

Seroepidemiology of Hepatitis B, C & HIV among Blood Donors in Jos, North-Central Nigeria

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Abstract

Background: Despite current efforts and availability of advanced technology such as nucleic acid amplification testing and Immunoassays, the risk of Transfusion Transmissible viral Infections (TTVIs) continues to exist. In low resource economies, where periodic large scale serosurveillance is impracticable; the use of donor seroprevalence to monitor the trends of epidemiologically significant TTVIs in adult population becomes imperative. This study therefore aimed to determine blood donor profile and seroepidemiology of HIV, HBV and HCV infection status in Jos North-Central Nigeria.

Methods: In this cross sectional study, 510 prospective blood donors were recruited as they presented for donation at the National Blood Transfusion Service centre and Plateau Specialist Hospital Jos. Their blood samples were tested for HbsAg, anti-HCV, and HIV, using a third generation ELISA, by Bio-Rad. Data analyzed with SPSS version 20, associations between categorical variables tested using Chi-square (χ^2) test and $P < 0.05$ was considered significant.

Results: There were 510 respondents, aged 18 to 65 years. Mean age \pm SD was 30.20 \pm 9.10. The overall prevalence of TTVIs was 15.5% which was significantly lower than the 22.1% found in an earlier study. The prevalence of HBV, HIV and HCV were 7.5%, 3.1% and 2.7% respectively, while co infections with HIV/HBV, HIV/HCV and HBV/HCV were 1.6%; 0.2%; and 0.4% respectively. Infection prevalence was observed to be significantly lower in donors with tertiary education.

Conclusion: There was a decline in the prevalence of TTVIs in Jos, North-central Nigeria, and there was a significant association between educational level and blood donation ($P < 0.05$). We recommend a need to sustain the present policies and efforts, donor education and implementation of stringent donor eligibility criteria to further minimize the risk.

Keywords: Seroepidemiology; TTVIs; HIV; HBV; HCV; Jos; Nigeria

Introduction

The application of blood and blood product transfusion in healthcare service delivery as a vital lifesaving procedure is notable and unequivocal. However, blood transfusion still remains an important source of HIV and other Transfusion Transmissible Infections (TTIs) in Sub-Sahara Africa [1]. This and other challenges associated with the use of this vital resource are irrefutable, particularly in the developing economies of the world, where there is still much reliance on whole blood transfusion to manage anaemia cases complicating child birth, childhood infections, malaria, and the prevalent road traffic accidents. In such circumstances, advocacy efforts at provision of safe and adequate blood could not be more apt.

A plethora of factors had conspired against the safety of blood transfusion practice from its early beginning with William Harvey's

experiments on blood circulation in the 17th century. Successive attempts at blood transfusion since then, have given variable, sometimes fatal, results. In recent memory, the greatest threat to blood transfusion safety came in the early 80s with the emergence of Human Immunodeficiency Virus (HIV), and this practice have since been threatened by a number of emerging and re-emerging viral infections. Some of the epidemiologically important Transfusion Transmissible Viral Infections (TTVIs) include Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Hepatitis D Virus (HDV), Human T cell Lymphotropic Virus (HTLV), Human Pegivirus (HPgV). Others include West Nile Virus (WNV), and Cytomegalovirus (CMV) [2].

A total of 33 million of the global population were said to be living with HIV [3]. The prevalence of HIV in Nigeria has varied from 1.8% in 1991 to 3.8% in 1993, 4.5% in 1999, 5.8% & 5.0% in 2003, 4.4% in 2005, 4.6% in 2008 and 4.1% in 2010. Based on this overall national prevalence of 4.1%, it was estimated that 3.1million people in Nigeria

are living with HIV/AIDS in 2010 and about 1.5 million of them require ARV drugs [4]. HBV has been identified as a highly contagious virus, with unpredictable morbidity and lethal consequences. Worldwide, over 2 billion people are infected, of which about 370 million live with the chronic infection and about 2-4 million of the world population are suffering from chronic HBV/HIV co infection. Blood transfusion is recorded as an important mean of transmission of HBV infection, particularly in Sub-Sahara Africa where it is endemic [5]. HCV is said to be endemic in West Africa, [6] and the primary culprit in transfusion-related viral hepatitis globally [7]. There is an estimated 130 million cases of HCV infection world over, and about 4-5 million have HCV/HIV co infection[5].

Blood transfusion practice in Nigeria has been plagued by lots of myths and misconceptions, overdependence on family replacement and remunerated donors as against voluntary non-remunerated donors adjudged to be safer and less risky sources of TTIs, lack of infrastructure, poverty, and endemic corruption. In an attempt to at least reduce the transfusion associated risks, The World Health Assembly (WHA) in her resolutions 28.72, to which Nigeria is signatory, directed member countries to develop national blood transfusion services based on voluntary non- remunerated blood donation and to enact effective legislation governing the operation of blood services and to take other actions necessary to protect and promote the health of blood donors and of recipients of blood and blood products [8].

Transfusion related viral infections are still feared to occur when a donor blood is collected during window period, or if the donor has a variant strain of the infectious agent that may not be detected by the available screening test. The window (seroconversion) period is the period between the primary infection and when infection marker becomes detectable in the blood usually up to 12 weeks after initial infection. Within this period, the individual is infectious [9,10]. In fact, even with a highly advanced assay technique such as Mini-Pooled NAT combined with an integrated donor screening, the diagnostic window period for HIV in the blood donor population was commendably reduced to approximately 10 to 15 days [9, 10]. As good as this may be, the risk is still significant, and all efforts must still be mustered to further lower or completely eliminate this risk. The prevalence of TTIs is said to be higher in low and middle-income countries, than in high-income countries. The median prevalence rate of HIV among blood donors in high-income countries is 0.001%, in comparison with 0.06% and 0.5% in middle and low income countries respectively [11]. Economic and sociodemographic characteristics of the various populations studied may in part, account for the variability in most seroprevalence studies.

This study therefore aims to determine blood donor profile and seroepidemiology of HIV, HBV and HCV infections in our blood donor population.

Methodology

In this cross sectional study, a total of 510 consenting prospective blood donors were recruited through a convenient sampling technique from May 2011 to October 2014, at the National Blood Transfusion Service Centre (NBTS), community blood donor drive centre and Plateau Specialist Hospital blood bank. These centres cater for the blood transfusion needs of the people in the state and other neighbouring states in the North Central zone of Nigeria. Ethical

clearance was obtained from Jos University Teaching Hospital ethical committee.

Methods of blood donation were by voluntary non-remunerated donors through NBTS routine donor drives and replacement blood donation (donors been relatives and friends of patients) for patients admitted at the specialist hospital

The nature and objectives of the study were explained to the donors. Written informed consent was obtained from all participants after detailed explanation was given to them. The study was at no cost to the participants, while the option to opt out of the study at any time was left open to them without any prejudice. The bio-data which include personal and demographic information such as age, sex, weight, blood pressure, haemoglobin levels as well as medical history regarding risk factors and all other relevant pre-donation screening information were collected with the aid of a pretested self-administered questionnaire to the consenting blood donors who met the inclusion or donor eligibility criteria. The criteria for blood donation in this centre include age 18 to 65 years, weight of 50kg or more, haemoglobin level of 12.5 g/dl or more, without a history of HBV, HCV and sexually transmitted infections. There should also be no history of jaundice in the past 1 year. Confidentiality of donor information was also maintained.

Five millilitres (5mls) of venous blood was collected aseptically from each donated unit of blood and emptied into a sterile labelled plain vacutainer tube. The blood was allowed to clot by standing at room temperature and then spun in a centrifuge at 2500 g for 5 minutes to separate the serum. The serum was dispensed into a clean dry glass tube and used to test for HbsAg, anti-HCV, and HIV-1 & 2, using third generation enzyme-linked immunosorbent assays (ELISA); Monolisa HBsAg and anti-HCV ULTRA, and the Genscreen™ ULTRA HIV Ag-Ab manufactured by Bio-..Rad., The test was done following manufacturer's instructions and the results interpreted and documented accordingly.

Statistical Analysis

Data obtained were coded, entered and analyzed with SPSS version 20. The associations between categorical variables were tested using Chi-square (χ^2) test. $P < 0.05$ was considered significant.

Results

A total of 510 respondents were recruited for the study. The age range of respondents was 18 to 65 years with mean age of 30.20 ± 9.10 . Males ($n=378$; 74.1%), constituted the majority, while females accounted for 132(25.9%) with male to female ratio of 2.9:1 [Table 1]. The highest number of blood donors was in the 18-25 ($n=194$; 38.0%), and 26-33 ($n=184$; 36.1%) years age brackets. The age groups 50-57 and 58-65 years had the least number of blood donors ($n=24$; 4.7%) and ($n=4$; 0.8%) respectively [Table 1]. Those with tertiary education ($n=385$; 75.5%) were the highest respondents, while those with informal education ($n=14$; 2.7%) constituted the least [Table 1]. In occupation, students ($n=347$; 68.0%) were the majority, while health workers ($n=25$; 4.9%) had the least number of blood donors [Table 1].

	n (%)	Infection Status. n (%)		P-value
		No	Yes	
Sex				
Male	378(74.1)	316(83.6)	62(16.4)	

Female	132(25.9)	115(87.1)	17(12.9)	0.335ns
Total	510(100)	431(84.5)	79(15.5)	P>0.05
Age				
18-25	194(38.0)	157(80.9)	37(19.1)	
26-33	184(36.1)	152(82.6)	32(17.4)	
34-41	72 (14.1)	66 (91.7)	6 (8.3)	
42-49	32 (6.3)	28 (87.5)	4 (12.5)	
50-57	24 (4.7)	24 (100)	0 (0.0)	
58-65	4 (0.8)	4 (100)	0 (0.0)	0.060ns
Total	510(100)	431(84.5)	79(15.5)	P>0.05
Educa				
Info	14 (2.7)	9 (64.3)	5(35.7)	
Primary	20 (3.9)	9 (45.0)	11(55.0)	
Second	91 (17.8)	78 (85.7)	13(14.3)	
Tertiary	385(75.5)	335(87.0)	50(13.0)	0.000s
Total	510 (100)	431(84.5)	79(15.5)	P<0.05
Occupa				
Unemp	33 (6.5)	30 (90.9)	3 (9.1)	
H. wife	19 (3.70)	18(94.7)	1 (5.3)	
Stud	347(68.0)	282(81.3)	65(18.7)	
C serv.	70(13.7)	63(90.0)	7 (10.0)	
Bus	16 (3.1)	14(87.5)	2 (12.5)	
H work	25 (4.9)	24(96.0)	1 (4.0)	0.088ns
Total	510(100)	431(84.5)	79(15.5)	P>0.05
Edu, education; Info, informal; Pri, primary; Sec, secondary; Tert, tertiary; Unemp, unemployed; H wife, house wife; Stud, student; C Serv, civil servant; Bus, business; H work, health worker.				

Table 1: Blood donor profiles & association with TTIs status, Plateau state Nigeria.

The highest infection rate was in the male donors (n=62; 16.4%). There was however, no significant association between sex and infection rate in the blood donors [Table 1] Seventy nine (15.5%) of the blood donors had one form of infection or the other with the overall frequency of TTVIs among blood donors at 15.5%. No case of triple infection, the prevalence of single and dual infections and their 95% confidence interval are shown in Table 2 [Table 2].

	Status n (%)		Total n (%)	95%,Confidence Interval	
	No	Yes		Lower	Upper
None	431(84.5)	0(0.0)	431(84.5)	81.4	87.6
HIV	0(0.0)	16(3.1)	16(3.1)	1.8	4.7

HBV	0(0.0)	38(7.5)	38(7.5)	5.3	10
HCV	0(0.0))	14(2.7)	14(2.7)	1.4	4.3
HIV/HBV	0(0.0)	8(1.6)	8(1.6)	0.6	2.5
HIV/HCV	0(0.0)	1(0.2)	1(0.2)	0	0.6
HBV/HCV	0(0.0)	2(0.4)	2(0.4)	0	1
HIV/HBV/HCV	0(0.0)	0(0.0)	0(0.0)	-	-
Total	431(84.5)	79(15.5)	510(100)	100	100

Table 2: The frequency of TTIs among blood Donors in Jos, Nigeria.

The age groups 18-25, and 26-33 years had the highest infection rates of 37(19.1%) & 32(17.4%) respectively. There was no infection recorded in the age groups 50-57 and 58-65 years. This finding was also not significant [Table 1]. Infection rate was lowest in those with tertiary education (n=50; 13.0%) and highest in those with primary (n=11; 50.0%) and informal education (n=5; 35.7%). This difference was statistically significant with P<0.05[Table 1]. Infection rate was highest among the students (n=67; 18.7%) and lowest in health workers (n=1; 4.0%), followed by house wife (n=1; 5.3%). This difference was however not significant with P>0.05 [Table 1] [12].

The overall prevalence of TTIs of 15.5% found was compared to 22.1% found from the same area in a study done by Egah et al in 2007 [13] [Table 3].

Infection status	Observed n (%)	Expected (n)	Residual
No	431 (84.5)	397.3	33.7
Yes	79 (a15.5)	112.7	-33.7
Total	510 (100)		
(χ²)	12.942		
Df	1		
P-value	0		
Null Hypothesis (H ₀ =H ₁): a15.5 % = 22.1%. P-value<0.05, accept alternative hypothesis (H ₀ ≠ H ₁)			

Table 3: Comparing overall infection prevalence from this study with a previous one in the same area.

Discussion

In our study, males were the predominant blood donors, constituting 378(74.1%), with male: female ratio of 2.9:1. This was lower than the Male: Female ratio of 6:1 reported by Buseri et al [12] among blood donors from South-west Nigeria. The Majority of our donors were young adults, between 18 years to 33 years with mean age ±SD of 30.20±9.10 years. This agrees with mean age of 32.58 ± 10.24 years reported by Buseri et al [13]. This young age group combined, represented over 74% of our donor populations. Students made up 68% and represented the predominant donor population; most of this (75.5% of donors) had tertiary education. This research shows that our blood donors were mostly males, young adult students, with level of education playing a statistically significant role (p<0.05). This finding is similar to findings from many other parts of the world. In a previous

study, in the same environment by Egah et al [13], Jos North central Nigeria, 95% of blood donors were young adult males. There was also a similar finding by Muktar et al [14] in Zaria who reported 99% male young adults as the predominant blood donor population and 1% female. Researchers from the Niger-Delta, areas of Nigeria reported similar findings [15]. All available literature to us at the time of this work from African countries documented males as dominant blood donors. This is at variance with findings from parts of Europe. For example, a report from Turkey reported dominance of female donors as 62.7% while male was 37.3% [16]. This male dominance as donors is attributable to many factors. Some of these are misconceptions about males been healthier than females, or that females are already donating blood naturally through monthly menstrual cycles etc.

These findings have great significance, and must be seriously considered in any form of future strategic intervention plan aimed at blood transfusion safety. The broader geopolitical ties between the regions of Nigeria may partly explain this near similarities in our findings. Some widespread socio-cultural and religious beliefs, especially in the northern and north central parts of Nigeria prohibit females from blood donation and participation in some activities believed to be male-oriented [14].

The overall prevalence found was significantly less than the value earlier reported [Table 1], by Egah et al [13] in Jos, a difference that may suggest a decline in TTVIs in Jos.

This decline may be attributed to the numerous measures and steps taken in recent times by institutions, governmental and non-governmental organizations across the country. Most of these measures focus on stemming the tides of HIV and other related viral transmissions. Some of these include appropriate information and education on right behaviour and life style changes, establishment of National and regional Blood Transfusion Service Centres with the establishment and implementation of national policies on safe blood transfusion practice. Others include improvement in our donor recruitment and improved screening techniques on donated units of blood. This TTVIs prevalence is also less than the 28.8% reported by Buseri et al [12] South-West Nigeria, who also reported a highest prevalence of all infections in those aged 18 to 47 years which slightly differs from the 18 to 33years aged group found in our study. The overall prevalence of TTIs in our study was however higher than 4.09% reported by Sharma et al [17] in India among blood donors.

The prevalence of HBV

The HBV of 7.5% found in this study was lower than 15.1% earlier reported by Egah et al [13] among blood donors from Jos North-central Nigeria, and 14.3% reported by Uneke et al [18] also from Jos. It was also lower than 18.6% by Buseri et al [12], South-west Nigeria, 13.22% reported by Fasola et al [19] from Ibadan, 7.50% by Salawu et al [20] among blood donors from Ile-Ife, Nigeria, 21.7% by Bada et al [21] from Ilorin . This was also lower than 15.0% reported by Ampofo et al [22] from Ghana, 14.0% by Pawlotsky et al [23] from Central African Republic, 8.8%, reported by Matee et al [24] from Tanzania. This prevalence was however higher than 3.51% reported by Singh et al [25] from India, and 0.01% reported by Polizzotto et al [26] from Australia.

The prevalence of HIV

The HIV prevalence of 3.1% from our study was similar to the 3.1% reported by Buseri et al [12] from South-west Nigeria. It was less than

the 6.9% by Julie and Gideon [27] among blood donors in Jos North-central Nigeria, 5.8% in the works of Chikwem et al [28] from Maiduguri, North-Eastern Nigeria, 7.7% reported by Fasola et al [19] from Ibadan, South-western Nigeria. This prevalence was also lower than the National values of 5.8%, 5.0%, and 5.2% in 2001, 2004 and 2008 respectively in a sentinel survey by the Federal Ministry of Health in 2009 [4] as well the 8.7%, reported by Matee et al [24]. This value was higher than the 2.7% among blood donors by Egah et al [13] from Jos and 0.13% reported by Singh et al [25] from India. Glynn et al [29] in the United States reported a decline in a yearly prevalence of HIV (per 100,000 donations) from 0.030% to 0.015% in first time donors.

The prevalence of HCV

Our study found the prevalence of HCV to be 2.7%. This was less than the 4.3% reported from Jos [13], 5.8% from southern Nigeria Mutimer et al [30], 6.0% by Buseri et al [12], 5.0% by Jeremiah et al [31], Port Harcourt, South-south Nigeria but greater than 0.24% reported by Singh et al [25] among Indian blood donors.

The prevalence of co infection

Overall co infection prevalence was 2.2% in this study. It was less than the 8.9% reported by Buseri et al [12] and the 19% by Ampofo et al [22] in Ghana.

In this study, the HIV/HBV co-infection was 1.6%, this was higher than 0.4% reported by Egah et al [13] from Jos, 0.1% reported by Ejele et al [15] Port Harcourt South-south Nigeria, 0.5% reported by Oladele et al [32] in Osun State Nigeria, and 0.77% Fouelifack et al [33] among blood donors in Cameroon.

In this study co infection with HIV/HCV of 0.2% found, was slightly higher than 0.0% by Egah et al [13] in the same area in a previous study and also higher than 0.06% by Fouelifack et al [33] reported from Cameroon.

HBV/HCV co infection of 0.4% in our study was similar to the 0.4% in the same area reported by Egah et al [13] but again higher than 0.21% Fouelifack et al [33] in Cameroon. There was no case of HIV/HBV/HCV triple infection; this was similar to the finding of Buseri et al [12] in South-west Nigeria.

Conclusion

Considering the prevalence rates of HIV, HBV and HCV (3.1%, 7.5% and 2.7% respectively) and the overall prevalence of TTVIs (15.5%) observed in this study which was significantly lower than the 22.1% found from the same area in an earlier study, we therefore concluded that the seroprevalence of TTVIs in Jos North -Central Nigeria was on the decline. There was also a significant association between donor educational level and blood donation.

Recommendations

We recommend that despite the observed decline in the seroprevalence of TTVIs in Jos, North-central Nigeria, there is need to sustain the present policies and efforts, donor education and implementation of stringent donor eligibility criteria to further minimize the risk.

Limitation

There were uncontrolled factor such as myths, beliefs, and other restrictions to blood donation prevalent in the countries and various study groups compared.

Authors' contributions

This research work was done by all the authors. Author Onoja AM conceptualized and prepared the entire components of the manuscript for scientific publication. Author Orkuma JA, reviewed the manuscript and assisted with statistical analysis. Nwannadi AI, reviewed manuscript and contributed extensive literature review. Author Ejele AO supervised, reviewed, and approved for scientific publication. Author Egesie OJ supervised reviewed and approved for publication. Author Onoja TA collected samples, compiled data and reviewed manuscript. Author Alao OO, reviewed manuscript and analyzed the data. Ibrahim IN collected samples, wrote and reviewed manuscript for scientific publication.

All the authors read and approved the final manuscript.

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