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ORIGINAL ARTICLE

Seroepidemiology of Transfusion Transmissible Viral Infection among University Fresh Students in Port Harcourt, Nigeria

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Background and Aims: **Most studies on the prevalence of transfusion-transmissible infections (TTIs) have been done on preselected blood donors. There is paucity of information on the prevalence of these TTIs in the general population in Port Harcourt, Nigeria.**

Methods: **A total of 1,500 apparently healthy individuals aged 17–50 years consisting of 701 (46.7%) males and 799 (53.3%) females were tested for human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) using Determine and Genie II HIV-1/HIV-2, Clinotech hepatitis B surface antigen (HBsAg), and HCV kits.**

Results: **Prevalence rates of 1.7%, 2.1%, and 0.1% were obtained for HIV, HBV, and HCV, respectively. A breakdown of HIV prevalence gave HIV-1 (1.1%), HIV-2 (0.27%), and HIV-1 /2 (0.33%). From the 1,500 subjects tested, 357 (23.8%) belong to the Ijaw, 408 (27.2%) to Ikwerre, 201(13.4%) to Ogoni/Eleme, 75 (5.0%) Ekpeye and 459(30.6%) belong to the other ethnic groups. Other ethnic groups accounted for the highest prevalence of HIV and HBsAg. Youths aged 21 to 30 constituted the highest number of HIV and hepatitis infections. Of the 23 subjects positive for HIV, 16 (1.2%) had HIV-1, 4 (0.3%) had HIV-2, and 5 (0.5%) had the HIV-1/2. Of the 1,500 subjects tested, 0.2% had HIV and HBV co-infection. Chi-square analysis indicated that age was a risk factor for the transmission of the three transmissible infections ($P < 0.01$, $P < 0.05$, and $P < 0.05$ for HIV, HBsAg, and HCV, respectively). Gender had an influence on HIV and HBsAg ($P < 0.05$). There was also a positive association between the ethnic groups and the TTIs ($\chi^2 = 18.136$, $P < 0.01$ for HIV; $\chi^2 = 2.785$, $P < 0.05$ for HBsAg; and $\chi^2 = 2.411$, $P < 0.05$ for HCV). The 0.1% prevalence of HCV in this study occurred exclusively among nonnatives.**

Conclusions: **This study has provided epidemiological data on some transfusion-transmissible viral infections in Port Harcourt and has identified some risk factors associated with it. To ensure safety in blood-transfusion practices, selection and screening of donors within the high-risk groups, especially individuals 21 to 30 years old, should be thorough and in accordance with the approved safety guidelines.**

Keywords: **Transfusion Transmissible Infection, HIV, HCV, HBsAg, Nigeria**

Introduction

Although blood transfusion saves millions of lives worldwide each year, recipients of transfusions risk becoming infected with blood-borne diseases such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) through transfusion of infected blood and blood products [(1)]. The discovery that HIV, HBV, and HCV could be transmitted by transfusion herald a new era in blood transfusion practice and

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has provoked a greatly heightened emphasis on two fundamental objectives: safety and protection of human life [2]. These three viral infections are distinct but share a similar mode of transmission, primarily through unscreened and contaminated blood and blood products by contact or transfusion. Other routes include sexual intercourse and vertical transmission from mother to fetus in the immediate prenatal period [3-5].

HIV, HBV, and HCV infections are major causes of mortality and morbidity in Nigeria and many parts of the world [6]. Epidemics of acquired immunodeficiency virus (AIDS) caused by infection with HIV (Gallo *et al*., 1984) have now existed for more than two decades. There are two types of HIV: type 1 and type 2. Most reported cases of HIV around the world have been attributed to HIV-1. Nearly all cases of HIV in the United States are due to HIV-1.

In Nigeria, the prevalence of HIV has increased steadily over the years, from 1.8% in 1991 to 3.8% in 1993, 4.5% in 1996, 5.4% in 1999, 5.8% in 2001 and 5.0% in 2003 [7].

HBV causes acute and chronic hepatitis with a high tendency to progress to cirrhosis and hepatocellular carcinoma [8]. A previous study by Baba *et al.* [9], reported a prevalence rate of 14% among blood donors in Zimbabwe, Southern Africa. Emmanuel *et al.* [10] observed a prevalence of 3.5% among Zimbabweans donors.

HCV accounts for 20% of all acute cases of viral hepatitis, and approximately 170 million of world population are infected [11]. Although much remains to be learned about hepatitis C, it appears most often to be transmitted parentally, and sexual and fecal-oral routes also exist. Approximately 0.5% of blood donors in the United States are infected with HCV [11, 12].

In the late 1980s, the risk of HCV transmission was 1:100 in Spain and most of Southern Europe and well over 1:1000 in many developed countries [13]. Previous reports by Ejele *et al.* [14] and Jeremiah *et al.* [15] found prevalence rates of HCV to be 3.0% and 5.0%, respectively, among blood donors.

Most studies are centered on the prevalence of transfusion-transmitted infections among blood donors who belong to a preselected group with little or no regard to the general population; hence, the impact of these transmitted infections on the general population is often not known. This study was aimed to 1) determine the impact of transfusion-transmissible viral infections among the adult nonhospitalized population in the Niger Delta and 2) evaluate the current prevalence of HIV, HBV, and HCV among the general population using a student population and compare the value with those of other parts of the world.

Materials and Methods

Subjects

Between October 2007 and April 2008, 1,500 apparently healthy individuals aged 17-50 years consisting of 705 males and 795 females (ratio 1:1.12) volunteered for the study. They were all students of the Rivers State University of Science and Technology, Port Harcourt, Nigeria, drawn from first-year full- and part-time students during medical examinations. All individuals were offered pre- and posttest counseling. Informed consent was obtained from all participants before blood samples were collected from them.

Specimen Acquisition and Laboratory Methods

Whole blood samples were collected by means of 5-milliliter hypodermic syringe and needle into potassium EDTA anticoagulated tubes (3 milliliters) and plain tubes without anticoagulant (2 milliliters). The blood was allowed to clot, after which it was centrifuged for 5 minutes, Disposable pipettes were used to collect the serum. Sera derived from the plain tubes were screened for the presence of HIV 1 and 2 antibodies using Determine (Abbot, Japan), an immunochromatographic method for the qualitative *in vitro* detection of antibodies to HIV 1 and 2. All initial reactive samples were confirmed using WHO approved Genie 11 HIV-1/2 test kits (Bio Rad, France), and hepatitis B surface antigen (HBsAg) and hepatitis C virus antibody (anti-HCV) were assayed using commercially available Clinotech HBsAg and anti-HCV kits. Procedures were followed as contained in the standard operating manual accompanying the kits.

Statistics

Data were entered and analyzed in SPSS (version 11, SPSS Inc, Chicago, USA) for Windows. The statistical analysis included a frequency distribution and chi-square analyses to measure correlations.

Results

A total of 1,500 adults aged between 17 and 47 years were tested for HIV, HBsAg, and HCV infection.

Table 1 shows the frequency for demographic characteristics of the study participants (age group). The majority (71.2%) of the study participants belonged to the 21-30 age group, followed by the 31-40 age group (n = 217, 14.5%), the under-20 age group (n = 181, 12.1%), and finally the 41-50 age group (n = 34, 2.3%). Out of the 1,500 subjects tested, 701 (46.7%) were males, and 799 (53.3%)

Table 1. Demographic characteristics of the study population.

Demographics	Number Tested	Percentage (%)
Age Group		
Under 20	181	12.1
21-30	1068	71.2
31-40	217	14.5
41-50	34	2.3
Sex		
Male	701	46.7
Female	799	53.3
Ethnic Groups		
Ijaw	357	23.8
Ikwerre	408	27.2
Ogoni/Eleme	201	13.4
Ekpeye	75	5.0
Others	459	30.6

were females. The participants were grouped into five ethnic groups consisting of Ijaw, Ikwerre, Ogoni/Eleme, Ekpeye, and other states of the ethnic groups. There were 357 Ijaw (23.8%), 408 Ikwerre (27.2%), 201 Ogoni/Eleme (13.4%), 75 Ekpeye (5.0%), and 459 from other states (30.6%).

The frequency distribution of HIV, HBsAg, and HCV among study participants is shown in Table 2. Sixteen (1.1%) participants were positive for HIV-1, four (0.27%) were positive for HIV-2, five (0.33%) were positive for HIV-1/2, and 1,476 (98.1%) were HIV negative; 31 (2.1%) had hepatitis B, whereas 1,469 (97.9%) were negative. Only one of the participants tested positive for HCV (0.1%), whereas 1,499 (99.9%) were negative, and three

Table 2. Distribution of HIV, HBsAg, and HCV among study participants.

Parameters	Number of Positive Cases	Percentage (%)
HIV-1 Pos	16	1.1
HIV-2 Pos	4	0.27
HIV-1 & 2 Pos	5	0.33
HBsAg Pos	31	2.1
HCV Pos	1	0.1
HIV & HBsAg	3	0.2

(0.2%) of the participants had dual infection of HIV and hepatitis B.

Table 3 shows the prevalence of HIV among the age groups of subjects. The highest prevalence of HIV-1 was 15 (1.0%) in the 21-30 age group, followed by 1 (0.1%) in the over-40 age group. The highest prevalence of HIV-1 and 2 was 4 (0.3%) in the 21-30 age group, followed by 1 (0.1%) in the over-40 age group. The highest prevalence of HIV-2 was 2 (0.1%) in the 21-30 age group, followed by 1 (0.1%) in the under-20 age group and 1 (0.1%) in the 31-40 age group ($\chi^2 = 16.157$, $P < 0.01$).

The prevalence of HBsAg among the age groups shown in Table 3 revealed that HBV infection was highest within the 21-30 age group (n = 21, 1.4%), followed by the 31-40 age group (n = 5, 0.3%) and the under-20 age group (n = 3, 0.2%); the lowest HBsAg prevalence occurred within the over-40 age group (n = 2, 0.1%) ($\chi^2 = 2.709$, $P < 0.05$). With respect to the prevalence of HCV, Table 3 shows that only one subject (0.1%) tested positive (in the 31-40 age group; $\chi^2 = 5.916$, $P < 0.05$).

Table 4 shows the distribution of HIV status based on gender. Three males (0.2%) and 13 females

Table 3. Prevalence of TTIs among different age group of participants.

HIV Status	< 20 n (%)	21 – 30 n (%)	31 – 40 n (%)	> 40 n (%)	Total n (%)
HIV-1	0 (%)	15 (1.0%)	0 (0%)	1 (0.1%)	16 (1.1%)
HIV-1 & 2	0 (%)	4 (0.3%)	0 (0%)	1 (0.1%)	5 (0.3%)
HIV-2	1 (0.1)	2 (0.1%)	1 (0.1%)	0 (0%)	4 (0.3%)
HIV Neg	180 (12.0%)	1047 (69.8%)	216 (14.4%)	32 (2.1%)	1475 (98.3%)
					$\chi^2 = 16.157^{**}$
HBsAg Pos	3 (0.2%)	21 (1.4%)	5 (0.3%)	2 (0.1%)	31 (2.1%)
HBsAg Neg	178 (11.9%)	1047 (69.8%)	212 (14.1%)	32(2.1%)	1469 (97.9%)
					$\chi^2 = 2.709^{*}$
HCV Pos	0 (0%)	0 (0%)	1 (0.1%)	0 (0%)	1 (0.1%)
HCV Neg	181 (12.1%)	1068 (71.2%)	216 (14.4%)	34 (2.3%)	1499 (99.9%)
					$\chi^2 = 5.916^{*}$

* significant at $P < 0.05$; ** significant $P < 0.01$

(9.0%) were positive for HIV-1; 1 male (0.1%) and 4 females (0.3%) were positive for HIV-1 & 2; and 2 males (0.1%) and 2 females (0.1%) had HIV-2. In regard to HBsAg, Table 4 shows that the highest prevalence occurred among males 23 (1.5%) and the lowest occurred among females 8 (5.0%); significant and positive associations were observed for the prevalence rates of HIV and HBsAg based on sex ($P < 0.05$ and $P < 0.01$, respectively). The distribution of HCV reveals that only one male (0.1%) was infected with HCV, and no females tested positive for HCV infection.

The prevalence of HIV status by ethnic group is shown in Figure 1. There was a statistically significant pattern of distribution of HIV, HBsAg, and HCV among the various ethnic groups ($\chi^2 = 18.136$, $P < 0.01$ for HIV; $\chi^2 = 2.785$, $P < 0.05$ for HBsAg; and $\chi^2 = 2.411$, $P < 0.05$ for HCV). The 0.1% prevalence of HCV in this study occurred exclusively among nonnatives (classified as *others* in this study; also, all of the transfusion-transmitted infections for HIV, HBsAg, and HCV were present in this group).

Table 4. Prevalence of TTIs based on the gender of study participants.

TTIs	Male n (%)	Female n (%)	Total
HIV-1 Pos	3(0.2%)	13(0.9%)	16(1.1%)
HIV-1 & 2	1(0.1%)	4(0.3%)	5(0.3%)
HIV-2 Pos	2(0.1%)	2(0.1%)	4(0.3%)
HIV Neg	694(46.3%)	781(52.1%)	1475(98.3%)
			$\chi^2 = 5.549^{*}$
HBs Pos	23(1.5%)	8(0.5%)	31(2.1%)
HBs Neg	678(45.2%)	791(52.7%)	1469(97.9%)
			$\chi^2 = 9.589^{**}$
HCV Pos	1(0.1%)	0(0%)	1(0.1%)
HCV Neg	700(46.7%)	799(53.3%)	1499(99.9%)
			$\chi^2 = 1.141^{ns}$

* significant at $P < 0.05$; ** significant at $P < 0.01$; ns: not significant

Discussion

Blood transfusion in Nigeria currently faces interesting challenges. Transfusion-transmissible infection of HIV, HBV, and HCV has provoked a greatly heightened emphasis on safety, with inescapable implications on complexity and cost. The risk associated with the transfusion of unscreened blood in Port Harcourt, Nigeria, is largely unknown. This study examined the trends in the incidence of transfusion-transmissible infection for the general population.

In this study, we obtained prevalence rates of 1.7%, 2.1%, and 0.1% for HIV, HBV, and HCV, respectively. The observation of a 2.0% HIV prevalence rate among the general population in this study is however lower when compared with the 5.5% rate found in previous work by Baba *et al.* [9], which was conducted on donors in Maiduguri, Nigeria. In Aba, Nigeria, Amadi *et al.* [16] obtained a prevalence rate of 10.6%; in Kampala, Uganda,

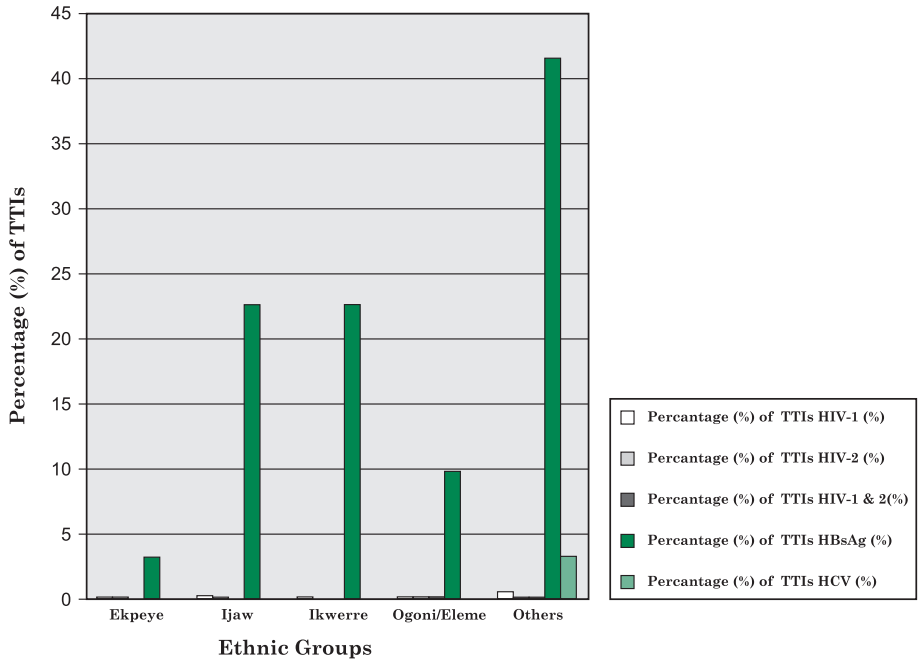

Figure 1. Prevalence of the TTIs among ethnic groups.

Caeswell *et al.* [17] obtained a rate of 15.86%; and in the United States, Glynn *et al.* [18] reported an HIV prevalence rate of 2.92%. This high prevalence among donors may be due to the fact that they were a preselected group.

The observation of a 2.0% HIV prevalence rate among the general population is higher than the 1.4% HIV prevalence rate among donors obtained by Ejele *et al.* [6] in Port Harcourt, Nigeria. Jeremiah *et al.* [15] reported an HCV prevalence rate of 5.0% among donors in Port Harcourt, Nigeria, and Lesi and Kehinde [19] also found a 5.0% HCV prevalence rate in Lagos, Nigeria. Finally, Petrick *et al.* [20] observed an HCV prevalence rate of 0.1% among donors in England.

In this study, it was observed that the prevalence rates of HIV and HBsAg were higher among 21- to 30-year-olds and lowest in individuals older than 40. This agrees with a previous report by Baba *et al.* [9], who observed a higher prevalence of HIV, HBV, and syphilis among youths (18-27 years).

The present study also observed that HIV-1 was the predominant viral subtype (n = 16, 1.1%), whereas HIV-2 and HIV-1 & 2 co-infection were present in 4 (0.27%) and 5 (0.33%) subjects, respectively. This observation is consistent with previous reports by Erhabor [7] and Akinsete *et al.* [21], who found HIV-1 to be the predominant viral subtype in their Nigerian samples.

The prevalence of HIV was significantly higher in females (n = 19, 1.3%) than in males (n = 6, 0.4%). Socioeconomic, cultural, and biological factors have been shown to contribute to the female gender's vulnerability to HIV. Women of all ages are more likely than men to become infected with HIV during unprotected vaginal intercourse [22]. The female vulnerability to HIV seen in this study parallels an observation in Sub-Saharan Africa that there were 12 to 13 HIV-infected women for every 10 infected men in 2001 [23].

Royce *et al.* [22] reported that during unprotected vaginal intercourse, a woman's risk of becoming infected is up to 4 times higher than the risk for a man. Royce *et al.* [22] also reported that females outnumber males in the ratio of 2:1. It was also observed in this study that the sex of the subject is an important indicator of the prevalence of HBsAg, as shown by a chi-square analysis (χ^2 = 9.589, P < 0.01).

This study observed an HIV/HBV co-infection rate of 0.2% among the subjects tested. A 15% prevalence rate of HIV/HBV co-infection was reported by Baba *et al.* [24], and a 28.7% prevalence rate was reported by Sirisena *et al.* [25] in North Central Nigeria. The prevalence rate of HIV/HBV co-infection in this study is lower than the 41% rate obtained among HIV-infected South Africans in Lodenyo *et al.*'s study [26]. This association may have been due to the fact that both viruses have a common mode of transmission and risk factors: sexual behavior, homosexual and heterosexual promiscuity, intravenous drug use, and transfusion of infected or unscreened blood or blood products.

There was no significant correlation between ethnic group and HIV status, hepatitis B, and hepatitis C. The ethnic groups grouped into the *other* category had the highest prevalence of HIV, whereas the Ikwerre and Ekpeye ethnic groups had the lowest prevalence. The high rate for the *other* ethnic groups was probably because those groups included many different states in Nigeria, including some northern states such as Akwa-Ibom, where the prevalence of HIV may be high when pooled together. Prevalence of HBsAg was also high in the Ikwerre ethnic group. This may be due to the location where this work was done.

Conclusions

This study has provided epidemiological data on some transfusion-transmissible viral infections in Port Harcourt and has identified some risk factors associated with those infections .There was a downward trend in the prevalence of TTIs in the general population when compared with the previously published data. The prevalence rates of 1.7%, 2.1%, and 0.1% for HIV, HBsAg, and HCV, respectively, in this study have provided further evidence of the importance of blood-donor screening in Nigeria (considering the fact that most health centers, particularly in rural areas of the Niger Delta, do not have screening facilities) and the risk associated with the transfusion of unscreened blood. In this study, a positive association between sex and hepatitis B was noted (χ^2 = 9.589, P < 0.002). A combination of preventive strategies such as safe injection practices, proper sterilization of medical equipment, public education programs for barbers, and issuance of relevant guidelines for counseling and management of donors may reduce the incidence of these transfusion-transmissible infections in developing countries.

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