

## Serological Evidence of HBV Prevalence and Socio-Demographic Features of HIV-Infected Individuals attending Rivers State University Teaching Hospital (RSUTH) in Port Harcourt, Rivers State, Nigeria

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**Abstract:** Hepatitis B virus (HBV) infection is a significant public health concern among people living with human immunodeficiency virus (HIV), as coinfection accelerates liver disease progression and complicates treatment outcomes. This study assessed the prevalence of HBV and its socio-demographic distribution among HIV-infected individuals attending Rivers State University Teaching Hospital (RSUTH), Port Harcourt, Nigeria. A cross-sectional descriptive study was conducted among 88 HIV-positive adults receiving care at the ART clinic. Socio-demographic data were collected using a structured questionnaire, and blood samples were analyzed for Hepatitis B surface antigen (HBsAg) using the Monolisa ELISA kit (Bio-Rad, France). Results: HBV/HIV coinfection was identified in 3 participants (3.4%). Infection was detected among individuals aged 21–40 years (4.6%) and 41–60 years (3.0%), with higher prevalence in females (3.9%) compared to males (2.8%). HBV was slightly more common among singles (4.4%), participants with no formal education (7.7%), and the employed group (6.1%). By religion, HBV infection occurred only among Christian participants (3.9%), with no cases among other religious affiliations. HBV prevalence among HIV-infected individuals at RSUTH is relatively low but varies across socio-demographic groups. The findings highlight the need for routine HBV screening, targeted health education, and vaccination programs within HIV care services to reduce liver-related morbidity and optimize patient outcomes.

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**Keywords:** Hepatitis B virus; HIV; coinfection; prevalence; socio-demographic factors; Nigeria; ELISA

### 1. Introduction

Hepatitis B virus (HBV) infection is a major global public health problem, affecting an estimated 296 million people worldwide, with the highest burden in sub-Saharan Africa and Asia (World Health Organization [WHO], 2024). HBV is a DNA virus belonging to the Hepadnaviridae family and is primarily transmitted through parenteral, sexual, and vertical routes. Chronic HBV infection can lead to liver cirrhosis, hepatocellular carcinoma, and premature mortality, particularly when coexisting with other immunosuppressive conditions, such as human immunodeficiency virus (HIV) infection (Schweitzer et al., 2015).

HIV infection, which compromises the immune system, is prevalent in sub-Saharan Africa, including Nigeria, where it poses a significant public health challenge. HIV and HBV share similar transmission routes, predisposing HIV-infected individuals to a higher risk of HBV coinfection. HBV/HIV coinfection has been associated with accelerated liver disease progression, increased hepatotoxicity during antiretroviral therapy, and higher morbidity and mortality rates compared to individuals with HIV or HBV infection alone (Thio et al., 2021).

Rivers State, located in the Niger Delta region of Nigeria, has a heterogeneous population and is a hub

for commerce, oil and gas industries, and migration. Port Harcourt, the state capital, hosts the Rivers State University Teaching Hospital (RSUTH), a tertiary healthcare facility providing comprehensive HIV care, including antiretroviral therapy (ART). Despite the clinical significance of HBV/HIV coinfection, data on the prevalence and socio-demographic correlates of HBV among HIV-infected patients in Port Harcourt remain limited. Understanding the distribution of HBV infection in this population is critical for informing screening, vaccination, and management strategies tailored to high-risk groups.

This study therefore seeks to determine the prevalence of HBV infection and examine the socio-demographic features of HIV-infected individuals attending RSUTH, with the aim of providing evidence-based recommendations for improving patient outcomes and reducing the burden of HBV/HIV coinfection in Rivers State.

### 2. Material and Methods

#### 2.1. Study Area

The study was conducted at the Rivers State University Teaching Hospital (RSUTH), located in Port Harcourt, the capital city of Rivers State, Nigeria. Rivers State lies in the South-South geopolitical zone of Nigeria and is one of the most industrialized states

in the Niger Delta region. It shares boundaries with Imo, Abia, and Anambra States to the north; Akwa Ibom State to the east; Bayelsa and Delta States to the west; and the Atlantic Ocean to the south. The state has a diverse population, with Port Harcourt serving as the administrative, commercial, and educational hub, attracting individuals from across Nigeria and neighboring countries (National Population Commission [NPC], 2020).

Port Harcourt is a cosmopolitan city characterized by high urbanization and industrial activities, particularly in the oil and gas sector. The city's diverse population includes civil servants, traders, students, professionals, and migrant workers, resulting in increased population mobility and varying exposure to infectious diseases. The urban setting, coupled with socio-economic disparities, contributes to varying risks of HBV and HIV transmission among residents.

Rivers State University Teaching Hospital (RSUTH) is a tertiary healthcare facility that provides a wide range of specialized medical services, including comprehensive HIV care and treatment through its Antiretroviral Therapy (ART) clinic. RSUTH serves as a referral center for Rivers State and surrounding states in the Niger Delta region. The hospital is also a training and research center, supporting clinical studies and laboratory investigations, making it an ideal site for assessing HBV prevalence and socio-demographic characteristics among HIV-infected patients.

The hospital's patient population is drawn from both urban and peri-urban communities, allowing for robust assessment of socio-demographic patterns and risk factors associated with HBV/HIV coinfection. The setting provides a representative sample of HIV-infected individuals in the region, facilitating evidence-based recommendations for screening, prevention, and management strategies targeting high-risk groups.

## 2.2. Study Design

This study adopted a cross-sectional descriptive design to determine the prevalence of hepatitis B virus (HBV) infection and examine the socio-demographic characteristics of HIV-infected individuals attending the Antiretroviral Therapy (ART) clinic at Rivers State University Teaching Hospital (RSUTH), Port Harcourt, Nigeria. The cross-sectional design was selected because it allows for the simultaneous assessment of exposure (socio-demographic characteristics) and outcome (HBV infection status) at a single point in time, providing a snapshot of HBV prevalence within the study population.

Participants were consecutively recruited during routine clinic visits over the study period. Eligible individuals were adults aged 18 years and above, confirmed to be HIV-positive, and receiving care at

RSUTH. Written informed consent was obtained from all participants before enrollment.

Data collection comprised two main components:

**2.2.1. Socio-Demographic and Clinical Data:** Information on participants' age, sex, marital status, education, occupation, and religion was obtained using a structured, interviewer-administered questionnaire. Clinical data, including duration of HIV infection and antiretroviral therapy (ART) regimen, were also collected from medical records with participants' consent.

**2.2.2. Laboratory Investigation:** Blood samples were collected from each participant and analyzed for Hepatitis B surface antigen (HBsAg) using the Monolisa ELISA kit (Bio-Rad, France). This provided laboratory confirmation of HBV infection status. Standard procedures were followed to ensure accuracy, including the use of positive and negative controls for each assay batch.

The cross-sectional design is particularly suitable for prevalence studies and for identifying socio-demographic correlates of HBV infection among HIV-infected individuals. It also allows for timely and cost-effective data collection, making it appropriate for hospital-based studies in resource-limited settings.

## 2.3. Study Population

The study population comprised HIV-infected individuals attending the Antiretroviral Therapy (ART) clinic at Rivers State University Teaching Hospital (RSUTH), Port Harcourt, Nigeria. These individuals represent a population at risk for hepatitis B virus (HBV) coinfection due to overlapping transmission routes and immunosuppression associated with HIV infection. Participants were drawn from both urban and peri-urban communities, reflecting a diverse socio-demographic profile relevant for assessing HBV prevalence and associated risk factors.

### 2.3.1. Inclusion Criteria

HIV-infected individuals aged 18 years and above. Registered patients receiving care and treatment at the ART clinic of RSUTH. Individuals who provide written informed consent to participate in the study.

### 2.3.2. Exclusion Criteria

HIV-infected individuals who decline consent to participate. Patients with incomplete socio-demographic or clinical data. Severely ill patients who are unable to respond to the questionnaire.

## 2.4. Sample Size Determination

The minimum sample size was determined using the Cochran formula (1963) for prevalence studies.

$$n = Z^2(pq)/d^2$$

Where:

- n = required sample size
- Z = standard normal deviation at 95% confidence level = 1.96
- p = estimated prevalence of HBV among HIV-infected individuals (3.8% reported for Rivers State by NAIIS, 2019).
- q = 1 - p
- d = degree of precision (0.05)

Thus, a minimum of 56 HIV-infected individuals was recruited for the study. However, 88 HIV-infected individuals were enrolled in the study.

## 2.5. Data Collection Methods

Data collection involved both laboratory investigations and structured questionnaires:

### 2.5.1. Questionnaire Administration

A structured, interviewer-administered questionnaire was used to collect socio-demographic and clinical data. Information included age, sex, marital status, educational level, occupation, place of residence, and relevant risk factors (such as history of blood transfusion, tattooing, scarification, multiple sexual partners, and alcohol use). Clinical history such as duration since HIV diagnosis and ART regimen was also be recorded.

### 2.5.2. Laboratory Investigation

**i. Sample Collection:** Approximately 5 mL of venous blood was collected aseptically from each participant into sterile plain vacutainer tubes.

**ii. Sample Processing:** The samples were allowed to clot at room temperature and then centrifuged at 3,000 rpm for 10 minutes to separate the serum. The sera were carefully aspirated into properly labeled cryovials and stored at  $-20^{\circ}\text{C}$  until analysis.

**iii. HBV Testing:** Sera were screened for Hepatitis B surface antigen (HBsAg) using a third-generation Enzyme-Linked Immunosorbent Assay (ELISA) kit, following the manufacturer's instructions.

**iv. Quality Control:** Positive and negative controls were included in each batch of tests to ensure reliability and accuracy of results.

## 2.6. Laboratory Detection of Hepatitis B surface Antigen (HBsAg)

The laboratory detection of Hepatitis B surface antigen (HBsAg) among HIV-infected participants was carried out using the HBsAg Monolisa ELISA kit (Bio-Rad, France), following the manufacturer's protocol. Prior to testing, all reagents and serum samples were brought to room temperature ( $18-25^{\circ}\text{C}$ ). The Monolisa HBsAg ELISA is based on the sandwich enzyme immunoassay principle.

Microplate wells pre-coated with monoclonal anti-HBs antibodies served as the solid phase. For each assay run, 100  $\mu\text{L}$  of participant serum was pipetted into designated wells. If HBsAg was present, it bound to the immobilized antibodies. After the initial incubation, unbound materials were removed by washing the wells with the provided wash buffer.

Subsequently, a conjugate solution containing horseradish peroxidase (HRP)-labeled anti-HBs antibodies was added to each well. This conjugate bound to any captured HBsAg, forming an antigen-antibody-enzyme complex. Following a second incubation, excess conjugate was removed through additional washing steps to eliminate nonspecific binding.

The wells were then treated with the tetramethylbenzidine (TMB) substrate solution, which reacts with the enzyme (HRP) to produce a blue-colored product. After a controlled incubation in the dark, the reaction was stopped by adding 0.5 M sulfuric acid (stop solution), which changed the color from blue to yellow.

The optical density (OD) of each well was measured using a microplate reader at 450 nm with a reference wavelength of 620 nm. The cut-off value was calculated in accordance with the manufacturer's instructions. Samples with OD values greater than or equal to the cut-off were interpreted as positive for HBsAg, while those below the cut-off were recorded as negative.

Each assay batch included positive and negative controls supplied by the manufacturer to validate the test performance and ensure result reliability. All laboratory procedures were carried out under strict biosafety conditions, using appropriate personal protective equipment (PPE) and standard precautions to minimize the risk of contamination and exposure.

## 2.7. Data Analysis

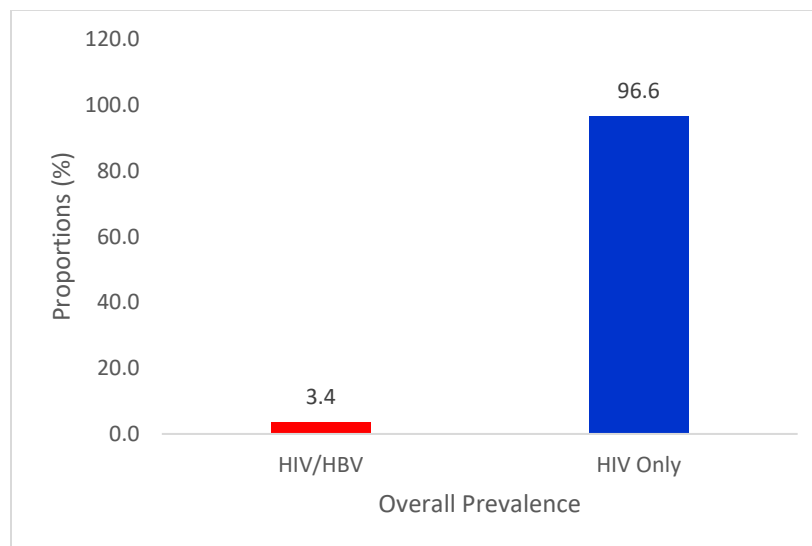
Data were coded and entered into Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM Corp, Armonk, NY). Descriptive statistics (frequencies, percentages, means, and standard deviations) was used to summarize socio-demographic and clinical characteristics of participants. Prevalence of HBV infection was expressed as a proportion of HBsAg-positive cases among the HIV-infected participants. Chi-square ( $\chi^2$ ) test was used to determine associations between HBV seropositivity and categorical socio-demographic variables (e.g., sex, marital status, educational level, occupation). A p-value  $< 0.05$  was considered statistically significant. Results were presented in tables, charts, and graphs for clarity.

## 2.8. Ethical Considerations

Ethical clearance was obtained from the University of Port Harcourt Research Ethics Committee (UPHREC). Written informed consent was obtained from each participant after explaining the purpose, benefits, and risks of the study. Participation was voluntary, and participants have the right to withdraw at any stage without penalty. Participant information was kept strictly confidential. Data was coded to exclude personal identifiers. Participants who test positive for HBsAg was referred to the Heamatology unit of RSUTH for further evaluation and appropriate management. Standard precautions were observed during blood collection to minimize risks of infection. Selection of participants were without bias regarding gender, age, religion, or socio-economic status.

## 3. Results

Out of the total study population of HIV-infected individuals assessed at the Rivers State University Teaching Hospital (RSUTH), 3.4% were found to be co-infected with hepatitis B virus (HBV/HIV coinfection), while the majority, 96.6%, were infected with HIV only (Figure 1). This finding indicates that although most patients were mono-infected with HIV, nearly one in every ten carried dual infection with HBV. The observed HBV/HIV coinfection rate highlights the public health significance of HBV among people living with HIV in this setting and underscores the need for routine HBV screening, vaccination, and integrated management within HIV care programs.



**Figure 1: Overall Prevalence**

Table 1 depicts HBV prevalence and sociodemographic features of the study participants at the Rivers State University Teaching Hospital (RSUTH). A total of 88 HIV-infected participants attending the Rivers State University Teaching Hospital (RSUTH) were screened for hepatitis B virus (HBV) infection, with 3 participants (3.4%) testing positive for HBsAg, indicating HBV/HIV coinfection.

**Age Distribution:** HBV infection was detected among participants aged 21–40 years (4.6%) and 41–60 years (3.0%), while no infection was observed in participants younger than 20 years or older than 61 years. This indicates that middle-aged adults were slightly more affected compared to other age groups (Table 1).

**Sex:** Female participants showed a higher prevalence of HBV (3.9%) compared to males (2.8%), suggesting a marginally higher burden among women in this cohort (Table 1).

**Marital Status:** Among marital categories, singles (4.4%) had a slightly higher prevalence than married participants (2.4%). No HBV infection was detected among divorced participants or other marital categories (Table 1).

**Educational Background:** The prevalence of HBV was highest among participants with no formal education (7.7%), followed by primary education (4.8%) and secondary education (3.0%). Interestingly, no HBV infection was detected among participants with tertiary education (Table 1).

**Occupation:** Among occupational groups, employed participants had the highest prevalence (6.1%), followed by self-employed individuals (3.5%), whereas unemployed participants and students had no recorded infection (Table 1).

**Religion:** By religious affiliation, HBV infection was observed only among Christian participants (3.9%), with no cases detected among Muslims, traditional religion practitioners, or participants with no religious affiliation (Table 1).

Overall, the findings indicate that HBV/HIV coinfection among participants at RSUTH is relatively low (3.4%) and shows slight variations across socio-demographic characteristics. Middle-aged adults, females, singles, participants with no formal education, and employed individuals were marginally more affected, highlighting the need for targeted HBV screening and preventive interventions within the HIV-infected population (Table 1).

**Table 1: HBV Prevalence and Socio-Demographic Features of the Study Participants in RSUTH**

Variables	Category	RSUTH		
		No. Tested	No +Ve	% Positive
Age Group	<20	9	0.0	0.0
	21-40	44	2.0	4.6
	41-60	33	1.0	3.0
	>61	2	0.0	0.0
Sex	Males	36	1.0	2.8
	Females	52	2.0	3.9
Marital Status	Singles	45	2.0	4.4
	Married	42	1.0	2.4
	Divorced	1	0.0	0.0
	Others	0	0.0	0.0
Educational Background	Primary	21	1.0	4.8
	Secondary	33	1.0	3.0
	Tertiary	21	0.0	0.0
	None	13	1.0	7.7
Occupation	Employed	33	2.0	6.1
	Self-Employed	29	1.0	3.5
	Unemployed	13	0.0	0.0
	Students	13	0.0	0.0
Religion	Christian	78	3.0	3.9
	Islam	6	0.0	0.0
	Traditional	2	0.0	0.0
	None	2	0.0	0.0
<b>Total</b>		<b>88</b>	<b>3.0</b>	<b>3.4</b>

#### 4. Discussions

The present study determined the prevalence of hepatitis B virus (HBV) infection and its socio-demographic distribution among HIV-infected individuals attending Rivers State University Teaching Hospital (RSUTH), Port Harcourt. The overall prevalence of HBV/HIV coinfection was 3.4%, indicating a relatively low burden among this cohort. This finding is consistent with previous Nigerian studies reporting HBV prevalence rates of 2–5% among HIV-positive populations (Eze, Onyekwere, & Okeke, 2019; Abiodun, Adeyemi, & Oluwaseun, 2018). The relatively lower prevalence observed at RSUTH compared to other tertiary hospitals may reflect differences in patient demographics, urbanization, health-seeking behavior, or vaccination coverage (Ola & Odaibo, 2020).

Age-related trends showed that HBV infection was detected among participants aged 21–40 years

(4.6%) and 41–60 years (3.0%), with no cases in participants younger than 20 years or older than 61 years. This pattern aligns with previous reports suggesting that middle-aged adults are at higher risk due to cumulative exposure to HBV risk factors such as sexual activity, medical procedures, and other parenteral exposures (Schweitzer, Horn, Mikolajczyk, Krause, & Ott, 2015).

Regarding sex, females exhibited a slightly higher prevalence (3.9%) than males (2.8%), which may reflect differences in biological susceptibility or health-seeking behaviors (Thio, Guo, & Smeaton, 2021). The marital status analysis revealed a marginally higher prevalence among singles (4.4%) compared to married participants (2.4%), suggesting that sexual exposure outside marriage may contribute to HBV transmission.

Educational and occupational factors showed that participants with no formal education had the

highest prevalence (7.7%), and employed participants recorded a higher prevalence (6.1%) compared to other occupational groups. These findings suggest that socio-economic status, literacy, and occupational exposure may influence HBV risk among HIV-infected individuals (Ndongo, Fokou, & Njouom, 2020).

Finally, analysis by religion indicated that HBV infection was observed only among Christian participants (3.9%), while no cases were detected among Muslims, traditional religion practitioners, or participants with no religious affiliation. Although the small sample size in some religious groups may limit interpretation, these differences underscore the importance of targeted public health interventions.

Overall, the study highlights a low but significant prevalence of HBV among HIV-infected individuals at RSUTH, emphasizing the need for routine HBV screening, vaccination, and health education to reduce morbidity and improve outcomes in this population (World Health Organization [WHO], 2024).

## 5. Conclusion

The study revealed a 3.4% prevalence of hepatitis B virus (HBV) infection among HIV-infected individuals attending Rivers State University Teaching Hospital (RSUTH), indicating a relatively low but notable burden. HBV infection was more common among middle-aged adults, females, singles, participants with no formal education, and employed individuals. These findings demonstrate that even in a low-prevalence setting, certain socio-demographic groups remain at higher risk of HBV/HIV coinfection. The results underscore the importance of integrating routine HBV screening, vaccination, and health education within HIV care programs to prevent liver-related complications and optimize patient outcomes.

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