0.25%, and syphilis as 0.22%.<sup>13</sup>

Jashim, *et al.* in Bangladesh, found the prevalence of HIV as 0.135%, HBV as 1.4%, HCV as 0.13%, and syphilis as 0.46%.<sup>14</sup>

Bhattacharya, *et al.* in their study found the prevalence of HBV as 1.66%, HIV as 0.35%, HCV as 0.35%, and syphilis as 0.8%. Serious concerns were raised regarding the safety of the blood supply in the community, even after donors were screened for HBs Ag. Transfusion associated HBV infection in India was estimated to be approximately 50% or more in patients who have received a multiple transfusion. They found that in apparently healthy individuals absence of HBs Ag in the blood may not be sufficient to ensure lack of circulating HBV. Blood containing anti-HBc antibodies with or without detectable presence of HBs Ag might be infectious. They suggest that routine anti-HBc screening of blood donations could prevent some transfusion transmitted HBV infections.<sup>15</sup>

The safest blood donors for sustainable blood supply are voluntary, non-remunerated blood donors from low-risk populations. In the key global fact and figures in 2011 (Fact sheet number 279, in 62 countries, national blood supplies are based on 100% or almost 100% (more than 99.9%) voluntary unpaid blood donations. Forty countries collect less than 25% of their blood supplies from voluntary unpaid blood donors. The World Health Organization's (WHO) goal is for all countries to obtain all blood supplies from voluntary unpaid donors by 2020 in accordance with World Health Assembly resolution 28.72, which was adopted in 1975.

World Health Organization and the International Federation of Red Cross and Red Crescent Societies has jointly developed a global framework for action to achieve 100% voluntary blood donation. It is designed to provide guidance and support to countries seeking to establish effective voluntary blood donor programmes, phase out family/replacement blood donation and eliminate paid donation.<sup>16</sup>

Medical history by professional or replacement donors, if concealed pose a great threat to the safe blood supply. Asymptomatic carriers in the society, blood donations during the window period, laboratory errors, and genetic variability in the viral strains also pose problems.<sup>17</sup>

#### Prevention of TTI

- Strategies have been extremely effective, but transmission of diseases still occurs, primarily because of the inability of the test to detect the disease in the “window” phase of their infection
- High cost of screening tests,
- Lack of funds and trained laboratory personnel,
- Genetically variant viruses,
- Non-seroconverting immune silent or chronic carriers and
- Laboratory testing errors.

#### CONCLUSION

Out of 14520 healthy donor samples, 212 cases screened positive. The overall prevalence of TTI's was 1.4%. Voluntary donors forms the majority 85.6% in our study; that shows good awareness among the population. In our study, overall prevalence of HBC, HIV, HCV, and Syphilis was 1.06%, 0.2%, 0.14%, and 0.05% respectively. Among the TTI, HBV was the more common in both voluntary and replacement donors, 70.5% and 86.2%, respectively. Among the positives samples, 98% were males and 2% were females, highest 69.8% were between 18 and 30 years, the second highest 28.3 % were from 31 to 45 age group. Study proves that many apparently healthy blood donors are not safe donors, so extensive donor selection and screening is mandatory. The present study concludes that motivating voluntary blood donors are the most effective way of ensuring adequate supplies of safe blood on a continuing basis.

#### Recommendations

- To reduce the risk of these infections non-remunerated repeat voluntary donor services need to be instituted
- The emphasis must also be laid on voluntary risk reduction, which will require increased awareness and change in the attitude of people
- Sterile aseptic precautions should be followed by medical staff while collecting and performing tests.

Even though the seroprevalence of blood borne infection is low among voluntary blood donors in Mandya, a larger study to generate more accurate estimates of the magnitude of the TTI diseases would be needed. Thus, understanding the demographic data would still reduce the overall burden on health care system.

## ACKNOWLEDGMENT

We sincerely thank Mr. Rafi brother for his support. We also thank Blood Bank staff, and all the laboratory technicians who helped in conducting the tests.

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**How to cite this article:** Ahmed K, Shoba KL, Sumangala B, Samaga MP, Akshantha BS, Shetty NS. Seroprevalence of Human Immunodeficiency Virus, Hepatitis B Virus, Hepatitis C Virus, and Syphilis in Blood Donors at District Level Blood Bank in a Teaching Hospital, Mandya, Karnataka. Int J Sci Stud 2015;3(7):76-81.

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