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# Seroprevalence of Human Immunodeficiency Virus (HIV) Among Blood Donors in Jos - Nigeria

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## 1. Introduction

Human immunodeficiency virus (HIV), the causative agent of Acquired immunodeficiency syndrome (AIDS) is found in pandemic proportions globally (Osmond and Dennis, 1994). HIV is a scourge, progressing and causing devastation to lives and the healthcare system worldwide (Carpenter et al, 2000). HIV accounted for 38.6 million infections worldwide at the end of 2005. As at 2003, there were about 5.0 million people infected with HIV in Nigeria, giving a national prevalence rate of 5.0% (Federal Ministry of Health, 2004). Infection with HIV occurs through the transfer of infected blood, semen, vaginal fluid, pre-ejaculate, or breast milk. The four major routes of transmission are unprotected sexual intercourse, contaminated blood transfusion, breast milk, transmission from an infected mother to her baby at birth (vertical transmission) (<http://en.wikipedia.org/wiki/HIV>). Millions of lives are saved each year through blood transfusion. Nonetheless people have a risk of becoming infected with HIV through transfusion of infected blood and blood products. Transmission of HIV and other blood-borne infections can occur during transfusion of blood components (ie, whole blood, packed red cells, fresh-frozen plasma, cryoprecipitate, and platelets) derived from the blood of an infected individual (Donegan et al, 1994). Depending on the production process used, blood products derived from pooled plasma can also transmit HIV and other viruses, but recombinant clotting factors cannot (Berkman et al, 2000) This chapter discusses the transmission of HIV through blood products; prevalence; risk of acquisition through blood transfusion, the current estimated safety of blood components and control measures.

## 2. HIV infection transmitted during blood transfusion

HIV infection resulting from blood transfusion has been documented repeatedly since the first case report in late 1982 (Curran et al, 1984). HIV transmission through unsafe blood accounts for the second largest source of HIV infection in Nigeria (Federal Ministry of Health, 2009). Not all Nigerian hospitals have the technology to effectively screen blood and therefore there is a risk of using contaminated blood. The Nigerian Federal Ministry of Health have responded by backing legislation that requires hospitals to only use blood from the National Blood Transfusion Service, which has far more advanced blood-screening technology (Nigeria Exchange, 2008).

### 3. Prevalence of HIV infection among blood donors

The prevalence of HIV infection among blood donors varies from one geographical location to another and can provide a reasonable 'proxy' for HIV infection levels in a larger adult population (WHO/UNAIDS, 2000).

As of January 2004 to December 2008, a total of 15,569 blood donors have been screened for HIV antibodies in Jos University Teaching Hospital of which 1070 were positive, giving a seroprevalence rate of 6.9% (Egesie et al, 2011) as shown in table 1. A fluctuating course in the seroprevalence of HIV among blood donors was observed for the period under review. This finding is in agreement with the study by Hassan et al (2008) in Kaduna, North-western Nigeria and the work by Fasola et al (2009) in Ibadan, South-west Nigeria.

Year	Total number screened	Positive	Negative
2004	1473(100%)	95(6.4%)	1378(93.6%)
2005	4547(100%)	294(6.5%)	4253(93.5%)
2006	3299(100%)	184(5.6%)	3115(94.4%)
2007	1443(100%)	61(4.2%)	1382(95.8%)
2008	4807(100%)	436(9.1%)	4371(90.9%)
Grand Total	15,569	1070	14499

Table 1. Blood donors screened for human immunodeficiency virus in Jos

This prevalence rate obtained in Jos is higher than the 0.08% found by Gupta et al (2004) in their study among Indian blood donors. It is also much higher than the 0.004% found by Bhatti et al (2007) in Karachi among Pakistani donors, and the 0.00009% found by Khan et al (2002) in Peshawar among Pakistani donors. These prevalence rates are shown in table 2 below.

Location	Prevalence (%)
Peshawar (Pakistan)	0.00009
Karachi (Pakistan)	0.004
India	0.08
Kenya	5.8
Tanzania	8.7

Table 2. Prevalence of HIV among blood donors in other parts of the world

The HIV infection rate in this study is also higher than 1.0% in the work of Ejele et al (2005) in Port Harcourt, South-south Nigeria; the 3.1% found by Fiekumo et al (2009) in Osogbo, South-west Nigeria; the 3.9% found by Esumeh et al (2003) in another study in Benin city, South-south Nigeria; the 5.8% in the works of Chikwem et al (1997) in Maiduguri, North-eastern Nigeria and that of Abdalla et al (2005) among Kenyan donors. Furthermore, Fasola et al (2009) found an infection rate of 7.7% among their donors in Ibadan, Southwestern Nigeria while Matee et al (1999) in their work among Tanzanian donors, and Kagu et al (2005) in their work in Nguru, North-eastern Nigeria found an HIV infection rate of 8.7%. (Table 3)

Location	Prevalence (%)
Port Harcourt	1.0
Osogbo	3.1
Benin City	3.9
Maiduguri	5.8
Ibadan	7.7
Nguru	8.7

Table 3. Prevalence of HIV among blood donors in other parts of Nigeria

The wide differences in the HIV infection rate among the blood donors in the different regions within Nigeria, and even those outside Nigeria may be due to the differences in geographical locations, age range of donors, sample sizes, the period of time the studies were carried out, and the different socio-cultural practices such as sexual behavior, marriage practices, circumcision, scarification, tattooing etc which take place in these regions. Access to healthcare services and the laboratory test reagent kits used may also be contributory factors.

The high prevalence of HIV infection among blood donors has heightened the problems of blood safety in Nigeria. The implication of HIV in voluntary blood donors is the risk of transmission of these infections to recipients of blood and blood products as safe blood will be more difficult to get. . It also reflects the prevalence of the infection in the general population from which these blood donors are drawn.

An unsafe blood transfusion is very costly both in terms of human and economic costs. Morbidity and mortality resulting from the transfusion of infected blood have far-reaching consequences, not only for the recipients themselves, but also their families, their communities and the wider society (WHO, 2002 and 2007). Since a person can transmit HIV infection during the asymptomatic phase, it can contribute to an ever-widening pool of HIV infection in the wider population. From the study in Jos-Nigeria, it was observed that HIV infection was found among the 20-39 years age range. This finding is in agreement with the study by Ejele et al (2005) in which higher prevalence of transfusion-transmissible viral infections were observed among youths. This observation is worrisome since the most productive and economically viable age group of the populations is worst hit. There is the urgent need for renewed intensification of preventive programmes aimed at reducing the scourge of this infection (Olokoba et al, 2010).

In some resource-rich countries, testing of donated blood for HIV antibodies was not immediately initiated for a variety of reasons. France began HIV antibody testing in June 1985, Canada began testing in November 1985, and Switzerland began testing in May 1986. Germany inconsistently tested plasma products between 1987 and 1993, as did Japan in 1985 and 1986. These delays led to criminal investigations in France, Germany, Switzerland, and Japan, which in some cases led to criminal conviction of those persons found to be responsible (Weinberg et al, 2002). At least 20 countries initiated compensation programs for some individuals infected by transfusion of HIV-contaminated blood and blood products.

#### **4. Risk of acquisition of HIV infection through blood transfusion and estimated safety of components**

The risk of HIV transfusion through infected blood products exceeds that of any other risk exposure. Ninety percent of recipients transfused with HIV antibody-positive blood were

found to be HIV infected at follow-up (Donegan et al, 1994). The 90% probability of seroconversion is independent of the age or sex of the recipient, the reason for transfusion, and the type of component transfused (excluding washed red blood cells, which transmit HIV at a lower rate) (Donegan et al, 1990).

HIV infectivity of red blood cell components that were not washed before transfusion decreases as storage time increases. HIV-contaminated red blood cells stored for <8 days are 96% infectious, whereas those stored for >3 weeks are 50% infectious (Donegan et al, 1994). The level of a donor's viremia at the time of donation is also an important determinant of HIV transmission risk, but no other donor characteristics have been found to affect transmission (Busch et al, 1996). Of all transfused patients, half die within 6 months after transfusion from the underlying disease that necessitated the transfusion. Currently, cases involving transfusion of HIV-positive blood do not increase the overall 1-year post transfusion mortality rate of recipients in the United States (Donegan et al, 1994). In Zaire, however, patients transfused with HIV-positive blood are 31% more likely to be dead 1 year after transfusion than are patients transfused with HIV-negative blood (Colebunders et al, 1991). This difference is unexplained but emphasizes the importance of screening blood for HIV in developing countries.

HIV disease due to transfusion progresses in the recipient at rates comparable to those in individuals infected for similar duration but by other routes (Donegan et al, 1986). One report found that a transfusion recipient may develop AIDS more rapidly if the infected blood component comes from a blood donor who develops AIDS soon after the time of the blood donation. Other analyses, however, do not confirm this finding. (Busch et al, 1990) It is more likely that host factors, particularly the recipient's age and immune status, and perhaps other as-yet-undefined cofactors influence the progression to AIDS (Operskalski et al, 1995) The mean time of progression to AIDS is estimated to be 8.2 years for adult transfusion recipients who receive no antiretroviral therapy, with a cumulative prevalence of 20% having AIDS 5 years after infection (Medley et al, 1987). This progression rate may be overestimated, and the mean time to AIDS development underestimated, because these values are based primarily on data from recipients identified because they developed AIDS or because they received blood from donors who subsequently developed AIDS. The data exclude many donors and recipients who have not been identified because they remain asymptomatic.

Transmission of HIV by transfusion has decreased in developing countries since the initiation of voluntary deferral of donors at risk for HIV infection and routine HIV antibody testing of all donations. Continued improvement in donor recruitment practices, donor education, donor screening, and blood testing has resulted in continued decreases in the risk of transfusion transmission of HIV. In 1995, the risk in the United States of HIV-1 transmission per unit transfused was estimated to be between 1 in 450,000 and 1 in 660,000. (Schreiber et al 1996, Lackritz et al, 1995). By 2003, this estimated risk had decreased to between 1 in 1.4 million and 1 in 1.8 million units (Busch et al, 2003).

HIV antibody tests fail to identify HIV-infected blood donated by HIV-infected persons who have not yet seroconverted. Exclusion of donors is voluntary. Interviews with HIV antibody-positive donors reveal that most recognize their risk but fail to exclude themselves. (Cleary et al, 1988) As a result, laboratory efforts to eliminate HIV-infected donors have continued and testing has improved. Currently, HIV antibody tests detect both HIV-1 and HIV-2 and detect antibody approximately 22 days (the "window period") after

the viremic phase of HIV infection begins. Antigen testing for p24, mandated by the U.S. Food and Drug Administration (FDA) in 1996, shortened the window period to approximately 16 days. The nucleic acid amplification test (NAT), which detects HIV-1 RNA in minipools (16-24 donation samples/pool), was introduced in the United States in 1999 and further reduces the window period of potential HIV transmission to 11 days (Goodnough et al, 2003). As of early 2003, three transfusion recipients are known to have become HIV infected by transfusion of HIV antibody-negative, p24 antigen-negative, and HIV NAT-negative blood from two different blood donors (among 25 million donations) ([www.cbsnews.com/stories/2002/07/19/health/main/515694.shtml](http://www.cbsnews.com/stories/2002/07/19/health/main/515694.shtml))

The global perspective is not as bright as that described for resource-rich countries. Worldwide, 75 million units of blood are estimated to be donated annually, compared with 1.5 million donations in Nigeria. Of the 191 WHO member states, only 43% test blood for HIV, hepatitis C, and hepatitis B viruses. Transfusion-transmitted HIV infection is thought to account for 80,000-160,000 infections annually, contributing 2-4% of all cases of HIV transmission (Bharucha, et al, 2002). Only 20% of the world's supply of safe blood is available to countries with 80% of the world's population.

## 5. Control measures

Significant progress has been made globally by a number of countries in reducing HIV prevalence through sound prevention effort. HIV prevention still remains the most effective strategy towards addressing the global AIDS pandemic. It is for this reason that various groups and organizations have instituted foundations and committee as a necessary step towards that goal. (National Agency for the Control of AIDS, 2010)

In Nigeria, various preventive strategies are being carried out. One of the components of such preventive strategies is the blood safety programme. This is particularly important in view of the fact that the risk of transmission of HIV through infected blood is virtually 100% (Roberts et al, 1994).

Transmission of HIV through infected blood and blood products accounts for approximately 10% in African region (Mvere, 2002) and the second largest source of HIV infection in Nigeria (Federal Ministry of Health, 2009).

Blood safety remains an issue of major concern in transfusion medicine in developing countries like Nigeria where national blood transfusion services, appropriate infrastructure, trained personnel and financial resources are inadequate due to poor budgetary allocation to the health sector. Inadequate funding for HIV testing is only a part of the problem.

Specific issues that urgently need to be addressed include the lack of a sufficient volunteer blood donor pool, inadequate blood donor screening information, counseling, and confidentiality.

Implementation of standardized and monitored test manufacturing practices, inclusion of test validation procedures, ongoing staff training, and continuous internal and external quality assessment programs are all necessary components of an effective program to prevent transmission. Moreover, transfusion practices must be monitored locally so that HIV transmission from unnecessary transfusions does not occur.

Since blood transfusion is an important part of modern medicine, safety of blood and blood products remains a global issue. The continuous monitoring of the magnitude of transfusion transmissible infections in blood donors is important for estimating the risk of transfusion

and optimizing infectious diseases transmission (Tessema et al, 2010). Strict selection of blood donors with the emphasis on getting voluntary donors and comprehensive screening of blood donors for HIV and other transfusion transmissible infections using standard methods are highly recommended to ensure the safety of blood for recipient. We therefore recommend the screening of all prospective blood donors for all transfusion transmissible infections. A strict selection criterion for blood donors to exclude those who have multiple sexual partners and those who engage in high risk behaviour and also that blood transfusion should be given only when absolutely indicated.

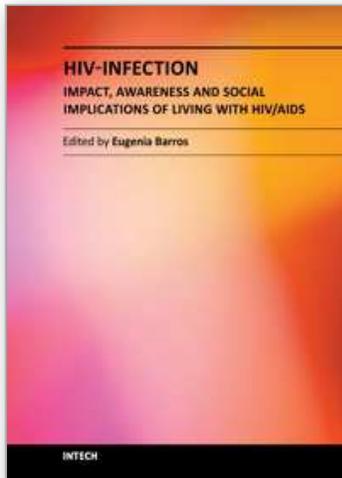
## 6. References

- Abdalla F, Mwanda OW, Rana F (2005). Comparing walk-in and call-responsive donors in a national and a private hospital in Nairobi. *East African Medical Journal*. 82(10):532-536.
- Bhatti FA, Ullah Z, Salamat N, Ayub M, Ghani E (2007). Anti-hepatitis B core antigen testing, viral markers, and occult hepatitis B virus infection in Pakistani blood donors: implication for transfusion practice. *Transfusion*. 47(1):74-79.
- Berkman SA, Groopman JE (1988). Transfusion associated AIDS. *Transfus Med Rev*; 2:18-28.
- Bharucha ZS (2002). Risk management strategies for HIV in blood transfusion in developing countries. *Vox Sang*. Aug;83 Suppl 1:167-71.
- Busch MP, Donegan E, Stuart M, et al (1990). Transfusion Safety Study Group: Donor HIV-1 p24 antigenaemia and course of infection in recipients. *Lancet*;335:1342.
- Busch MP, Kleinman SH, Nemo GJ (2003). Current and emerging infectious risks of blood transfusions. *JAMA*26;289(8):959-62.
- Busch MP, Operskalski EA, Mosley JW, Lee TH, Henrard D, Herman S, Sachs DH, Harris M, Huang W, Stram DO (1996). Factors influencing human immunodeficiency virus type 1 transmission by blood transfusion. Transfusion Safety Study Group. *J Infect Dis*. 174(1):26-33.
- Carpenter CC, Cooper DA, Fischl MA et al (2000). Antiretroviral therapy update and recommendation of the international AIDS society- USA panel. *JAMA*. 28(3):381-390.
- CBS News. HIV-tainted blood infects two in Florida. <http://www.cbsnews.com/stories/2002/07/19/health/main515694.shtml> (accessed March 23, 2003)
- Chikwem J.O, Mohammed I, Okara G.C, Ukwandu, N.C, Ola T.O (1997). Prevalence of transmissible blood infections among blood donors at the University of Maiduguri Teaching Hospital, Maiduguri, Nigeria. *East African Medical Journal*. 74(4):213-216.
- Cleary PD, Singer E, Rogers TF, et al (1988). Sociodemographic and behavioral characteristics of HIV antibody-positive blood donors. *Am J Public Health*; 78:953-957.
- Colebunders R, Ryder R, Francis H, et al (1991). Seroconversion rate, mortality, and clinical manifestations associated with the receipt of a human immunodeficiency virus-infected blood transfusion in Kinshasa, Zaire. *J Infect Dis*; 164:450-456.
- Curran JW, Lawrence DN, Jaffe H, et al (1984). Acquired immunodeficiency syndrome (AIDS) associated with transfusions. *N Engl J Med*; 310:69-75.

- Donegan E, Lee H, Operskalski EA, et al (1994). Transfusion transmission of retroviruses: Human T-lymphotropic virus types I and II compared with human immunodeficiency virus type 1. *Transfusion*; 34:478-483.
- Donegan E, Perkins H, Vyas G, et al (1986). Mortality in the recipients of blood in the Transfusion Safety Study. *Blood*; 68:296A.
- Donegan E, Stuart M, Niland JC, et al (1990). Infection with human immunodeficiency virus type 1 (HIV-1) among recipients of antibody-positive blood donations. *Ann Intern Med*;113:733-739.
- Egesie O.J, Joseph D.E, Egesie U.G, Odeh C.I. (2011). Trends in the incidence of hepatitis B, C and human immunodeficiency virus among blood donors in a tertiary hospital in Nigeria. *J. Med. Tropics*; 13(1) (In press).
- Ejele OA, Erhabor O, Nwauche CA (2005). The risk of transfusion-transmissible viral infections in the Niger-Delta area of Nigeria. *Sahel Medical Journal*. 8(1):16-19.
- Fasola FA, Kotila TR, Akinyemi JO (2009). Trend in transfusion transmitted viral infections from 2001 to 2006 in Ibadan, Nigeria. *Intervirology*; 51:427-431.
- Federal Ministry of Health (2004). Summary of findings from 2003 National HIV seroprevalence survey in Nigeria. Information for policy makers.12-38.
- Federal Ministry of Health (2009) 'National Blood Transfusion Service - About Us'
- Fiekumo I.B., Musa A.M., Jeremiah Z.A (2009). Seroepidemiology of transfusion-transmissible infectious diseases among blood donors in Osogbo, South-west, Nigeria. *Blood Transfusion*.1:1-10.
- Goodnough LT, Shander A, Brecher ME (2003). Transfusion medicine: looking to the future. *Lancet*. 11;361(9352):161-9.
- Gupta N., Kumar V., Kaur A (2004). Seroprevalence of HIV, HBV, HCV, and syphilis in voluntary blood donors. *Indian J Med Sci.*, 58(6): 255-256.  
(<http://en.wikipedia.org/wiki/HIV>)
- Hassan A, Muktar HM, Mamman AI, Ahmed AJ, Isa AH and Babadoko AA (2008). The incidence of HIV among blood donors in Kaduna, Nigeria. *Afr. Health Sc*. 8(1); 60.
- Kagu MB, Kawuwa MB, Ayilara AO, Ali BZ (2005). Seroprevalence of HIV and hepatitis viruses in directed blood donors: a preliminary report. *Highland Medical Research Journal*. 3(2):76-80.
- Khan Z, Raziq F, Aslam N (2002). Prevalence of HIV in N.W.F.P. *Journal of Postgraduate Medical Institute*. 16(2):187-189.
- Lackritz EM, Satten, GA, Aberle-Grasse J, et al (1995). Estimated risk of transmission of the human immunodeficiency virus by screened blood in the United States. *N Engl J Med*; 333:1721-1725.
- Matee MI, Lyamuya EF, Mbena EC, Magessa PM, Sufi J, Marwa GJ et al (1997). Prevalence of transfusion associated viral infections and syphilis among blood donors in Muhimbili Medical Centre, Dar es Salaam, Tanzania. *East Afr Med J*. 76(3):167-171.
- Medley GF, Anderson RM, Cox DR, et al (1987). Incubation period of AIDS in patients infected via blood transfusion. *Nature*; 328:719-721.
- Mvere DA (2002). A strategy for blood safety in the African region. *Afri Health*; 24(5): 9-11.
- Nigeria Exchange (2008) 'Ministry of health alerts Nigerians to the transfusion of unsafe blood in hospitals'

- Olokoba A.B, Tidi S.K, Salawu F.K et al (2010). Human immunodeficiency virus infection in voluntary blood donors in North-Eastern Nigeria. *American Journal of scientific and industrial research*. 1(3):435-438.
- Operskalski EA, Stram DO, Lee H, et al (1995). Human immunodeficiency virus type 1 infection: Relationship of risk group and age to rate of progression to AIDS. *J Infect Dis*; 172:648-655.
- Osmond M, Dennis H (1994). Classification and staging of HIV disease, In *The AIDS knowledge base*. 2nd Ed. Cohen PT, Sande MA, Volberding PA(eds). New York: Little Brown.
- Roberts CR, Longfield JN, Platte RC, Zielmanski KP, Wages J and Fowler A (1994). Transfusion-associated human immunodeficiency virus type1 from screened antibody-negative blood donor. *Arch. Pathol. Lab. Med*;118(12): 1188-1192.
- Schreiber GB, Busch MP, Kleinman SH, et al (1996). The risk of transfusion-transmitted viral infections. *N Engl J Med*; 334:1686-1690.
- Tessema B, Yismaw G, Kassu A, Amsalu A, Mulu A, Emmrich F and Sack U (2010). Seroprevalence of HIV, HBV, HCV and syphilis infections among blood donors at Gondar University Teaching Hospital, Northwest Ethiopia: declining trends over a period of five years. *BMC Infectious diseases*; 10:111. Also available @<http://www.biomedcentral.com/1471-2334/10/111>
- Weinberg PD, Hounshell J, Sherman LA, Godwin J, Ali S, Tomori C, Bennett CL(2002). Legal, financial, and public health consequences of HIV contamination of blood and blood products in the 1980s and 1990s. *Ann Intern Med*. 19; 136(4):312-9.
- World Health Organization (2002). *Blood Safety Strategy for the African Region*. Brazzaville, World Health Organization, Regional Office for Africa (WHO AFR/RC51/9 Rev.1).
- World Health Organization (2007). *Status of blood safety in the WHO African Region: Report of the 2004 Survey WHO Regional Office for Africa, Brazzaville* .1-25
- WHO/UNAIDS (2000). *Guidelines for second generation HIV surveillance*. Geneva, Switzerland: World Health Organization and Joint United Nations Programme on HIV/AIDS.

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## **HIV-infection - Impact, Awareness and Social Implications of living with HIV/AIDS**

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The past few decades have seen the escalation of HIV-infections and the 'frantic' search for new drugs to treat the millions of people that live with HIV-AIDS. However because HIV-AIDS cannot be cured, but only controlled with drugs, and the Antiretroviral (ARV) treatment itself results in some undesirable conditions, it is important to generate wider awareness of the plight of people living with this condition. This book attempts to provide information of the initiatives that have been used, successfully or unsuccessfully, to both prevent and combat this 'pandemic' taking into consideration the social, economic, cultural and educational aspects that involve individuals, communities and the countries affected.

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