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Original Article

Hepatitis B surface antigen prevalence among people living with HIV in a tertiary hospital in Lagos, Nigeria

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Abstract

Introduction: Human immunodeficiency virus (HIV) and hepatitis B virus (HBV) share transmission routes and may interact synergistically, accelerating liver disease and worsening HIV outcomes. This study assessed the prevalence and serological pattern of HBV infection among people living with HIV attending a tertiary health facility in Lagos, Nigeria, providing local evidence to inform integrated screening and prevention strategies.

Methodology: A cross-sectional study was conducted among 200 HIV-positive individuals aged 16–65 years attending a tertiary healthcare facility in Lagos, Nigeria, between January and June 2023. Participants recruited included 31 males and 169 females. Samples were screened for hepatitis B surface antigen (HBsAg) using a rapid immunochromatographic test strip. Additional markers (HBsAb, HBeAg, HBeAb, HBcAb) were assessed among HBsAg-positive individuals. Associations were tested using chi-square analysis with significance at $p < 0.05$, and prevalence estimates were reported with 95% confidence intervals.

Results: HBV/HIV co-infection prevalence was 5.5% (11/200; 95% CI: 2.3–8.7). Co-infection was higher among males, 8.2% (5/61), than among females, 3.6% (6/139), but the difference was not significant ($\chi^2 = 1.228$, $p = 0.268$). Highest prevalence occurred among those aged 25–29 years (22.2%; 2/9) and 45–49 years (13.2%; 5/38), although age was not significantly associated with HBsAg positivity ($\chi^2 = 13.44$, $p = 0.062$). Among HBsAg-positive participants tested with additional markers (n = 6), HBeAb was detected in four individuals. Dual profiles included HBeAg + HBeAb and HBeAb + HBcAb (each 16.7%).

Conclusions: HBV/HIV coinfection persists in this population, highlighting the need for routine HBV screening, vaccination, and integrated care programs.

Key words: Hepatitis B; prevalence; HIV-infected.

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Introduction

Hepatitis B virus (HBV) and human immunodeficiency virus (HIV) are important contributors to morbidity and mortality worldwide [1,2]. Both are bloodborne viral agents transmitted primarily through sexual exposure and the use of contaminated sharps, leading to an increased risk of simultaneous infection [3]. HBV contributes significantly to liver disease that results in deaths globally, especially among individuals living with HIV/AIDS. Viral hepatitis refers to inflammation of the liver that may be acute or chronic and is associated with viral infections [4].

In 2015, it was estimated that about 37 million people were living with HIV [5]. Furthermore, 248 million individuals were reported to have chronic HBV infection [6]. It is known that between five and twenty people out of 100 people living with HIV are estimated to have chronic HBV infection. People living with HIV who acquire HBV have an increased risk of developing chronic hepatitis [1]. Coinfection with hepatitis and HIV can lead to chronic hepatitis, cirrhosis, and hepatocellular carcinoma, which pose a significant burden on health care systems and public health due to increased risks of liver-related morbidity and mortality [7].

According to Weldemhret [1] the mean prevalence of HBV among individuals living with HIV in sub-Saharan Africa is 15%. Similarly, Kenfack-Momo *et al*. [8] reported that the African region has the highest burden of HBV–HIV coinfections, with a prevalence of 10.5%. Notably, Nigeria, along with other developing regions, faces a substantial burden of coinfections between HIV and HBV [9]. In Nigeria, HIV-HBV co-infection has a high prevalence associated with increased morbidity [10-12].

Several studies have indicated that HIV affects HBV by increasing viral replication, thereby potentiating chronicity, which may lead to fast-paced liver damage and the likelihood of progression to liver

cancer [4,13,14]. In contrast, HBV infection increases in vitro replication of HIV and exacerbates the progression of HIV disease towards AIDS [2]. Mortality rates among individuals coinfected with HIV and HBV are significantly higher than those among individuals with HIV or HBV infection alone [15]. In the United States, HIV/HBV co-infection was found to increase mortality by 8-fold compared with HIV infection alone and 19-fold compared with HBV infection alone [16]. The precise impact of HBV on the progression of HIV disease is not well elucidated [16], although it is speculated that HBV infection may directly affect the immune response in patients on antiretroviral therapy (ART) and contribute to ART-related liver toxicity [2,16]. Unfortunately, there is still limited access to antiviral medications in resource-limited settings, especially with children and adolescents living with HIV who have substantially lower access to antiretroviral therapy compared with adults, highlighting persistent treatment gaps in many low- and middle-income countries in sub-Saharan Africa [17]. The so-called silent epidemic of viral hepatitis is currently overshadowed by the urgency of HIV prevention in the broader community. In many resource-limited settings, HBV screening is often performed only when clinically indicated or during enrolment into HIV care programs, leading to under-detection of HBV infection among people living with HIV [18]. Consequently, reliable epidemiological data on HIV/HBV coinfection remain limited in several parts of Nigeria. Continuous surveillance is therefore necessary to better understand the burden and serological characteristics of HBV infection in HIV-infected populations. This study aimed to determine the prevalence and serological profile of hepatitis B virus infection among people living with HIV attending a tertiary health facility in Lagos, Nigeria, and to evaluate demographic factors associated with HBV infection in this population. In addition to estimating the burden of HBV/HIV coinfection, this study further assessed selected HBV serological markers among HBsAg-positive individuals to provide insights into the pattern of HBV infection in HIV-infected patients. By generating recent data from a tertiary healthcare setting in Lagos, this work contributes updated local evidence that may support improved HBV screening, vaccination strategies, and integrated management of HBV within HIV care programs in Nigeria.

Methodology

Study Design

A hospital-based cross-sectional study design was employed among people living with HIV attending the Lagos State University Teaching Hospital (LASUTH), Lagos State, Nigeria, for routine clinical care. The study population consisted of HIV-positive individuals aged 16–65 years who had previously been confirmed HIV-positive through standard diagnostic procedures and who provided written informed consent to participate in the study.

Participants were recruited using purposive sampling, a non-probability sampling technique in which eligible patients attending the HIV clinic during the study period were approached consecutively and invited to participate. Recruitment was conducted between January and June 2023 during routine clinic visits. Individuals who met the inclusion criteria and consented to participate were enrolled until the predetermined sample size of 200 participants was achieved. The final study population consisted of 31 males and 169 females, reflecting the gender distribution of patients attending the HIV clinic during the study period.

Eligible participants included HIV-positive individuals aged 16–70 years who had been confirmed positive using the established HIV screening algorithm, provided informed consent to participate in the study, and completed the administered questionnaire appropriately. Individuals who declined to participate or withdrew their consent at any stage of the study were excluded. Following enrollment, sociodemographic characteristics, potential risk factors, and relevant clinical and epidemiological information were obtained from participants using a structured questionnaire administered by trained research personnel. This study calculated a minimum sample size of 113 participants using Fisher's formula with a prevalence of 8.0%, as reported by Omatola *et al*. [11], but a total of 200 participants were recruited for this study.

Sample collection, transport and storage

Blood samples were aseptically obtained by cleaning the venipuncture site with 70% alcohol. A phlebotomist collected 5 mL of venous blood from each patient using a fixed-hypodermic needle. The collected blood was transferred into an EDTA bottle to extract the plasma. The blood samples were subsequently centrifuged at 3000 revolutions per minute (rpm) for 10 minutes. The resulting plasma was separated via a sterile disposable Pasteur pipette and transferred into cryovials, which were properly labelled. The cryovials containing the plasma samples were then stored at -20°C until further analysis.

Laboratory analysis

Laboratory analysis was carried out at the Microbiology Laboratory in the Department of Biological Sciences and Biotechnology, Caleb University, Imota, Ikorodu, Lagos State. Screening for hepatitis B virus infection was performed using rapid immunochromatographic test strips to detect HBsAg and other HBV serological markers (GIMA S.p.A., Gessate, Italy). These assays are based on lateral flow immunochromatographic technology, which allows qualitative detection of HBV antigens and antibodies in serum or plasma samples. According to the manufacturer, the HBsAg rapid test has a diagnostic sensitivity of approximately 99% and specificity of 99–99.5%. Rapid immunochromatographic assays for HBV markers have been widely evaluated in Nigeria and other resource-limited settings and have demonstrated good diagnostic performance when compared with enzyme-linked immunosorbent assays (ELISA). Studies conducted in Nigeria have reported sensitivities ranging from 72.2–98.5% and specificities between 80.0–97.4% for rapid HBsAg screening assays [19,20]. Similar rapid immunochromatographic methods have also been used to detect HBeAg, HBeAb, HBcAb, and HBsAb, showing acceptable diagnostic reliability for epidemiological screening and clinical studies [19,21]. These studies support the suitability of rapid lateral-flow assays for detecting HBV serological markers in clinical and public health research settings.

The test strip is a quick, one-step method for the qualitative detection of HBsAg in blood or plasma. Prior to testing, all test strips and stored plasma samples were allowed to acclimate to room temperature (15–30°C). Five microliters of each plasma sample were added to the sample point in each strip, after which the results were observed in accordance with the manufacturer's instructions at 15 minutes of development of the test and control lines, and no result was determined beyond 30 minutes to avoid false-positive or false-negative outcomes.

Qualitative detection of all 5 markers was done using a commercially available rapid diagnostic test kit (hepatitis B surface antigen (HBsAg), hepatitis B surface antibody (HBsAb), hepatitis B e antigen (HBeAg), hepatitis B e antibody (HBeAb), and hepatitis B core antibody (HBcAb)) and was carried out following the manufacturer's instructions. The test results were interpreted at 15 minutes of development of the test and control lines, and no results were considered valid beyond 30 minutes to avoid false-positive or false-negative outcomes.

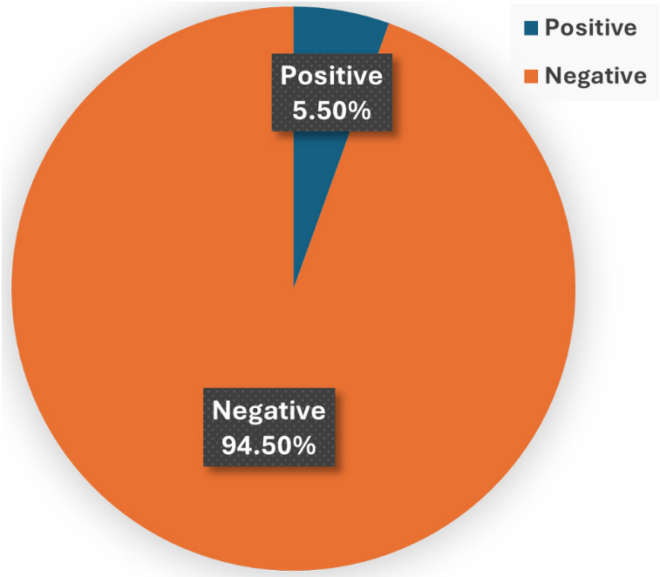
Data analysis

The data obtained in this study were analyzed using the statistical software GraphPad Prism software version 8.0 for Windows (GraphPad Software, San Diego, CA, USA). The descriptive statistics are presented as simple percentages in the tables and figures, and the chi-square test was used for inferential statistics to determine the associations between the variables. A $p \leq 0.05$ was considered to indicate statistical significance.

Ethical Considerations

This study was approved by the Health Research Ethics Committee of the Lagos State University Teaching Hospital with Approval number LREC/06/10/2029. There was strict adherence to ethical issues such as complete disclosure of nature of the study, associated risks, associated benefits, alternatives, and opportunity to ask questions, ability of each participant to make an informed decision on participation, obtaining well-informed and written and/or verbal consent from participants, and administration of questionnaire with extreme confidentiality in line with the 1964 Declaration of Helsinki and its later amendments.

Figure 1. Prevalence of hepatitis B virus antigen (HBsAg) among people living with HIV.



Results

The prevalence of hepatitis B virus antigen (HBsAg) was 5.5% (11/200) among people living with HIV receiving care at the Lagos State University Teaching Hospital (LASUTH), as shown in Figure 1. The distribution of participants by sex revealed that

approximately 8.2% of males and 3.6% of females had HBsAg detected in their blood, as shown in Table 1. The distribution of participants according to age group revealed that co-infection with HBV, as evidenced by HBsAg positivity, was highest in the 25–29-year-old age group, with a prevalence of 22.2% (2/9), although this age group had the lowest participation compared with the 45–49-year-old age group, which had higher participation and frequency of positive HBsAg (5/38) and a prevalence of 13.2% (Figure 2). Zero prevalence was recorded among those aged 16–19 years, 20–24 years, 30–34 years, and among those aged 50 years and above. There was no statistically significant association between the different age groups considered in this study ($\chi^2 = 13.44$, $p = 0.0621$).

The prevalence of other HBV markers (HBsAb, HBeAg, HBeAb, and HBcAb) in 11 HBV (HBsAg)-positive participants is shown in Table 2. Five of the 11 HBsAg-positive participants did not have any other markers detected. Among the other serological markers detected, HBeAb was the most frequently detected marker (66.7%; 4/6) and occurred equally in males and females. No isolated detection of HBsAb, HBeAg, or HBcAb was observed. Dual serological patterns were identified in two participants, including HBeAg + HBeAb (16.7%) and HBeAb + HBcAb (16.7%), both occurring in males. Positive HBV/HIV-positive participants were linked to several risk-associated activities in this study. Three of the participants (27.3%) had undergone surgical procedures, two (18.2%) had sexual exposure, and one participant (9.1%) reported the risk activities of incision/tattooing and needle sharing, as shown in Figure 3. However, there was no statistically significant association between the risk activities considered ($\chi^2 = 1.869$, $p = 0.6001$).

A total of 13 participants (6.5%) reported having received the hepatitis B vaccine. However, none of those who were reactive to HBsAg had received the vaccine. The participants who had HBsAg in their blood had a history of HIV from 2003-2022, which ranged from one-20 years and an average of 8 years of HIV infection, whereas those who were not HBsAg reactive had a history of HIV from 1998-2022, with a range of one-25 years and an average of approximately 10 years of HIV infection.

Table 1. Gender prevalence of hepatitis B virus surface antigen among people living with HIV receiving care at LASUTH.

Gender	Hepatitis B Virus Surface Antigen (HBsAg)	
	No. tested (%)	No. Positive
Male	61 (30.5)	5 (8.2)
Female	139 (69.5)	6 (3.6)

$\chi^2 = 1.228$; $p = 0.2678$.

Figure 2. Age-related prevalence of HBsAg among people living with HIV.

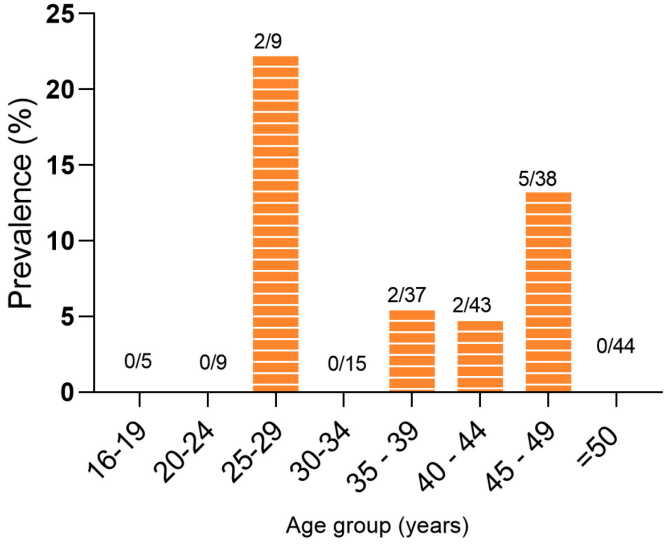


Figure 3. Risk factors associated with hepatitis B virus surface antigen (HBsAg) positivity among people living with HIV.

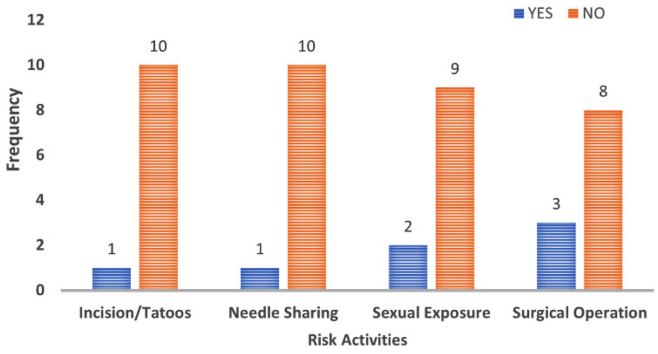


Table 2. Distribution of HBV serological markers in HBV/HIV coinfection-positive participants.

HBV Serological marker	No.	%	Gender	
			M	F
HBsAb	0	0.0	0	0
HBeAg	0	0.0	0	0
HBeAb	4	66.7	2	2
HBcAb	0	0.0	0	0
HBeAg + HBeAb	1	16.7	1	0
HBeAb + HBcAb	1	16.7	1	0

M: Male; F: Female.

Discussion

Globally, hepatitis B virus (HBV) infection remains an important comorbidity among people living with HIV. There is evidence that suggests that approximately 5–10% of people living with HIV worldwide are chronically infected with HBV, while in Africa the burden is higher, with a pooled prevalence of approximately 10.5% (95% CI: 9.6–11.3) among HIV-infected individuals based on recent systematic review and meta-analysis [8]. The probability of HIV/HBV coinfection stems from the fact that HIV and HBV share similar risk factors, and many instances of HIV infection occur in HBV carriers. Research has indicated that hepatitis B virus (HBV) infection is widely prevalent in Nigeria, but available data on HIV/HBV co-infection needs to be updated [8,10,22].

In this study, the prevalence of HBV among people living with HIV at a tertiary health facility in Lagos was 5.5%. This indicates a high burden of HBV coinfection within this population. The reported prevalence in this study is a glaring indication that HBV is a major threat to HIV/AIDS patients. The high prevalence of HBV/HIV coinfection in general has several implications. First, it emphasizes the importance of routine screening for both HBV and HIV among at-risk populations, which is done routinely for all the newly enrolled HIV infected at the center. Early detection and timely management are crucial for preventing disease progression and reducing transmission rates. Second, the burden of co-infection places additional strain on healthcare systems, requiring increased resources and targeted interventions to ensure comprehensive care for affected individuals [9]. The prevalence data obtained in this study are lower than the 16.1%, 7.8%, and 8.0% reported in three southwestern states of Oyo, Osun, and Kwara [23]; Enugu, Southeast Nigeria [10]; and Lokoja, North Central Nigeria [9], respectively.

Similarly, this study revealed the occurrence of four different patterns (HBsAg, HBeAb, HBeAb/HBcAb and HBeAb/HBeAg) of five HBV serology markers tested. None of the HBsAg-positive participants tested positive for HBsAb, indicating the absence of protective antibodies and suggesting active HBV infection. In contrast, only one participant tested positive for HBeAg, which signifies a higher viral load and increased infectivity. However, this marker is associated with HBeAb. This raises concerns about the potential for disease transmission among this patient [24]. Furthermore, 4 (66.7%) participants tested positive for HBeAb, indicating the transition from acute to chronic HBV infection, in which the virus becomes less actively replicating, with a low viral load and a reduced risk of transmission [25]. Additionally, the combined detection of HBeAb/HBcAb and HBeAb/HBeAg in 1 (16.7%) HBV-positive participant indicates a carrier with low viral replication, which may suggest chronicity and that the immune system has mounted a response against the virus or indicates past exposure and potential recovery from the infection [26], whereas the detection of HBeAb/HBeAg in 1 (9.0%) HBV-positive participant may also indicate an acute infection with a high viral load tending towards chronicity.

There is a gender disparity in HBV infection rates among HIV-positive patients at the facility, as the number of females outnumbers the number of males in this study. The higher prevalence of HBsAg observed among males compared with females in this study may reflect gender-related differences in behavioral and occupational exposures that increase the risk of HBV transmission. In many settings, men are more likely to engage in behaviors associated with increased HBV exposure, including multiple sexual partnerships, higher rates of unprotected sexual activity, and greater involvement in occupations or practices that may involve contact with blood or sharps. Previous studies conducted in Nigeria have similarly reported a higher prevalence of HBV infection among males, which has been attributed to behavioral and sociocultural factors that predispose men to increased exposure to blood-borne infections [10,22]

In addition, health-seeking behavior differs by gender, with women often accessing healthcare services more frequently through antenatal and reproductive health programs where HBV screening and preventive interventions may be provided, potentially reducing the likelihood of undiagnosed infection. Hence, the observation in this study does not necessarily mean that more women in the population are HIV positive, although more women are known to be infected by HIV because of their anatomy.

In this study, the highest prevalence of HBV (22.2%) was observed in the 25–29-year age group. This finding aligns with a previous study conducted in Yola, Nigeria, in which the highest prevalence, 12.9%, was reported among those aged 26–39 years [27]. Another study in Lome, Togo, reported the highest prevalence of 26.3% among those aged 20–29 years [28]. The higher prevalence observed among this age group may be attributed to increased sexual activity, particularly among adolescents. The young age at which these infections occur underscores the need for concerted efforts to implement preventive measures targeting the most susceptible age group [29].

Conversely, Avwioro *et al*. [30] reported that individuals aged 31-50 years had the highest prevalence of HBV infection in the Niger Delta, Nigeria, indicating an increase in prevalence with age.

The variation in HBsAg prevalence across age groups observed in this study may also reflect differences in cumulative exposure risk and behavioral patterns. The relatively higher prevalence among participants aged 25–29 years and 45–49 years may be associated with increased sexual activity, longer duration of exposure to risk factors, and potential engagement in high-risk behaviors during these life stages. Similar age-related patterns have been reported in studies from Nigeria and other parts of sub-Saharan Africa, where HBV infection tends to occur more frequently among sexually active adults and individuals with prolonged exposure to transmission risks [10]. Younger age groups showed no detectable infection in this study, which may partly reflect smaller sample sizes and lower cumulative exposure, whereas the absence of HBsAg positivity among older participants may be related to viral clearance, survival bias, or reduced exposure to high-risk behaviors over time.

This study revealed that various risk factors are involved in HBV transmission. Sexual exposure accounted for 18.1% of the cases, suggesting a significant role of sexual transmission in HBV infection among this population. Incision/tattoo procedures and needle sharing were each associated with 9.1% of the cases. Additionally, surgery was identified as a major predisposing factor, accounting for 27.3% of cases. This scenario is similar to a previous report in Lokoja, North Central Nigeria [11]. These findings underscore the importance of addressing these specific risk factors in the prevention and control of HBV transmission among people living with HIV. There is a need to emphasize the need for comprehensive sexual health education, safe injection practices, and infection control measures among people living with HIV.

This study revealed that those infected with HBsAg had no history of HBV vaccination. Fourteen (14) participants, accounting for 7% of the participants tested, reported being vaccinated. This study did not screen all participants for other HBV markers, which is a limitation. The high prevalence of HBsAg among participants in this cohort indicates that HBV vaccination with an improved four-dose schedule is the best way to improve immune response among persons with comorbidities or evidence of immunodeficiency [31]. Additionally, vaccine improvements, exemplified by the recombinant HBV vaccine with a toll-like receptor agonist adjuvant approved in the United States, which targets robust immunological responses at lower doses, will be preferred in this population to reduce the burden of HIV-associated hepatitis B infection [31].

The study addresses the important issue of HBV prevalence among people living with HIV, which has significant public health implications in Nigeria. It directly contributes updated data to the burden of HIV/HBV coinfection in a resource-limited setting while providing details of multiple HBV markers among positive participants. The study includes detailed demographic data (such as age and gender), providing a nuanced understanding of HBV prevalence and enabling age- and sex-specific analyses of coinfection rates.

Despite the valuable insights provided by this study, several limitations should be acknowledged. First, the diagnosis of hepatitis B virus infection was based primarily on serological detection of HBsAg using rapid immunochromatographic assays, without confirmation using molecular techniques such as polymerase chain reaction (PCR). Consequently, the study may not have identified cases of occult hepatitis B infection (OBI), which is characterized by HBV DNA in the absence of detectable HBsAg. Occult HBV infection has been reported among people living with HIV and may contribute to the underestimation of the true burden of HBV infection in this population. Second, the use of rapid diagnostic tests rather than more sensitive assays, such as enzyme-linked immunosorbent assay (ELISA) or nucleic acid testing, may have reduced detection sensitivity, potentially leading to misclassification of some cases. Third, the study's cross-sectional design limits the ability to establish temporal or causal relationships between demographic factors and HBV infection. Finally, as the study was conducted in a single tertiary healthcare facility, the findings may not be fully generalizable to the wider population of people living with HIV in other settings within Lagos or Nigeria. Future studies incorporating molecular diagnostic methods and multicenter designs would provide a more comprehensive understanding of HBV infection dynamics among HIV-infected individuals.

Conclusions

This study demonstrates that hepatitis B virus infection remains an important comorbidity among people living with HIV receiving care at a tertiary health facility in Lagos, Nigeria, with an observed prevalence of 5.5%. Although the prevalence reported in this study is lower than that in some other regions of Nigeria, the presence of HBV among HIV-infected

individuals highlights a persistent public health concern because coinfection is associated with accelerated liver disease progression, increased risk of hepatotoxicity during antiretroviral therapy, and poorer clinical outcomes. The higher prevalence observed among males and among sexually active age groups further underscores the influence of behavioral and cumulative exposure risks in HBV transmission within this population.

From a public health perspective, these findings emphasize the need to strengthen integrated HBV prevention and management strategies within HIV care programs. Routine HBV screening at enrollment into HIV care, expanded HBV vaccination coverage for susceptible individuals, and appropriate clinical monitoring of coinfected patients should be prioritized in order to reduce the burden of liver-related complications. In addition, targeted health education addressing behavioral risk factors and improving awareness of HBV transmission among people living with HIV may contribute to reducing new infections. Strengthening these integrated interventions within HIV treatment programs will be critical for improving long-term health outcomes and reducing the dual burden of HBV/HIV comorbidity in Nigeria and other resource-limited settings.

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Authors' contributions

OSA conceived the study and was involved in all processes of data acquisition, analysis, and interpretation of the results. EAA was involved in analysis, interpretation of the results and reviewed the manuscript. SNU collected and analysed data. OAA contributed to the manuscript and reviewed the contents. AAA critically reviewed the research contents and reviewed the manuscript.

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Conflict of interest

No conflict of interest is declared.

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