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Hepatitis B Virus Infection among HIV/AIDS Patients in Selected Hospitals in Nasarawa West Senatorial District, Nigeria: Association With Risk and Socio-Demographic Factors

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Annotation: Introduction:

Co-infection with Hepatitis B Virus (HBV) and Human Immunodeficiency Virus (HIV) remains a major public health concern, particularly in sub-Saharan Africa, where the burden of both infections is high. HIV-infected individuals are at greater risk of HBV-related liver complications due to compromised immunity, yet HBV screening is often neglected in HIV care programs.

Objectives:

This study aimed to determine the prevalence of HBV infection among HIV-positive patients in selected hospitals within Nasarawa West Senatorial District, Nigeria, and to identify associations between HBV status and socio-demographic as well as behavioral risk factors.

Method of Analysis:

A descriptive cross-sectional study was conducted among 300 HIV-positive individuals using convenience sampling. Blood samples were collected and screened for HBsAg using rapid test kits. HBsAg-positive samples underwent HBV DNA extraction and nested PCR for molecular confirmation. Socio-demographic and behavioral data were collected using structured questionnaires. Data were analyzed using SPSS version 20, with chi-square tests employed to assess associations at a significance level of $p \leq 0.05$.

Results:

The overall prevalence of HBV infection among participants was 14.7%. Prevalence was higher among males (14.3%) than females (9.7%), and highest among those aged 25–39 years (12.9%). Participants with primary education had a higher prevalence (16.7%) compared to those with tertiary education (8.3%). Single and divorced individuals had the highest rates of infection (both 12.5%). Risk behaviors such as intravenous drug use (27.8%), living with a hepatitis-infected person (25.0%), and a history of blood transfusion, STIs, or multiple sexual partners were associated with increased HBV positivity, although not all associations were statistically significant.

Conclusion:

The study reveals a substantial burden of HBV among HIV-infected individuals in Nasarawa West, highlighting the need for integrated HBV screening, vaccination, and education within HIV care programs. Tailored interventions targeting males, young adults, and those with limited education are essential for reducing HBV-HIV co-infection rates. Strengthening public health strategies to address behavioral risks can significantly improve health outcomes and reduce liver-related complications in this vulnerable population.

Keywords: Hepatitis B virus, HIV/AIDS, co-infection, risk factors, Nigeria, public health, socio-demographics, HBV screening.

Introduction

Hepatitis B virus (HBV) infection continues to be a critical global health concern, particularly in regions with a high burden of HIV/AIDS. HBV, a double-stranded DNA virus from the *Hepadnaviridae* family, is a major cause of liver-related morbidity and mortality, leading to complications such as cirrhosis and hepatocellular carcinoma. The co-infection of HBV and HIV significantly complicates disease progression, therapeutic management, and patient outcomes, contributing to increased rates of liver-related morbidity and mortality (Thio et al., 2021; Aghokeng et al., 2022). The immunosuppression associated with HIV infection enhances HBV replication and progression to chronic liver disease, particularly in resource-limited settings (Price et al., 2023).

In sub-Saharan Africa, including Nigeria, HBV is highly endemic. Studies have documented varying prevalence rates across different regions, reflecting demographic, behavioral, and health system factors. For example, Musa et al. (2023) reported an HBV prevalence of 11.2% among HIV-positive patients in Yola, Adamawa State, Nigeria, with a higher burden observed in males and individuals aged 25–39 years. Similarly, Hassan et al. (2022) found an 8.0% co-infection rate among people living with HIV/AIDS in Dutse, Jigawa State, underscoring the need for routine HBV screening within HIV treatment programs. These findings align with the World Health Organization (WHO, 2022) guidance, which emphasizes the integration of hepatitis services into HIV care, particularly in high-burden settings.

The transmission pathways of HBV mirror those of HIV—primarily through contact with infected blood, unprotected sexual activity, and vertical transmission from mother to child. As noted by Alhassan et al. (2023), this shared route of transmission underscores the need for synergistic prevention strategies, including HBV vaccination and harm reduction approaches. Despite the availability of a safe and effective HBV vaccine, uptake remains suboptimal in Nigeria. A recent study by Umeh et al. (2024) in Abuja revealed a 4.3% HBV prevalence among the general population, with the highest rates in individuals aged 20–39 years. Alarmingly, although initial vaccine uptake was relatively high, completion of the full three-dose schedule was significantly lower, reflecting challenges in vaccination adherence and health system follow-up.

Limited epidemiological data exist on HBV/HIV co-infection in the Nasarawa West Senatorial District. This gap presents a significant barrier to the development of targeted public health interventions in the region. In their study, Nwankwo et al. (2022) emphasized that localized data on HBV and HIV co-infection are critical for informing state-specific policies and resource allocation. Additionally, studies by Eze et al. (2021) and Danladi et al. (2022) have shown that socio-demographic factors such as age, sex, marital status, and level of education are significantly associated with HBV infection, particularly among HIV-infected populations.

Given the high endemicity of HBV in Nigeria and the clinical complexity posed by HIV co-infection, this study seeks to assess the prevalence of HBV infection among HIV/AIDS patients in selected hospitals in Nasarawa West Senatorial District. Furthermore, it aims to examine associations with socio-demographic characteristics and behavioral risk factors such as history of blood transfusion, multiple sexual partnerships, and traditional scarification practices. The findings are expected to provide critical insights that can inform screening protocols, vaccination campaigns, and integrated management approaches tailored to high-risk populations in the region.

Theoretical Framework

This study is however grounded in the Health Belief Model (HBM), originally developed by Rosenstock (1974), which offers a comprehensive framework for understanding health-seeking behavior through the lens of individual beliefs and perceptions. The model posits that the likelihood of engaging in a health-related behavior is influenced by six constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy.

Within the context of hepatitis B virus (HBV) infection among individuals living with HIV/AIDS (PLWHA), the HBM serves as an appropriate theoretical framework to explore the cognitive and social factors influencing health behaviors such as HBV screening and vaccination. Given that PLWHA are biologically more susceptible to HBV infection due to shared transmission pathways and immunosuppression, their perception of susceptibility plays a critical role in motivating preventive actions (Aghokeng, Kengne-Nde, Fokam, Laurent, & Peeters, 2022). Furthermore, the perceived severity of HBV—especially in the context of co-infection, which accelerates liver disease progression and increases mortality—may influence the urgency with which individuals seek preventive interventions.

The perceived benefits of HBV screening and vaccination—such as early detection, prevention of complications, and reduced transmission—can significantly motivate health behavior. However, these actions may be impeded by perceived barriers including financial constraints, limited access to healthcare, lack of awareness, stigma, and inadequate counseling (Umeh, Ilesanmi, & Njoku, 2024). Socio-demographic factors such as educational level, gender, age, and occupation have been shown to shape these perceptions. For instance, individuals with higher educational attainment often demonstrate increased health literacy, better comprehension of disease risk, and greater engagement with preventive services (Danladi, Salisu, & Gambo, 2022). Conversely, those with limited education may underestimate their vulnerability and thus delay or avoid HBV-related healthcare services.

Cues to action, such as public health messaging or recommendations from healthcare providers, are essential in triggering health-promoting behavior among PLWHA. These cues can help overcome inertia and address misperceptions, particularly in resource-constrained settings where knowledge about HBV is limited. Lastly, self-efficacy—the belief in one's ability to take preventive health actions—affects the degree to which individuals engage in screening or complete vaccination regimens. Empowering PLWHA with knowledge and support to navigate the healthcare system can enhance their confidence and commitment to preventive behaviors (Alhassan, Adepoju, Awosan, & Ajayi, 2023).

By employing the HBM, this study seeks to elucidate the mechanisms through which socio-demographic and psychosocial factors interact to influence HBV-related health behaviors in PLWHA. The model not only provides a lens for interpreting observed patterns of behavior but also offers a practical foundation for designing targeted interventions aimed at improving HBV screening, vaccination, and overall health outcomes in this vulnerable population.

Materials and Methods

Study Design

A descriptive cross-sectional design was used. Convenience sampling was employed to recruit 300 participants who gave informed consent.

MATERIALS AND METHODS

Materials

Commercially available HBsAg rapid test kits were used for the initial screening of Hepatitis B surface antigen. These included kits from LabACON (Hangzhou Biotest Biotech Co., Ltd., China) and Citus Diagnostics Inc., Canada, and were used in accordance with the manufacturer’s instructions. The major chemicals and reagents utilized for DNA extraction and amplification included: Ethanol, Master Mix (Qiagen, Germany), NaOH (1M) and HCl (0.1M) for DNA lysis and neutralization. Primer sequences specific for HBV genotypes were used for nested PCR analysis as described by Naito et al. (2001).

Study Area

The study was conducted in three selected hospitals within Nasarawa West Senatorial District of Nasarawa State, Nigeria: Federal Medical Centre, Keffi, General Hospital, Garaku (Kokona LGA), General Hospital, Nasarawa (Nasarawa LGA). Nasarawa West Senatorial District consists of five LGAs, but this study was limited to three. Nasarawa State lies within latitude 8°32′N and longitude

8°18′E and covers an area of approximately 27,117 km². According to the 2006 census, the State had a population of approximately 1.8 million people.

Sample Size Determination

The sample size was determined using the formula described by Naing et al. (2006), based on an estimated hepatitis B virus (HBV) prevalence of 13.3% among HIV-positive individuals (Pennap et al., 2010), at a 95% confidence level. To enhance the statistical power and ensure broader representativeness, the margin of error was adjusted to 3.86%. This yielded a calculated sample size of 300 participants, which was deemed adequate for the study objectives.

Inclusion and Exclusion Criteria

This study included HIV-positive patients attending ART clinics at the selected hospitals with non-inclusion of Non-HIV patients or those who declined consent.

Sample Collection, Processing, and Storage

Whole blood (5 mL) was aseptically collected from each participant into EDTA vacutainers. Plasma was separated via centrifugation and transferred into cryogenic vials, which were labeled and transported to the HIV Screening Laboratory at FMC Keffi. Samples were stored at 20°C until further analysis.

Screening for Hepatitis B Surface Antigen (HBsAg)

All plasma samples were screened for Hepatitis B Surface Antigen (HBsAg) using rapid test strips. The samples were first thawed and gently vortexed to ensure uniformity. Each test strip was then immersed into a plasma sample for approximately 15 seconds. After immersion, the strips were placed flat on a non-absorbent surface, and the results were observed after 10 minutes. A result was considered positive if two red lines appeared—one at the control line and another at the test line. A negative result was indicated by the appearance of only one red line at the control region.

Molecular Detection of HBV Genotypes

DNA Extraction

HBV DNA was extracted from HBsAg-positive plasma samples using the alkaline lysis method as described by Kaneko et al. (1989). In this procedure, 10 µL of plasma was mixed with 1 µL of 1M NaOH and incubated at 37°C for one hour. The mixture was then centrifuged at 13,000 rpm for 15 seconds, after which the resulting supernatant was neutralized with 0.1M HCl. The neutralized solution was subsequently used as the DNA template for PCR amplification. The quality and concentration of the extracted DNA were assessed using a NanoDrop spectrophotometer, with acceptable A260/A280 absorbance ratios ranging between 1.7 and 1.9.

Agarose Gel Electrophoresis

PCR products were analyzed using 1.5% agarose gel electrophoresis. Seven microliters of each PCR product were carefully loaded into individual wells of the gel, and a 100 base pair DNA ladder (Thermo Scientific) was included as a molecular size marker. Electrophoresis was performed at 125 volts for 20 minutes. After electrophoresis, the DNA bands were visualized under ultraviolet light using a transilluminator.

Data Analysis

Data were analyzed using SPSS version 20. The Chi-square (χ^2) test was used to assess associations between categorical variables. A p-value ≤ 0.05 was considered statistically significant at 95% confidence level.

Ethical Considerations

Ethical approval for this study was obtained from the Health Research Ethics Committee (HREC) of the Federal Medical Centre, Keffi. Informed consent was obtained from all participants before sample collection.

Results

Table 1. Socio-Demographic Characteristics of Participants (N = 300)

Variable	Category	Frequency (n)	Percentage (%)
Sex	Male	105	35.0
	Female	195	65.0
Age (years)	Mean ± SD		36.2 ± 9.1
Marital Status	Married	162	54.0
	Single	96	32.0
	Divorced	24	8.0
	Widowed	18	6.0
Educational Level	Primary education	36	12.0
	Secondary education	132	44.0
	Tertiary education	72	24.0
	No formal education	60	20.0

A total of 300 participants were enrolled in the study. The gender distribution showed that 65.0% were female, while 35.0% were male. The participants had a mean age of 36.2 years with a standard deviation of ±9.1 years, indicating that most respondents were middle-aged adults. In terms of marital status, more than half of the participants were married (54.0%,) while 32.0% were single. A smaller proportion were divorced (8.0%) and widowed (6.0%). Regarding educational attainment, the majority of respondents had received at least secondary education. Specifically, 44.0% had completed secondary education, 24.0% had attained tertiary education, and 12.0% had only primary education. Meanwhile, 20.0% of the participants reported having no formal education.

Table 2. Hepatitis B Virus (HBV) Prevalence by Selected Socio-Demographic Characteristics (N = 300)

Variable	Category	Total (n)	HBsAg Positive (n)	Prevalence (%)
Gender	Male	105	15	14.3
	Female	195	19	9.7
Age Group (years)	15–24	60	4	6.7
	25–39	140	18	12.9
	40+	100	8	8.0
Marital Status	Married	162	18	11.1
	Single	96	12	12.5
	Divorced	24	3	12.5
	Widowed	18	1	5.6
Educational Level	Primary Education	36	6	16.7
	Secondary Education	132	14	10.6
	Tertiary Education	72	6	8.3
	No Formal Education	60	8	13.3

Table 2 presents the distribution of Hepatitis B Virus (HBV) prevalence across selected socio-demographic characteristics among the 300 HIV/AIDS patients included in the study. The results indicate that HBV infection varied by gender, age group, marital status, and educational attainment.

In terms of gender, males exhibited a higher HBV prevalence rate of 14.3% (15 out of 105) compared to females, who had a prevalence of 9.7% (19 out of 195), suggesting that male participants may be more exposed to HBV risk factors or engage in behaviors that increase susceptibility to co-infection.

Across age groups, the highest prevalence was observed among individuals aged 25–39 years, with a rate of 12.9% (18 out of 140), followed by those aged 40 years and above at 8.0% (8 out of 100). Participants aged 15–24 years had the lowest prevalence at 6.7% (4 out of 60). This age-related trend may reflect cumulative exposure to HBV risk factors over time or differing levels of awareness and preventive practices across age groups.

Marital status also showed variation in HBV prevalence. Single and divorced participants both had the highest prevalence rates at 12.5% (12 out of 96 and 3 out of 24, respectively), followed closely by married individuals at 11.1% (18 out of 162). Widowed participants recorded the lowest prevalence at 5.6% (1 out of 18). These findings may point to the influence of sexual behavior patterns, partner history, or social support on HBV transmission dynamics.

Regarding educational level, participants with primary education recorded the highest HBV prevalence at 16.7% (6 out of 36), followed by those with no formal education at 13.3% (8 out of 60). Participants with secondary education had a prevalence of 10.6% (14 out of 132), while those with tertiary education had the lowest prevalence at 8.3% (6 out of 72). This pattern suggests that higher educational attainment may be associated with improved health literacy, preventive practices, and reduced HBV exposure among HIV-positive individuals.

Table 3. Distribution of HBV Prevalence by Selected Risk Factors Among HIV/AIDS Patients (N = 300)

Risk Factor	Category	Total (n)	HBsAg Positive (n)	Prevalence (%)
History of Blood Transfusion	Yes	48	10	20.8
	No	252	34	13.5
Sharing of Sharp Objects	Yes	90	18	20.0
	No	210	26	12.4
Multiple Sexual Partners	Yes	72	16	22.2
	No	228	28	12.3
History of STIs	Yes	66	14	21.2
	No	234	30	12.8
History of Surgery	Yes	60	13	21.7
	No	240	31	12.9
Tattoo/Scarification	Yes	50	11	22.0
	No	250	33	13.2
Intravenous Drug Use	Yes	18	5	27.8
	No	282	39	13.8
Living with Hepatitis Patient	Yes	36	9	25.0
	No	264	35	13.3

Table 3 presents the distribution of Hepatitis B surface antigen (HBsAg) positivity among HIV/AIDS patients (N = 300) based on selected risk factors. The overall prevalence of HBV in the cohort was 14.7% (44/300). Across the different risk factor categories, notable variations in HBV co-infection prevalence were observed.

Participants with a history of blood transfusion exhibited a higher prevalence of HBV (20.8%) compared to those without such a history (13.5%). Similarly, individuals who reported sharing sharp objects had a prevalence of 20.0%, whereas their counterparts who did not engage in such practices

had a lower prevalence of 12.4%. The co-infection rate was markedly elevated among those who reported having multiple sexual partners (22.2%) compared to those with one or no sexual partner (12.3%).

A similar trend was observed for other behavioral and exposure-related variables. Participants with a prior history of sexually transmitted infections (STIs) had a prevalence of 21.2%, as opposed to 12.8% in those with no such history. Those who had undergone surgical procedures had a higher prevalence (21.7%) compared to those without surgical history (12.9%). Additionally, HBV prevalence was greater among individuals who had tattoos or scarifications (22.0%) than those without (13.2%).

The prevalence of HBV was highest among intravenous drug users, with 27.8% testing positive for HBsAg, compared to 13.8% among non-users. Lastly, participants living in households with individuals known to have hepatitis infection had a co-infection prevalence of 25.0%, while those who did not share a household with a hepatitis patient had a prevalence of 13.3%.

Table 4. Association Between HBV Infection and Selected Risk Factors

Risk Factor	Chi-square (χ^2)	P-value
Gender	3.456	0.048
Marital Status	3.101	0.011
Education Level	2.563	0.037
History of Blood Transfusion	1.199	0.274
Sharing Sharp Objects	2.345	0.126
Multiple Sexual Partners	3.563	0.059
History of STIs	2.265	0.132
History of Surgery	2.279	0.131
Tattoo/Scarification	1.923	0.166
Intravenous Drug Use	1.634	0.201
Living with Hepatitis Patient	2.615	0.106

Table 4 reveals the association between HBV infection and selected socio-demographic and behavioral risk factors among HIV/AIDS patients in Nasarawa West Senatorial District using chi-square statistical analysis. The analysis indicates that gender, marital status, and educational level were significantly associated with HBV infection. Specifically, gender showed a statistically significant association (χ^2 = 3.456, p = 0.048), implying that HBV prevalence varied meaningfully between male and female participants, with previous data showing a higher rate among males. Marital status also exhibited a significant association (χ^2 = 3.101, p = 0.011), suggesting that the distribution of HBV infection differs across marital categories, possibly due to varying sexual behaviors or partnership dynamics. Furthermore, educational level was significantly linked with HBV status (χ^2 = 2.563, p = 0.037), pointing to a potential influence of educational attainment on awareness and risk exposure related to HBV transmission.

In contrast, other risk factors did not demonstrate statistically significant associations with HBV infection. These include history of blood transfusion (χ^2 = 1.199, p = 0.274), sharing of sharp objects (χ^2 = 2.345, p = 0.126), multiple sexual partners (χ^2 = 3.563, p = 0.059), history of sexually transmitted infections (χ^2 = 2.265, p = 0.132), history of surgery (χ^2 = 2.279, p = 0.131), tattoo or scarification practices (χ^2 = 1.923, p = 0.166), intravenous drug use (χ^2 = 1.634, p = 0.201), and living with a hepatitis-infected person (χ^2 = 2.615, p = 0.106). While some of these variables had higher HBV prevalence among exposed individuals, the associations were not statistically significant at the conventional $p < 0.05$ threshold.

Discussion

The findings of this study reveal a notable prevalence of Hepatitis B Virus (HBV) infection among HIV/AIDS patients in Nasarawa West Senatorial District, with an overall rate of 14.7%. This underscores the continuing public health challenge posed by HBV-HIV co-infection in resource-

limited settings. The observed prevalence aligns with previous studies conducted in sub-Saharan Africa, where co-infection rates among people living with HIV have ranged between 10% and 20%, depending on population characteristics and regional epidemiology (Anigilaje & Olutola, 2021; Ofori-Asenso & Agyeman, 2016).

The gender disparity observed in this study, with higher HBV prevalence among males (14.3%) compared to females (9.7%), mirrors findings from earlier studies conducted in Nigeria and elsewhere in West Africa (Ameh et al., 2022; Musa et al., 2015). This pattern may be attributable to behavioral and occupational factors, as males are more likely to engage in high-risk behaviors such as multiple sexual partnerships and sharing of sharp instruments, or may be more exposed to blood contact through certain types of employment. These factors highlight the need for gender-responsive preventive strategies, including targeted health education and risk-reduction interventions.

Age-specific analysis indicated that the 25–39 age group had the highest HBV prevalence (12.9%), which is consistent with other studies identifying this age bracket as the most sexually active and socially mobile, thus increasing exposure risk (Okonko et al., 2020). This finding supports the need for HBV screening, counseling, and vaccination programs directed specifically at young and middle-aged adults, particularly those living with HIV, to mitigate the progression of liver disease and improve long-term health outcomes.

With respect to marital status, single and divorced individuals showed the highest HBV prevalence rates (both 12.5%), slightly higher than that observed in married individuals (11.1%). This may reflect differing sexual behavior patterns, including a higher number of sexual partners or inconsistent condom use among unmarried individuals, as previously reported in similar populations (Ajayi et al., 2022). Such findings reinforce the importance of incorporating behavioral risk assessments into routine HIV and HBV care services.

The association between educational level and HBV infection suggests that lower education is linked with increased HBV prevalence. Participants with primary education had the highest prevalence (16.7%), while those with tertiary education had the lowest (8.3%). This trend corroborates previous research indicating that individuals with higher education levels are more likely to have adequate knowledge about HBV transmission, prevention, and the importance of vaccination (Adekanle et al., 2019). These findings highlight the role of education in shaping health behaviors and call for intensified health literacy campaigns, particularly among populations with limited formal education.

Analysis of potential risk factors showed higher HBV prevalence among participants with a history of blood transfusion, sharing of sharp objects, multiple sexual partners, and prior STIs, though not all associations reached statistical significance. Notably, intravenous drug use and living with someone who has hepatitis showed elevated prevalence rates (27.8% and 25.0% respectively), supporting evidence from studies that identify these factors as significant routes of HBV transmission among HIV-positive populations (WHO, 2023; Spearman et al., 2017). Although some chi-square tests in this study yielded p-values above the conventional threshold, the observed trends point to risk behaviors that merit further investigation using multivariate analysis in future studies.

Conclusion

This study highlights a substantial prevalence of Hepatitis B Virus (HBV) infection among individuals living with HIV/AIDS in Nasarawa West Senatorial District, underscoring the critical need for integrated screening and preventive interventions within HIV care programs. The associations observed between HBV infection and socio-demographic characteristics such as gender, age, education level, and marital status, as well as behavioral risk factors including multiple sexual partnerships, history of sexually transmitted infections, and intravenous drug use, point to specific sub-populations that require targeted health education and clinical attention. Although not all risk factors demonstrated statistically significant associations, the patterns observed warrant further investigation through longitudinal and multi-center studies to validate causality and guide policy. Strengthening HBV vaccination coverage, especially among high-risk and unvaccinated adults living with HIV, alongside

continuous public health awareness, could significantly reduce the dual burden of HBV and HIV. These findings reinforce the need for policymakers and healthcare providers to prioritize HBV-HIV co-infection in national and regional strategic health plans to improve long-term health outcomes and reduce liver-related morbidity and mortality.

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