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HIV/HBV Coinfections Among People Living With HIV/AIDS in Yenagoa, Bayelsa, Nigeria

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Abstract

Coinfection is another major challenge because it affects the rate at which HIV progress to AIDS. In this study, 104 HIV-positive patients were recruited and evaluated for the presence of HBV among people living with HIV/AIDs (PLWHA) in Yenagoa, Nigeria. Blood samples were re-screened for the presence of HIV antibodies using the Determine HIV-1/2 (Alere), then screened for HBsAg with RDT and ELISA kit following the respective manufacturer's instructions. The overall coinfection was 2.0% for HIV/HBV. CD4 counts and viral load was an indicator for HIV/HBV coinfections. A higher HIV/HBV coinfection occurred among age groups >41 years (2.2%), females (3.0%), CD4 counts <200 cells/µl (3.7%) and Viral load 200-999 copies/ml (2.4%). None of the sociodemographic characteristics of these participants was significantly associated ($p > 0.05$) with HIV/HBV coinfections. The present study has further confirmed the presence of HIV/HBV coinfections among PLWHA in Yenagoa, Nigeria Males were more prone to HIV/HBV coinfection. At the same time, their female counterparts demonstrated a more excellent disposition to HIV infection only. HIV status did seem to influence the predisposition to HBV infection, as an increase in susceptibility was observed with HIV-infected patients in Yenagoa, Nigeria.

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1. Introduction

Coinfection is another major challenge because it affects the rate at which the disease progress to AIDS (Okonko et al., 2020b). The frequency of HIV is now becoming epidemic in our world, especially in developing countries such as Nigeria. Infection with the Hepatitis B virus (HBV) is a significant global health burden (Im et al., 2022). An estimated 296 million people had chronic HBV infection in 2019, and more than 820,000 people died due to HBV (WHO, 2021a, b; Im et al., 2022). Chronic viral hepatitis is one of the highest disease loads in Nigeria (Cookey et al., 2022; Okonko et al., 2022). HBV accounts for approximately 96.0% of viral hepatitis deaths worldwide (Cooke et al., 2019; Flower et al., 2022). However, the incidence of these illnesses is poorly documented (Flower et al., 2022). Around 70 million of those with chronic HBV infections are Africans, making it commonly known as Africa's silent killer (Muanya, 2022); 75.0% of them reside in Asia, and 25.0% of them pass away from infection-related liver problems (Sato et al., 2014; Cooke et al., 2019; Flower et al., 2022; Demarchi et al., 2022).

According to reports, liver disease has become one of the leading causes of death in several countries, and both viral hepatitis infections are linked to faster advancement of liver fibrosis and fibrogenesis with HIV coinfection (Weber et al., 2006; Hernandez et al., 2011; Kilonzo et al., 2017; Boateng et al., 2019). A further estimate states that approximately 30% of HIV-positive individuals globally also have HCV or HBV infections (Lacombe & Rockstroh, 2012; Boateng et al., 2019).

The global prevalence of HBV/HIV coinfection varies from 1.13% to 59.0% (Askari et al., 2014; Lawal et al., 2020). In the United States of America [USA], the prevalence of HIV/HBV in children is 2.6% and 4.9% in China (Toussi et al., 2007; Zhou et al., 2010). Reports from Africa have revealed that the prevalence of HBV/HIV coinfection is between 10.0% and 20.0%, as many countries in sub-Saharan Africa are typically classified as endemic, high, or intermediate countries with HBV infections (Thio et al., 2009; Lawal et al., 2020). The global prevalence rate of HIV/HBV and HIV/ HCV coinfections in sub-Saharan African countries was 15.0% and 7.0%, respectively (Barth et al., 2010; Boateng et al., 2019).

Epidemiological studies have shown that HBV/HIV coinfection varies from 5.0 to 10.0% in the USA to 20–30% in parts of sub-Saharan Africa and Asia (WHO, 2009). In Tanzania, a prevalence of 1.2% was documented in children aged 18 months to 17 years, while 12.1% was documented in Cote d' Ivoire in West Africa (Telatela et al., 2007; Rouet et al., 2008; Lawal et al. 2020). In Nigeria, HIV/HBV coinfection rate is estimated to be between 10.0% and 70.0% (Owolabi et al., 2014).

In Nigeria, the rates were also at 13.0% and 3.6% for HIV/HBV and HIV/HCV, respectively. However, previous studies have reported that the prevalence rates of HBV and HCV in HIV-positive and HIV-negative Nigerian populations were reported as 8.0% to 13.0% (Olayinka et al., 2016; Spearman et al., 2017; Akindigh et al., 2019; WHO, 2020a, b; Ajuwon et al., 2021; Muanya, 2022; Odukoya et al., 2022) and 1.0%-2.1% (Omolade & Adeyemi, 2018; Muanya, 2022; Odukoya et al., 2022), respectively; indicating a clear viral hepatitis endemicity in Nigeria.

To the best of our knowledge, literature is scarce on the prevalence of HIV/HBV coinfections among HIV-positive individuals and related risk factors in Bayelsa State, Nigeria. This study was conducted to gather baseline data on the prevalence of HIV/HBV coinfections among patients living with HIV in Yenagoa, Nigeria.

2. Materials And Method

2.1. Study Area

The study was conducted at the Federal Medical Centre, Yenagoa, Bayelsa State, Nigeria. This hospital is one of the main treatment facilities for people with HIV and AIDS (PLWHA) in Bayelsa State, Southern Nigeria. Yenagoa is a Local Government area and city of Bayelsa State, Nigeria. It is located in the southern part of the country. The LGA has an area of 706 km^2 and a population of over 352,285 as of 2006. The Ijaw form the majority of the state. Bayelsa is situated in an area of swamps and mangroves, and tropical rainforests. It is located in the core of the Niger Delta region. Bayelsa state was formed in 1996 by Rivers State, making it one of the newest in the federation. The state bothers River State, which it was formerly part of and Delta state. The state is the smallest in Nigeria by population as of the 2006 Census and one of the smallest by area. Bayelsa State has a riverine and estuarine setting, with bodies of water preventing the development of significant road infrastructure. The petroleum industry dominates Bayelsa's economy.

2.2. Study Design

A hospital-based cross-sectional study design was adopted for the present study, which seeks to determine the HIV/HBV coinfection rates among people living with HIV and AIDS (PLWHA) attending Federal Medical Centre, Yenagoa, Bayelsa State, Nigeria. The method for this study consists of informed consent and blood withdrawal by venipuncture. Screening HIV/HBV coinfections, clinical evaluation and recording of demographic information such as the age of the participants, sex, marital status, educational background, occupation, and use of ART.

2.3. Ethics statement

The Federal Medical Centre in Yenagoa, Nigeria, gave their administrative clearance for this study. The University of Port Harcourt Research Ethics Committee reviewed the work for ethical issues and approved it following the standards for research involving human beings. Before samples were taken and processed, everyone who participated gave informed consent.

2.4. Study population

One hundred and four (104) PLWHA positively confirmed patients attending the HIV outpatient clinic of Federal Medical Centre, Yenagoa, Nigeria, who willingly gave informed consent and volunteered to have their stool samples examined were enlisted in the research. Patients attended the clinic for routine check-ups, collection of medications or other medical complaints. Determine HIV1/2 kit from Abbott Diagnostic Division, Hoofddorp, the Netherlands, was used to determine HIV status, followed by Unigold or Stat-Pak assay concurrently according to the serial algorithm of the Federal Government of Nigeria. Socio-demographic data were also collected. Necessary demographics (age, sex, marital status,

educational background and occupations) and clinical and epidemiological data of each patient were obtained using a well-structured questionnaire. Health personnel conducted the interview and entered the data using the pre-structured questionnaire. All PLWHA positively confirmed patients were eligible for the study. HIV-infected patients with missing data, such as age and duplicate records, were excluded from the study. However, PLWHA affirmatively confirmed that individuals adequately documented in the registration book were included.

2.5. Sample collection

The method of sample collection employed was the vein puncture technique. A soft tourniquet was fastened to the upper hand of the patient. The punctured site was cleansed with methylated spirit, and the vein was punctured with a 3 ml syringe. After sufficient blood collection, the tourniquet is released, and the needle is removed immediately. About 3 ml of venipuncture blood was collected in EDTA BA Vacutainer TM anti-coagulant tubes (BD, Franklin Lakes, USA), labelled with each patient's details. Plasma specimens were separated by centrifugation at 3,000 rpm (revolution per minute) for 5 min. For the laboratory tests, the plasma was used and kept at a temperature of -20°C.

2.6. Serological analysis

Using the Determine HIV-1/2 strips, blood samples from HIV-positive patients were again re-screened for HIV antibodies. Following the instructions provided by the kit's manufacturer, plasma was examined for HBsAg at the Virus & Genomics Research Unit, Department of Microbiology, University of Port Harcourt, Nigeria. Using HBsAg test strips, plasma taken from the participant's blood was examined for the presence of HBsAg. To find HBsAg in the blood, the strips were applied step-by-step. The test followed the manufacturer's instructions, and the findings were interpreted accordingly. Also, the plasma was examined using the MonolisaTM HBs Ag ULTRA kit for the enzyme immunoassay technique to detect the hepatitis b virus surface antigen in human serum or plasma (manufactured by Bio-Rad, France). All laboratory tests were done utilizing quality controls following standard operating procedures and were completed following the manufacturer's instructions.

2.7. CD4 and Viral Load Analysis

Blood samples were analyzed for CD4+ T cell estimates by flow cytometry and viral load by Abbott Real-Time protocol.

2.8. Data analysis

Data were analyzed using SPSS version 20.0 (SPSS Inc. Chicago, IL, USA). Prevalence of HIV/HBV coinfections among PLWHA was compared to CD4+ T cell count, viral loads and socio-demographic variables using Pearson's chi-square (χ^2) test or Fisher's exact test, where appropriate. Statistical significance for all analyses was determined at a 5% significance level.

3. Results

3.1. Study Population Characteristics

A total of 104 blood samples were obtained from people living with HIV and AIDS (PLWHA) attending the antiretroviral clinic of the Federal Medical Centre, Yenagoa. While all the samples were analyzed serologically, the participants were stratified into age, sex, marital status, educational background, and occupation. Characteristics of the study group are highlighted in Table 1.

Table 1. Patients Characteristics

Variables	Categories	No. Tested	Percentage (%)
Age groups (Years)	8-20	8	7.7
	21-40	51	49.0
	41 & above	45	43.3
Sex	Females	75	72.1
	Males	29	27.9
Marital Status	Singles	43	41.4
	Married	56	53.9
	Divorced	5	4.8
Educational Background	Primary	17	16.4
	Secondary	43	41.4
	Tertiary	42	40.4
	None	2	1.9
Occupations	Self-Employed	27	26.0
	Unemployed	10	9.6
	Business/Trader	29	28.0
	Students	23	22.1
	Artisans	7	6.7
	Civil Servants	8	7.7
CD4 Counts (Cells/µl)	<200	54	52.0
	200-349	10	9.6
	350-499	14	13.5
	500 & above	26	25.0
Viral Loads (Copies/ml)	<20	53	51.0
	20-999	41	39.4
	1000 & above	10	9.6
Total		**104**	**100.0**

3.2. HIV/HBV Coinfection

The overall prevalence of HIV/HBV coinfections is shown in Figure 1. HIV/HBV coinfection was determined to be 2.0%.

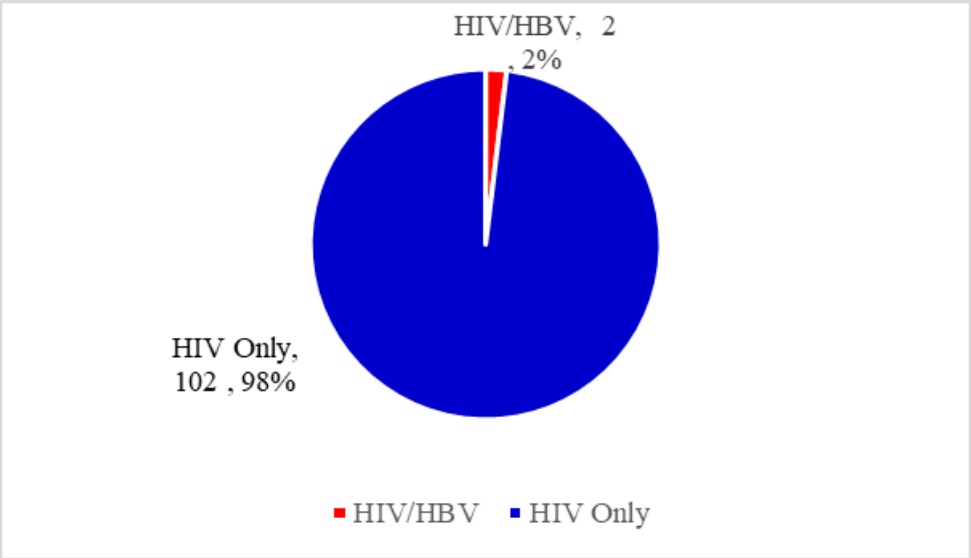

Figure 1. Overall HIV/HBV coinfections

3.3. Age-specific HIV/HBV coinfection

Higher HIV/HBV coinfection was also observed among age groups 41 years and above (2.2%) than in other age groups. This result was followed by ages 21– 40 (2.0%), while other age groups had the least prevalence (0.0%). However, these differences were not statistically associated (p= 0.91). About age, the seroprevalence of HBsAg was found to increase with an increase in age, from 0.0% for those within <20 years, to 2.0% (n = 1) for those within 21 – 40 years, to 2.2% (n = 1) for those within 41 years and above (Figure 2).

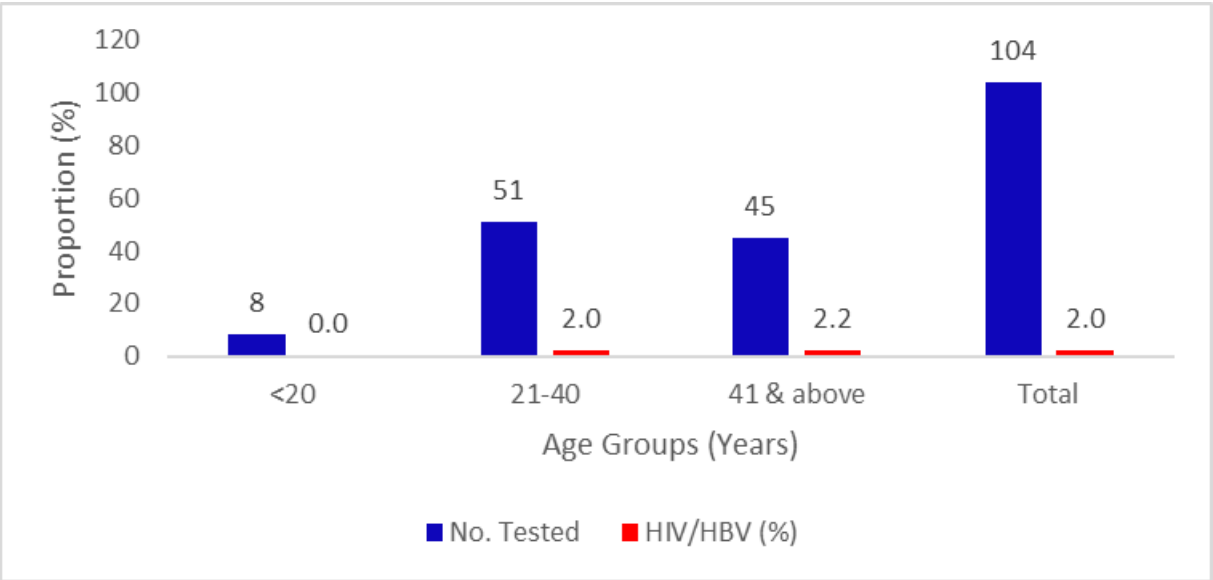

Figure 2. HIV/HBV coinfections with Age

3.4. Sex-specific HIV/HBV coinfection

A higher HIV/HBV coinfection rate occurred among females (3.0%) than in males (0.0%) (Figure 3). The study showed no significant association was found to exist between HIV/HBV coinfection and the sex of the study population (p= 0.48).

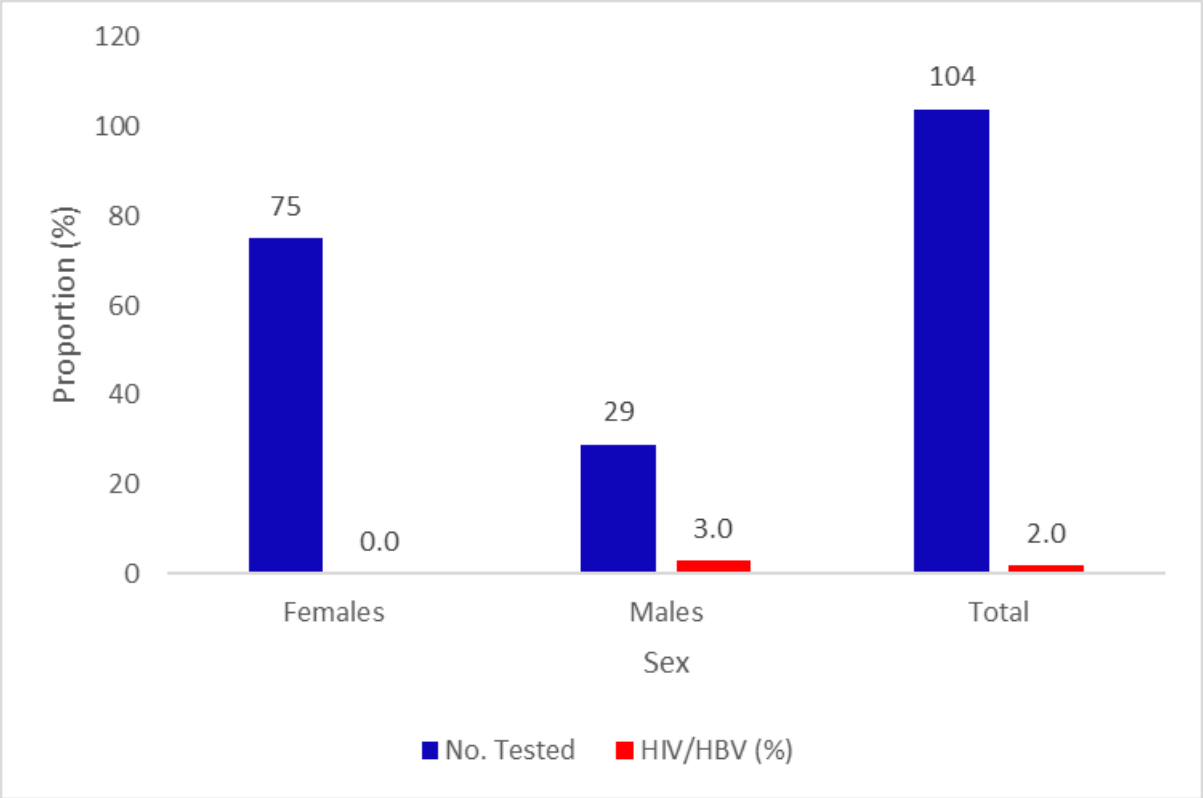

Figure 3. HIV/HBV coinfections with Sex

3.5. Marital Status-specific HIV/HBV coinfection

Higher HIV/HBV coinfection was observed among singles (2.3%) than among the married (2.0%) and divorced (0.0%) (Figure 4). No significant association existed between HIV/HBV coinfection and marital status (p = 0.93).

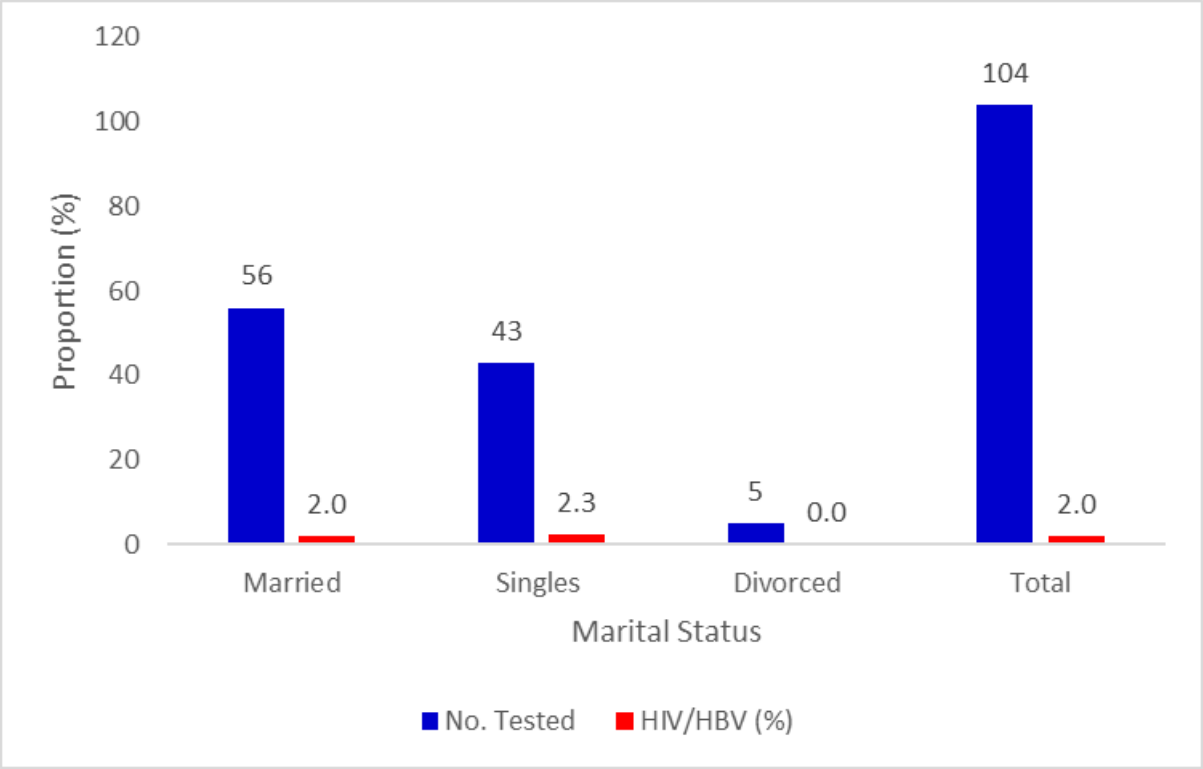

Figure 4. HIV/HBV coinfections with Marital Status

3.6. Educational Background-specific HIV/HBV coinfection

Higher HIV/HBV coinfection was observed among those with tertiary educational backgrounds (5.0%) than those with primary or secondary education (0.0%), as in Figure 5. No significant association existed between HIV/HBV coinfection and educational background ($p = 0.39$).

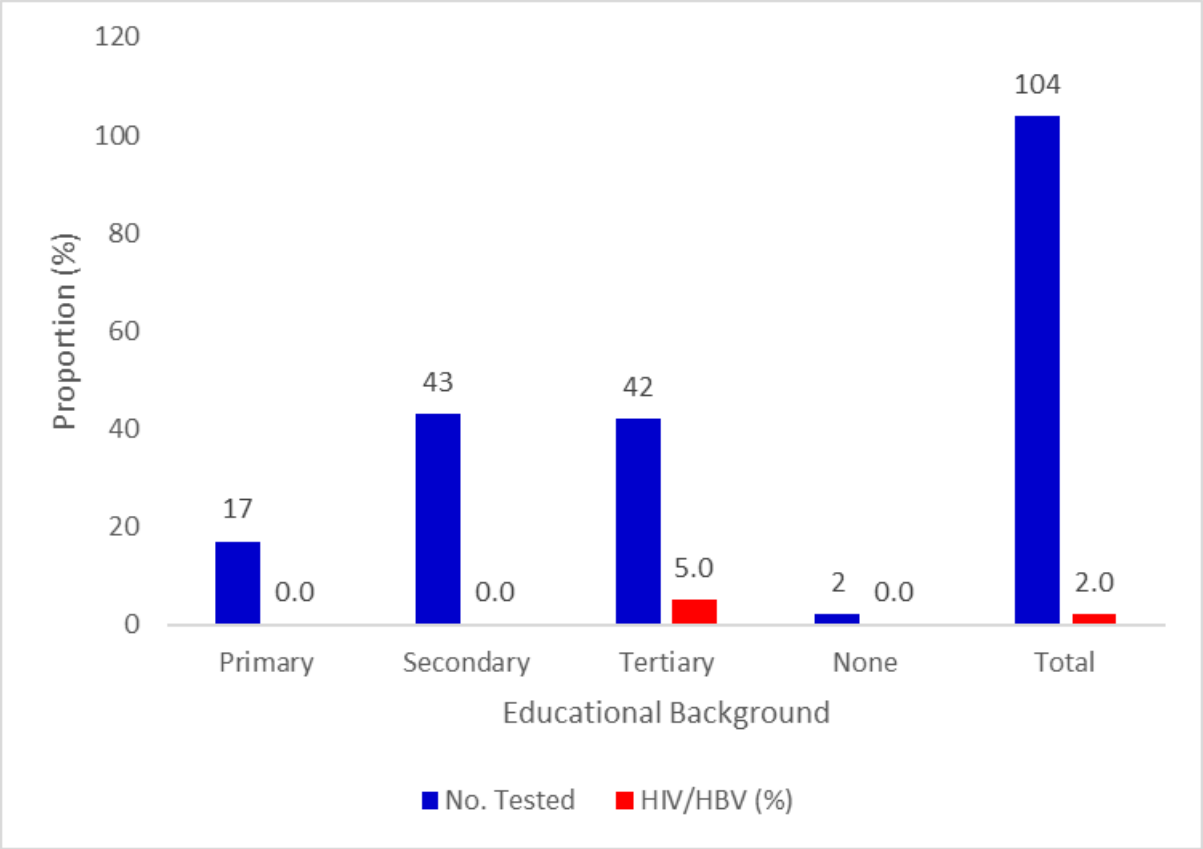

Figure 5. HIV/HBV coinfections with Educational Background

3.7. Occupation-specific HIV/HBV coinfection

Higher HIV/HBV coinfection was observed among students (4.3%) than among business/traders (3.4%) and other occupations 0.0% (Figure 6). No significant association existed between HIV/HBV coinfection and occupations ($p = 0.84$).

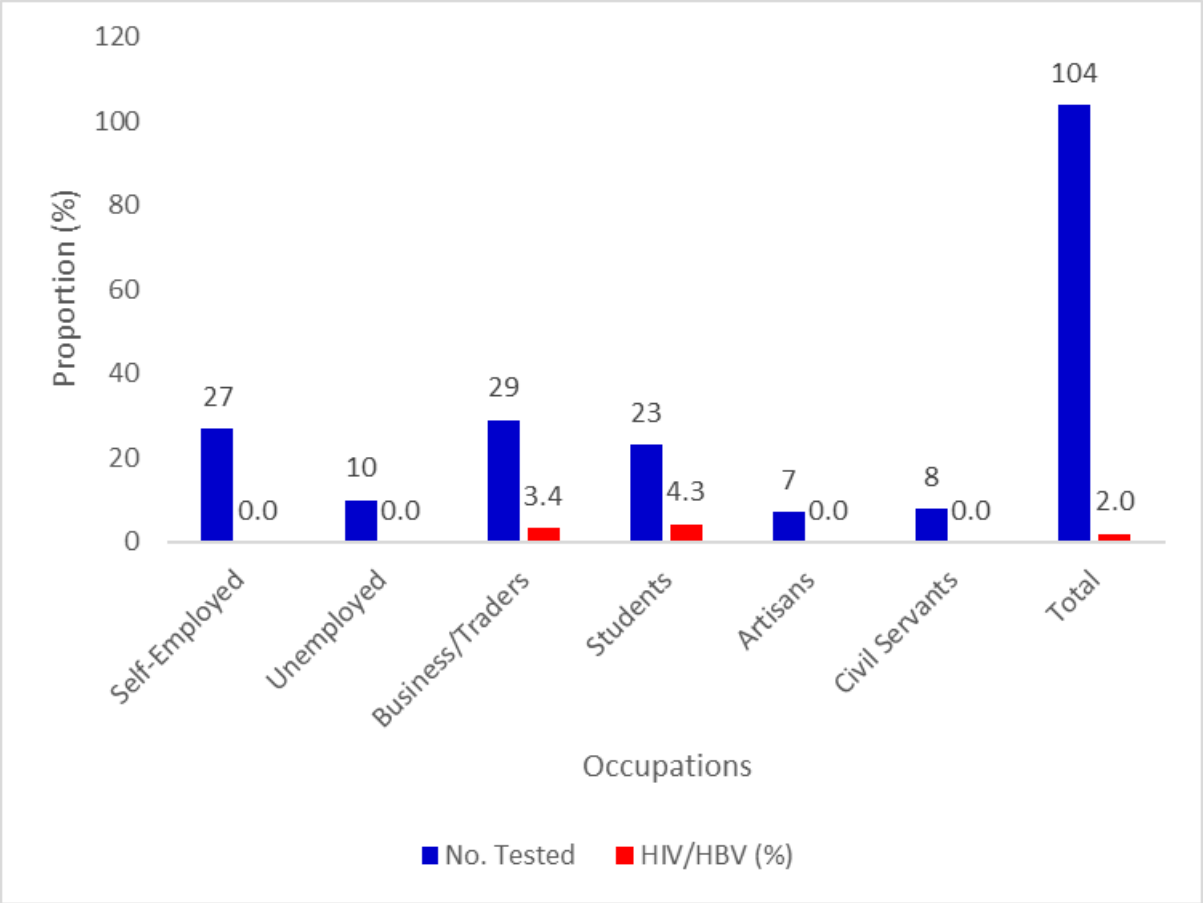

Figure 6. HIV/HBV coinfections with Occupation

3.8. CD4 Counts-Related Specific HIV/HBV coinfection

In terms of CD4 counts, higher HIV/HBV coinfection (3.7%) was observed with CD4 counts <200 than other categories (200-349, 350-499 and >500 cells/µl) with 0.0% (Figure 7). No significant association existed between HIV/HBV coinfection and CD4 counts ($p = 0.60$).

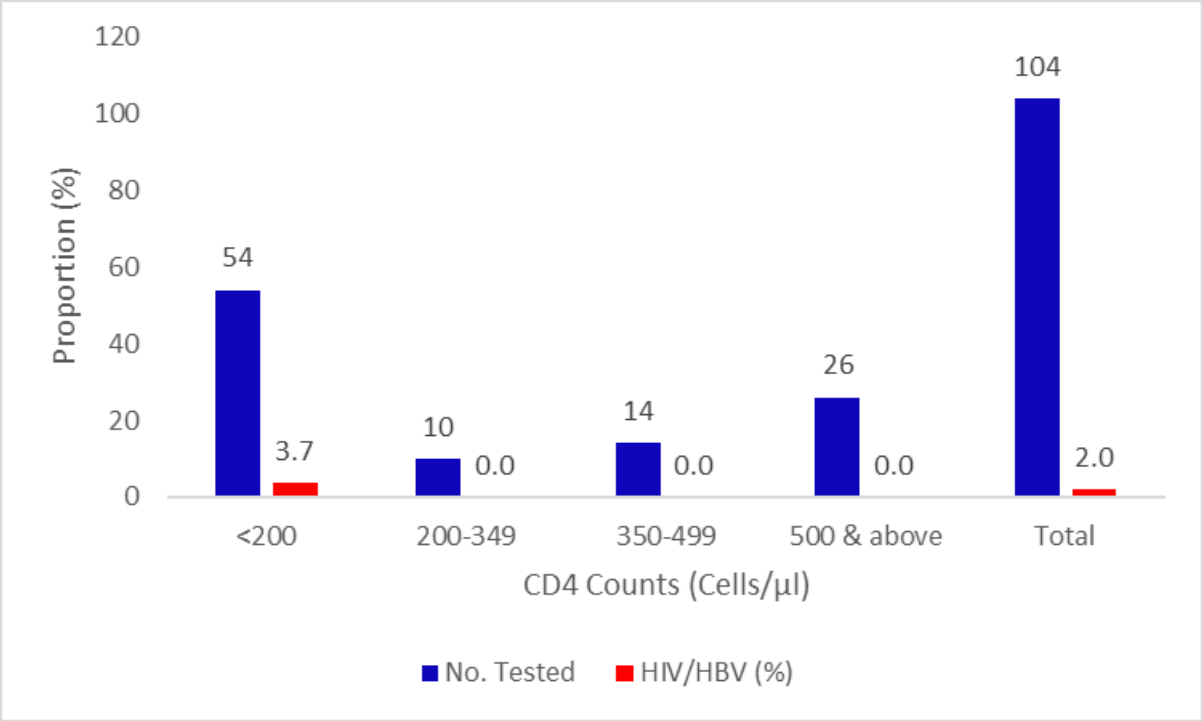

Figure 7. HIV/HBV coinfections with CD4 Counts

3.9. Viral Loads-Related Specific HIV/HBV coinfection

In terms of viral loads, higher HIV/HBV (2.4%) was recorded for participants that had 20-999 copies/ml than those with viral loads <20 copies/ml and >1000 copies/ml with 0.0% (Figure 8). No significant association existed between HIV/HBV coinfection and viral loads (p = 0.88).

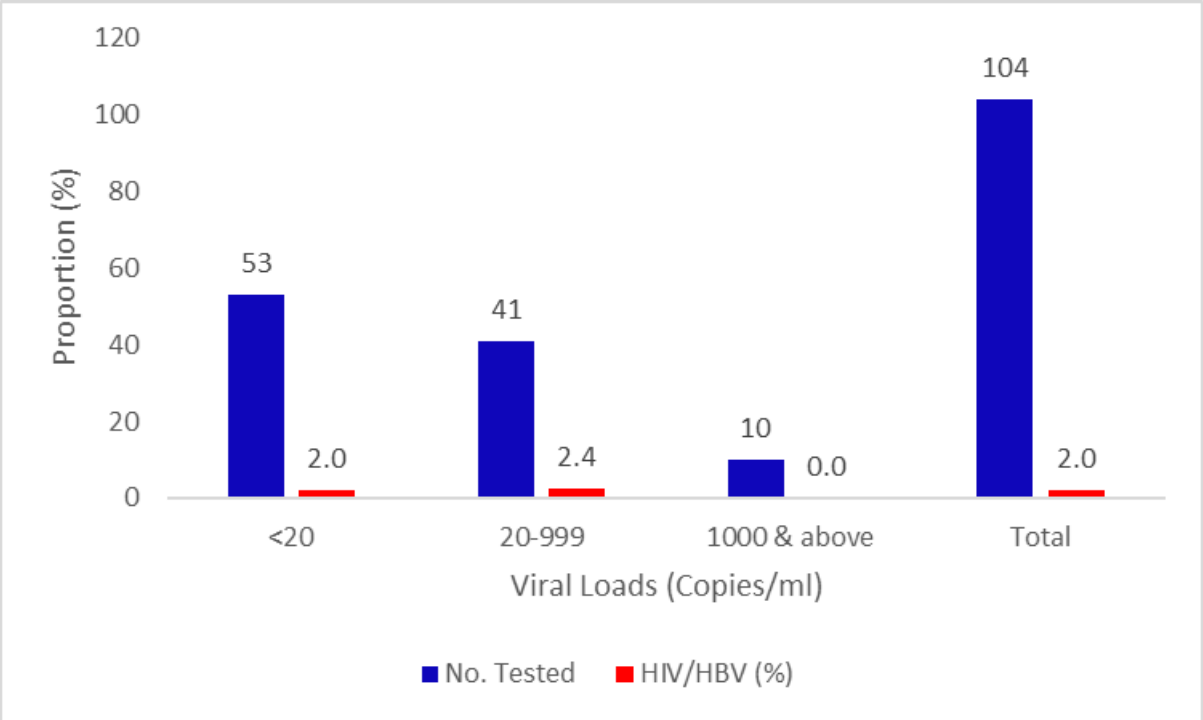

Figure 8. HIV/HBV coinfections with Viral Loads

Figure 3. HIV/HBV coinfections with viral loads

4. Discussion

A total HIV seropositivity of 100% was obtained for all samples, reconfirming their HIV status. HIV has been reported to be associated with a higher prevalence of HBV in Sub-Saharan Africa, and these infections share the same transmission mode with HIV (Innocent-Adiele et al., 2021). In Nigeria, hepatitis coinfection with HIV is linked with increased morbidity and mortality (Balogun et al., 2012). Consequently, coinfections of HIV with HBV were assessed, and a coinfection rate of 2.0% was observed with HIV/HBV. This result suggests that HIV coinfection with HBV among the study participants was low.

The current study showed the prevalence of HIV-HBV coinfection rate at 2.0%. In line with a recent meta-analysis survey on HBV and HIV, coinfection showed the rate at between 0.0% to as high as 28.0% in sub-Saharan Africa with higher rates being reported in West African countries (11.5%) and 4.1% for East African countries which have the lowest rates (Stabinski et al., 2015; Boateng et al., 2019).

The HIV/HBV coinfection rate from this study is similar to lower rates of 2.0% reported by Okonko et al. (2020b) and Aaron et al. (2021), both in Port Harcourt, 2.1% recorded by Odukoya et al. (2022) in Lagos, Nigeria and the 3.1% by Cookey et al. (2021) also in Port Harcourt, Nigeria, but lower than the 3.6% reported by Ihongbe et al. (2022) in Ogun State, Nigeria, the 4.0% observed by Banik et al. (2022), the 4.1% reported by Okoroiwu et al. (2018), the 4.9% observed by Zhou et al. (2010), the 4.8% and 5.3% observed by Lawal et al. (2020), the 6.3% observed by Innocent-Adiele et al. (2021), 6.7% observed by Okonko et al., (2015), 7.6% observed by Odita et al. (2023), 7.5% observed by Nwankwo et al. (2012), 6.7% in Ondo State, Nigeria (Ogundele et al., 2017), 9.20% discovered by Bittaye et al. (2019) and 10.87% discovered by Demarchi et al. (2022).

The 2.0% seropositivity is half lower than the findings of Alo et al. (2013) who had a general prevalence of 12.2% in Sokoto, Nigeria. The present findings do not agree with the findings of Kathryn et al. (2015), who reported a 10.0% prevalence in Africa and Boateng et al. (2019), who reported 12.5% in Kumasi, Ghana. It is also not in agreement with the findings of Otegbayo et al. (2008), who reported (11.9%) in Ibadan, Lesi et al. (2007) 9.2% and Oyesile-Balogun, (2007), who also reported (31.9%) in Lagos State, respectively because more people have become appropriately enlightened about the virus and it associated infection. It could be because more people have become appropriately enlightened about the virus and its associated infection. In Vietnam, Huy et al. (2014) had a general prevalence of 8.4%, while Mustapha & Jibrin (2004) analyzed 200 HIV patients in Gombe State and 26.5% prevalence. All these findings are relatively higher, depicting the endemics of HBV and HIV coinfection in Nigeria.

With age, the least seroprevalence of HIV/HBV of 0.0% was recorded for those less than 20 years, while the highest seroprevalence (2.2%) occurred among those 41 years and above and those within 21 – 40 years (2.0%). This result agrees with the reported findings of Adewole et al. (2009), who reported that the prevalence was more in patients below the age of 45 years in Abuja and the findings of Ekanem et al. (2013), who recorded the highest prevalence of 19% within

40-49 years patients in Uyo. It also agrees with the study of Forbi and another researcher who had more prevalence of 44.0% within the age of 51-60 in Jos. At Port Harcourt, Nigeria, Cookey et al. (2022) showed a higher frequency among 20 to 30-year-olds. According to Demarchi et al. (2022), the frequency was high in Brazil's age range of 21 to 30. It also disagrees with Okonko et al. (2023), who reported a higher prevalence among 21-40 years than others and Odita et al. (2023), who reported a higher prevalence among 14-16 years than others.

For sex, females had a higher HIV/HBV coinfection rate of 3.0% compared to 0.0% of males. This observation agrees with previous studies (Omatola et al., 2019; Cookey et al., 2021, 2022; Okonko et al., 2022). According to Okonko et al. (2022), there was a greater prevalence of HBV among females in Port Harcourt, Nigeria. Females in Anyigba, Nigeria, showed higher HBsAg seropositivity than males, according to a study by Omatola et al. (2019). Cookey et al. (2021 & 2022) also reported that females were more likely than males to have HBV infection in Port Harcourt, Nigeria. At Warri, Nigeria, Okonko et al. (2023a) reported HBV only among females. Also, this study's findings agreed with Adewole et al. (2009), who also reported a higher prevalence in females who were coinfected in FCT Abuja.

The current findings are not in agreement with other previous findings (Forbi et al., 2008; Isa et al., 2014; Ekanem et al., 2015; Zafrin et al., 2019; Omatola et al., 2020; Okonko et al., 2020b, 2023b). Ekanem et al. (2015) reported higher male prevalence in Uyo, Akwa Ibom State, Nigeria. Similarly, the study disagrees with the findings of Forbi et al. (2008), who reported a higher prevalence in males than females who were coinfected in Nassarawa State, Nigeria. Okonko et al. (2020b) also reported that males were more probable than females to have HBV infection in Port Harcourt, Nigeria. The outcomes align with those of Isa et al. (2014), who found that males had a higher prevalence than females. According to Zafrin et al. (2019), males are likelier than females to have HBV. The Omatola et al. (2020) study found that males were likelier than females to have HBV. The Odita et al. (2023) study found males to be more prone to have HBV. The present study on sex differences revealed that male safety enlightened in dealing with the infection than other researchers who revealed that the female categories are more careful than the males.

Higher HIV/HBV coinfection was observed among singles (2.3%) than the married (2.0%) and divorced (0.0%). This result disagrees with other findings (Bui et al., 2014; Zafrin et al., 2019; Mustapha et al., 2020; Cookey et al., 2022; Okonko et al., 2020a, 2022, 2023a, b). Bui et al. (2014) reported a higher prevalence among the married. In Port Harcourt, Nigeria, married people had a higher risk of HBV infection (Cookey et al., 2022; Okonko et al. (2020a, 2022, 2023b). Okonko et al. (2023a) found that married people had a higher risk of HBV in Warri, Nigeria. Nevertheless, this observation agrees with the work of Olayinka et al. (2016), who reported a higher prevalence in singles. According to Demarchi et al. (2022)'s research, unmarried Brazilians are more likely to have HBsAg. At Uyo, Nigeria, Innocent-Adiele (2021) likewise noted a higher frequency among single people. In another study in Port Harcourt, Nigeria, Cookey et al. (2021) discovered higher HBV infection rates among widowed people. Omatola et al. (2019) found that widowed patients had a significantly higher prevalence of HBsAg. This observation could be because marriage is one of the significant risk factors in sexually transmitted diseases and other factors such as sexual intercourse when menstruating, genital ulcers, and some other pelvic inflammatory diseases (PID) (Akinbami et al., 2012).

Higher HIV/HBV coinfection was observed among those with tertiary educational backgrounds (5.0%) than those with

primary or secondary education with 0.0%. This result is consistent with our past research in Warri and Port Harcourt, Nigeria, where HBV infection was exclusively found in people with tertiary education (Okonko et al., 2023a, b). This result concurs with findings from Ihongbe et al. (2022), who discovered a higher prevalence of HBV among tertiary education holders. Also, it contradicts a study by Katamba et al. (2020) that asserted a higher prevalence among those with elementary (primary) school attendance. Omatola et al. (2020) also asserted a higher prevalence among individuals with less formal education in Anyigba, Nigeria. Okonko et al. (2022) asserted a higher frequency among people with secondary education in Port Harcourt, Nigeria.

Higher HIV/HBV coinfection was observed among students (4.3%) than among business/traders (3.4%) and other occupations with 0.0%. This result is consistent with the findings of other studies (Okonko et al., 2020b). This result contrasts our earlier research in Port Harcourt, Nigeria, where we asserted a higher rate among non-students (Okonko et al., 2020a). This discovery also contrasts with our earlier research in Warri, Nigeria, which showed that exclusively traders had HBV infections (Okonko et al., 2023a) and in Port Harcourt, which indicated a higher rate among self-employed persons (Okonko et al., 2022). Omatola et al. (2020) did not support the present observation, which asserted that homemakers had a higher prevalence.

In terms of CD4 counts, higher HIV/HBV coinfection (3.7%) was observed for participants with CD4 counts <200 than other categories (200-349, 350-499 and >500 cells/µl) with 0.0%. This finding was comparable to other studies (Okonko et al., 2020b; Innocent-Adiele et al., 2021). In line with our expectation, the current study showed that HIV/HBV coinfection was associated with severe immunosuppression. This observation is consistent with a previous study in Ghana (Noubiap et al., 2015; Boateng et al., 2019). More so, several other studies have suggested that CD4+ T-cell count <200 cells/mm^3 is often associated with higher HBV DNA levels (Jobarteh et al., 2010; Soriano et al., 2010; Saha et al., 2013; Boateng et al., 2019) and increased risk for liver-related mortality (Thio et al., 2002; Boateng et al., 2019).

In terms of viral loads, higher HIV/HBV (2.4%) was recorded for participants that had 20-999 copies/ml than those with viral loads <20 copies/ml and >1000 copies/ml with 0.0%. However, no association between the traits of the research participants and HBV infection was determined to be statistically significant. This finding was comparable to other studies (Okonko et al., 2020b; Innocent-Adiele et al., 2021). In line with our expectation, the current study showed that HIV/HBV coinfection was not associated with increased viral load. In contrast to their HIV monoinfected counterparts, most HBV-coinfected patients did not have advanced HIV illness, casting doubt on the idea that HBV-mediated immunosuppression and contradicting reports from Ghana and Tanzania (Kilonzo et al., 2017; Boateng et al., 2019). Contrary to international reports (Sagoe et al., 2012; Muriuki et al., 2013; Saha et al., 2013; Manyazewal et al., 2014; Puglia et al., 2016; Boateng et al., 2019), the current study revealed that patients with HIV/HBV coinfection were not severely immunosuppressed and had lower HIV loads compared to those with HIV mono-infection.

5. Conclusion

The overall prevalence of HIV/HBV coinfections in this study was 2.0%. The viral load and CD4 levels were indicators of

HIV/HBV coinfections. People living with HIV and AIDS (PLWHA) in Yenagoa, Nigeria, have HIV/HBV coinfections, which the current study has further validated. It also demonstrated that among PLWHA in Yenagoa, Nigeria, the prevalence of HIV/HBV coinfections is low. Men were more likely to have HIV/HBV coinfection, while their female counterparts demonstrated a more excellent disposition to HIV infection only. This study also reveals a low prevalence of HIV/HBV coinfection, significantly correlated with low CD4+ T cell count and high viral load (as in the case of HBV) among PLWHA in Yenagoa, Nigeria. Moreover, among PLWHA who are currently on ART, a decreased prevalence of this HIV/HBV coinfection was seen. To fully comprehend the effect of ART on HIV/HBV coinfection among PLWHA, more research is advised. This further study will make it easier to keep tabs on the disease's consequences and rate of progression.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors have declared that no competing interests exist.

Statement of ethical approval

The Federal Medical Centre in Yenagoa, Nigeria, gave their administrative clearance for this study. All authors declare that all experiments have been examined and approved by the University of Port Harcourt Research Ethics committee. Therefore, the study is performed following the ethical standards laid down in the 1964 Declaration of Helsinki.

Statement of informed consent

“All authors declare that informed consent was obtained from all individual participants included in the study.”

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