

## Prevalence of HIV Infection among Blood Donors at a Tertiary Care Centre in Gwalior, India

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### Authors' contributions

This work was carried out in collaboration between all authors. Authors DCS and AJ designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors PW and SR managed the literature searches, analysis of the study performed and the spectroscopy analysis. Authors LT and SB managed the experimental process. Author RG supervised the research work. All authors read and approved the final manuscript.

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### ABSTRACT

**Background:** Transfusion Transmitted Infections (TTIs) threaten safety of the recipients and the community as a whole and are the subject of real concern worldwide. Human immunodeficiency virus (HIV) causes Acquired Immunodeficiency Syndrome (AIDS) which can affect people of any age group. It can be transmitted by sexual intercourse, sharing of needles, transfusion of blood and blood products and vertical transmission from mother to child. There's no complete cure for HIV till date. Incidence among donors reflects the overall disease burden on the society.

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**Aims and Objectives:** The purpose of this study is to estimate the prevalence of HIV infection among the voluntary blood donors at blood bank, J.A hospital, Gwalior Madhya Pradesh, India for a period of eleven years, *i.e.*, from 2004 to 2014.

**Materials and Methods:** A retrospective study was carried out at Blood Bank J.A Hospital & G.R Medical college Gwalior and seroprevalence of HIV infection among blood donors who donated blood from 2004-2014 at Blood Bank was compiled.

**Results:** Out of the total 1, 37,767 donors tested for HIV infection, 266 (0.19%) were found to be HIV sero-positive and prevalence difference of HIV positive according to the year 2004 to 2014 were found to be significantly different. ( $p=0.000002$ ).

**Conclusion:** The prevalence of HIV was 0.19% among blood donors of Gwalior region and showed decline pattern from 2004 to 2014.

*Keywords: Transfusion Transmitted Infections (TTIs); Blood Donor (BD); Human Immunodeficiency Virus (HIV); Acquired Immunodeficiency Syndrome (AIDS).*

## 1. INTRODUCTION

Transfusion of blood and/or its components is a life saving measure but at the same time it has life threatening hazards also and with every unit of blood, there is 1% chance of transfusion-associated problems including transfusion-transmitted diseases [1,2]. Blood transfusion carries the risk of transfusion transmissible infections (TTI), including HIV, Hepatitis B & C, Syphilis and Malaria. Their tests were made mandatory in the year 2001 in India prior to the issue of compatible blood to the patient [3]. Other infections that can be transmitted through blood transfusion are Toxoplasmosis, Brucellosis and some other viral infections like CMV, EBV and Herpes, which are uncommon in India hence, WHO didn't recommend their tests mandatory before transfusion of blood and blood components For Asia Pacific region. Among all infections, HIV and hepatitis are the most dreadful. India has a population of more than 1.2 billion with 5.7 (reduced to 2.5) million Human Immunodeficiency Virus (HIV) positive, 43 million HBV-positive and 15 million HCV-positive people [4]. Human immunodeficiency virus (HIV) was discovered in 1983 by Barre-Sinoussi et al. [5]. HIV is a lentivirus (a subgroup of retrovirus) that causes HIV infection and acquired immunodeficiency syndrome (AIDS) [6,7]. The full pathogenic potential of human retroviruses was not realized until HIV was established as the cause of AIDS in 1984 [8]. AIDS is a condition in humans in which progressive failure of the immune system allows life-threatening opportunistic infections and cancers to thrive [6,7]. Without treatment, average survival time after infection with HIV is estimated to be 9 to 11 years, depending on the HIV subtype [9]. The disease is transmitted by sexual intercourse, sharing of needles, transfusion of blood and blood products and vertical

transmission from mother to child. HIV is present in body fluids in the form of free virus particles and also within infected immune cells. HIV infects vital cells in the human immune system such as helper T cells (specifically CD4+ T cells), macrophages, and dendritic cells [10]. It leads to lowering the level of CD4 + T cells through a number of mechanisms including apoptosis of uninfected bystander cells [11]. The HIV/AIDS epidemic is one of the largest public health crises of the 21<sup>st</sup> century, which has evolved from a mysterious illness to a global pandemic in less than 20 years. In 2007, a total of 33.2 million people were living with HIV with global prevalence of 2.5 million. In India, the estimated number of HIV-infected people was 2.4 million in 2007. Although globally, as well as in India, the predominant mode of HIV transmission is through heterosexual contact, the risk of contracting HIV infection from transfusion of a unit of infected blood is estimated to be over 95% [12]. In 1992, Government of India demonstrated its commitment to combat the disease with the launch of the first National AIDS Control Programme (NACP-I) as a comprehensive programme for prevention and control of HIV/AIDS in India [13]. Responding to the immense challenge of the HIV/AIDS threat in India, National AIDS Control Organization (NACO) has a response to increase access to services and effectively communicate for behavior change. With continuous efforts, today we stand at the beginning of NACP IV [14]. In 2010, NACO approved the Teach AIDS curriculum for use in India, an innovation which represented the first time that HIV/AIDS education could be provided in a curriculum which did not need to be coupled with sex education [15].

According to HIV sentinel surveillance (HSS) 2012-2013, the overall HIV prevalence among

ANC clinic attendees, considered a proxy for prevalence among the general population, continues to be low at 0.35% in the country, with an overall declining trend at the national level. The highest prevalence was recorded in Nagaland (0.88%), followed by Mizoram (0.68%), Manipur (0.64%), Andhra Pradesh (0.59%) and Karnataka (0.53%). Also, States like Chhattisgarh (0.51%), Gujarat (0.50%), Maharashtra (0.40%), Delhi (0.40%) and Punjab (0.37%) recorded HIV prevalence of more than the national average. Decline in HIV prevalence has been recorded among Female Sex Workers at national level (5.06% in 2007 to 2.67% in 2011), among Men who have Sex with Men (7.41% in 2007 to 4.43% in 2011) and Stable trends have been recorded among Injecting Drug Users at national level (7.23% in 2007 to 7.14% in 2011) [16].

## 2. MATERIALS AND METHODS

This study was carried out at Blood Bank, Department Of Pathology, Gajra Raja Medical College, Gwalior (Madhya Pradesh), India. Donors were screened by trained personnel after satisfactory completion of the donor's questionnaire, their physical examination and hemoglobin (Hb %) estimation. A total of 1, 37,767 blood units from the selected donors were collected over a period of eleven years (1st January 2004 to 31<sup>st</sup> December 2014). These donors were Voluntary Donors (VD) and Replacement Donors (RD). Replacement donors were those donors who donated blood for ailing patients and were family members, close relatives and friend's of recipient. The Voluntary donations were obtained from walk in donors and in voluntary blood donation camps organized by different institutions, neighboring colleges, different social and political organizations. Professional and paid donors were carefully eliminated. Written consent from the donor was also taken prior to blood donation. Three ml blood in plain vial and 2 ml blood in EDTA (ethylene diamine tetra acetic acid) vial taken from the satellite bag. All samples were screened for HIV and other Transfusion transmitted diseases. Test for HIV I and II was performed by following commercially available ELISA and card test kits in last 11 years:

1. Rapid card test HIV: an immunochromatography method (J. Mitra & Co. Pvt. Ltd.)
2. Rapid card test HIV: Alere true line, make: Standard Diagnostic

3. Rapid card test HIV: Alere true line, make Standard Diagnostic
4. Microlisa for HIV I & II: Third Generation (J. Mitra & Co. Pvt. Ltd.)
5. Microlisa for HIV I & II: Third generation (SD Bio Standard Diagnostic Pvt LTD.)
6. Elisa HIV I & II: Fourth generation, antibodies & P24 antigen detection (Meril Diagnostic):

Presently, we are doing fourth generation Elisa and card test for detection of HIV.

Confirmation of all the Positive and every 20<sup>th</sup> Negative test results was done by State Reference Laboratory (SRL), Department of Microbiology, G. R. Medical College, Gwalior and National Reference Laboratory (NRL), National Institute of Immunohaematology (NIH), K.E.M. Hospital, Parel, Mumbai, India. The blood unit was discarded as per guidelines of NACO, whenever the pilot donor samples were found positive for any TTI. All HIV positive cases were traced and send to Integrated counselling and testing centre (ICTC) Department of Microbiology, G. R. Medical College, Gwalior for confirmation and counselling. From there Patients refer to anti-retroviral therapy (ART) Centre, Out Patient Department (OPD), J. A. Hospital, Gwalior for CD4 count and antiretroviral therapy.

The HIV data of past eleven years was retrieved and results were analyzed in the present study and have been compared statistically by frequency distribution and percentage proportion. Chi square ( $X^2$ ) test was applied to know the significant (*p value*) ratio of difference statistically.

## 3. RESULTS

Blood from 1, 37, 767 apparently healthy donors aging 18-60 years was collected during the study period. Male to Female donor's ratio in the study was 96.2% (1, 32,470) and 3.8% (5297). Out of 1, 37,767 donors, 94,092 (68.2%) were Voluntary blood donors while 43,564 (31.6%) were relative blood donors (Table No. 1).

Increasing trend in voluntary blood donation was reported from the year 2004 to 2014 (Table No. 1 and Fig. 1).

A total number 1, 37,767 blood donors were tested out of which 266 (0.19%) were positive for HIV infection (Fig. 2). Decreasing Pattern of seropositivity incidence of HIV was reported in

the present study from 2004-2014 (Fig. 3 and Table no. 1).

#### 4. DISCUSSION

It is obvious from the result that blood donation in females is markedly less than males in our study because of the fact that a large population of the females in India are usually underweight and anemic according to the donor's selection criteria. And also due to traditional thinking of Indian society. Many studies in Africa reported a male dominance in blood donation programs (71.2% in Burkina Faso) and (90% in Ghana) [17-18]. Our results are in agreement with previous report among blood donors in India which indicated that female gender is less disposed to blood donation [19]. In our study 96.2% donors were males and 3.8% were females. There's a wide range of male: Female voluntary donation ratio geographically. To minimize the gap between the demand and supply of blood/blood components in India (Blood Demand 8.5 million unit/ year requirement and availability is only 4.4 million units/year; Gap 48%) [20], female gender participation in blood donation should be ensured.

One decade ago i.e. in 2004 our voluntary blood donation was only 15.2%. At that time blood was mostly collected from relative donors or/ & from directed donation which increased drastically in 2014 i.e. 90.9%. There's steep rise between the

years 2007-2009 which was 38.5% to 91.3%. Increase in voluntary donors may be attributed to the increasing public awareness and involvement of Government bodies like NACO that actively propagate voluntary blood donation in our country. Since 2009 voluntary blood donation attained a stabilized percentage which is approximately 90% till date. This effort improved the quality of blood component, blood transfusion services and is one of the major factors in controlling and reducing the prevalence of HIV infection in the society. Overall, voluntary versus relative donors are 68.2% and 31.6% respectively. In 2004 voluntary versus replacement donors were 15.2% & 84.8% which reversed in 2009 to 91.3% and 8.7% while national data is still 52% [20]. It has been accepted internationally that prevalence of transfusion-transmitted diseases is much lower in healthy voluntary non-remunerated blood donors [21]. Voluntary unpaid blood donors are the foundation of a safe blood supply because they are usually assumed to be associated with low levels of transfusion-transmitted infection (TTI), including HIV and hepatitis viruses. Voluntary blood donors consider themselves to be healthy, have no infections to their knowledge and come to the blood bank with the intention of helping someone [22]. Voluntary blood donation was not improved after the efforts of WHO in underdeveloped countries like Kenya which reported 64% voluntary and 36% relative blood donors [23].

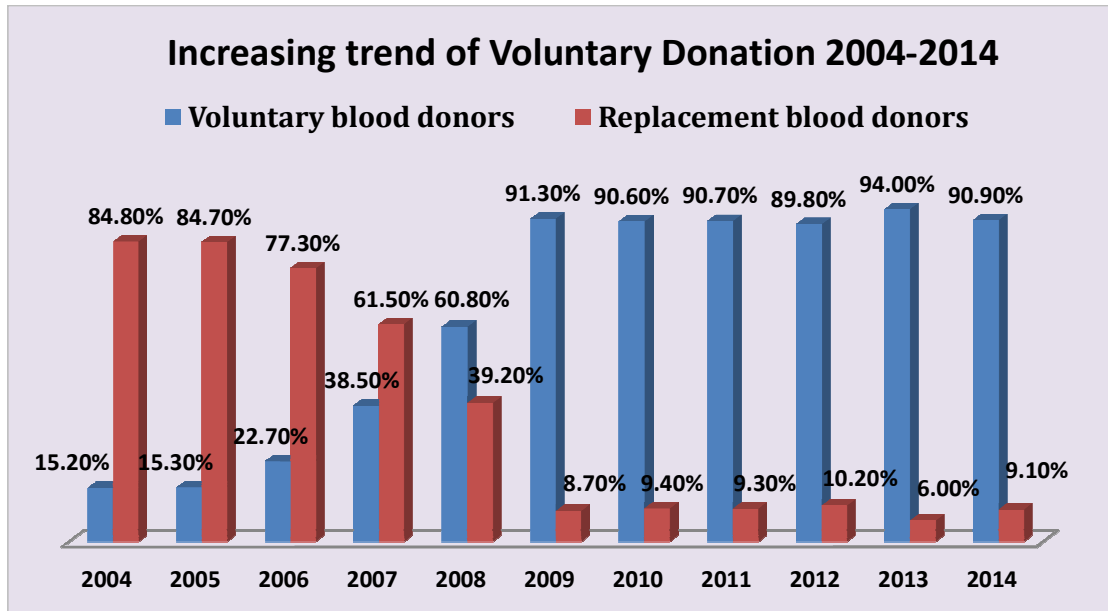
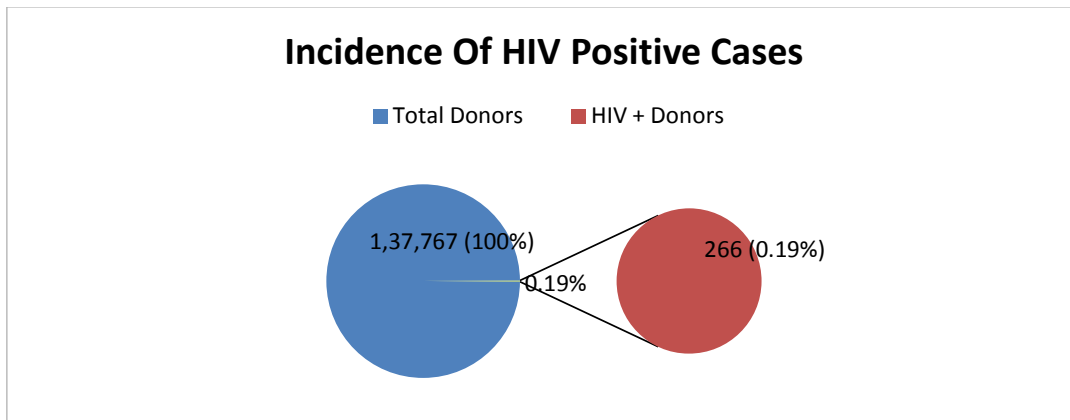


Fig. 1. Trend of voluntary blood donation in past eleven years

**Table 1. Blood donations, HIV reactivity and categories of blood donors'**

Year	Total blood donations	HIV reactive	Voluntary vs replacement donor	
			Voluntary blood donors	Replacement blood donors
2004	7,900	28(0.35%)	1,201 (15.2%)	6,699 (84.8%)
2005	8,201	30(0.36%)	1,254 (15.3%)	6,947 (84.7%)
2006	11,366	33(0.29%)	2,528 (22.7%)	8,838 (77.3%)
2007	14,461	48(0.33%)	5,580 (38.5%)	8,881 (61.5%)
2008	12,946	25(0.19%)	7,878 (60.8%)	5,068 (39.2%)
2009	12,914	20(0.15%)	11,788 (91.3%)	1,126 (8.7%)
2010	12,638	16(0.12%)	11,449 (90.6%)	1,189 (9.4%)
2011	13,106	17(0.12%)	11,886 (90.7%)	1,220 (9.3%)
2012	14,001	25(0.17%)	12,573 (89.8%)	1,428 (10.2%)
2013	14,473	13(0.09%)	13,613 (94.0%)	860 (6.0%)
2014	15,761	11(0.06%)	14342 (90.9%)	1,308 (9.1%)
Total	137767	266(0.19%)	94,092 (68.2%)	43,564 (31.6%)



**Fig. 2. Prevalence of seropositivity in the study**

Overall prevalence of HIV in our study is 0.19%, which is similar to studies by Mathai et al. in Kerala [24], and Chandra et al. in Uttar Pradesh [25] while study reported by Ramanamma et al in Vishakhapatnam [26] and Kulkarni et al. in Mumbai [27] showed higher prevalence in their respective study whereas prevalence among the general population is 0.35% in our country [20]. In our study, prevalence of HIV showed decline pattern (Table 1 and Fig. 3) as it was 0.35% in 2004 which was sustained with minor variations up to the year 2007. In 2008 there was a substantial decrement in the prevalence i.e. 0.19%. After that there is a to & fro variation in the prevalence and finally in 2014 it was 0.06%. From 2004 to 2014 downfall linearity is reported in HIV prevalence which is explained in Fig. 3.

The Indian government has organized rigorous campaigns against AIDS along with numerous awareness and educational programme throughout the country which is responsible for

the decrease in prevalence rate of HIV infection in the past 10 years, low literacy level and migration in northeastern and southern region of India HIV is now most commonly concentrated in these areas[13]. HIV infection has a high prevalence rate in sub Saharan Africa with a prevalence of 17.9%. South Africa has the highest epidemic of any country, the remaining countries in southern Africa has a prevalence rate of 10-15% [28]. Multiple partners, unemployment & labor migration are considered the major causative factors of the high incidence rate of HIV infection in this area [29,30].

Countries such as Afghanistan and Cape Verde are reported to have the lowest prevalence of the disease i.e. less than 0.1% of their populations [31]. The low prevalence of HIV in general populations of Middle East and North Africa has been attributed in part to the region's religious and cultural norms, which discourage premarital sex and include the universal practice of male circumcision.

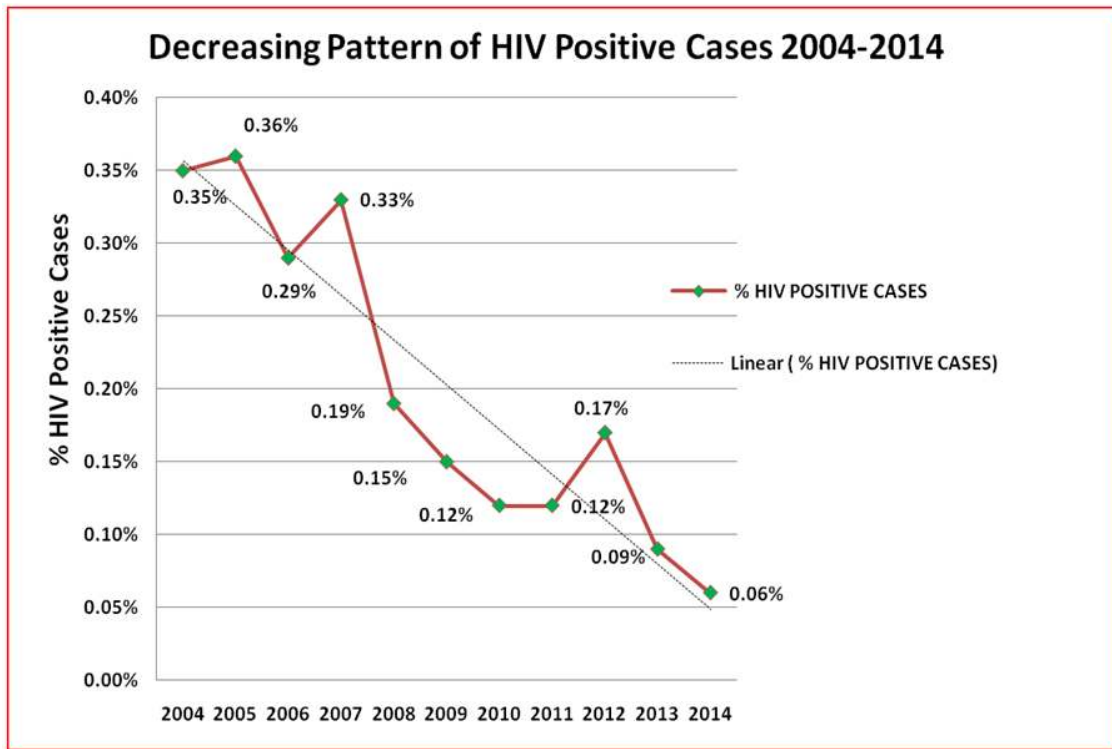


Fig. 3. Decreasing pattern of HIV positive cases from 2004-2014

## 5. CONCLUSION

From the present study it can be concluded that there is an increasing trend of voluntary donation with a male predominance. It can also be seen from the above data that there's a marked fall in the prevalence of HIV infection in the past decade i.e. from 2004-2014 which could be due to the various awareness, educational programs and campaigns run by The Government of India.

## CONSENT

The authors declare that written informed consent was obtained from the patients before being recruited for this research.

## ETHICAL APPROVAL

All author(s) hereby declare that all procedure have been examined and approved by the appropriate ethics committee of Gajra Raja Medical College, Gwalior, India and research have therefore been performed in accordance with the ethical standards laid down in the 1964 declaration of Helsinki.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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