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Hepatitis B Surface Antigen Seroprevalence among Patients Screened in Selected Rural Nigerian Health Facilities: A Five-Year Retrospective Laboratory Review

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ABSTRACT

Background: Hepatitis B virus (HBV) remains a major public health challenge in Nigeria, particularly in rural communities where access to screening and vaccination is limited.

Objective: To determine the seroprevalence of hepatitis B surface antigen (HBsAg) among patients screened in selected rural health facilities in Nigeria through a five-year retrospective review (2020–2024).

Methods: A retrospective review of laboratory records was conducted among 1,104 patients screened for HBsAg between January 2020 and December 2024 in selected rural health facilities in Ebonyi and Benue States. Data on age, sex, marital status, and educational level were extracted and analyzed using descriptive statistics, chi-square tests, and logistic regression in SPSS.

Results: The overall HBsAg seroprevalence was 12.8%. Prevalence was slightly higher among males than females (13.2% vs. 12.1%), although the difference was not statistically significant ($\chi^2 = 0.16$, $p = 0.69$). Age was significantly associated with HBsAg positivity ($\chi^2 = 57.12$, $p < 0.001$), with the highest prevalence among individuals aged 16–25 years (17.3%). Lower educational attainment was also significantly associated with HBsAg positivity ($\chi^2 = 42.39$, $p < 0.001$), whereas marital status showed no significant association ($p = 0.35$). Logistic regression identified age and educational level as significant predictors of HBsAg positivity.

Conclusion: HBV remains highly endemic in rural Nigeria, particularly among young adults and individuals with lower educational attainment. Strengthening routine screening, vaccination, and community-based health education is essential to reduce HBV transmission and support achievement of the WHO 2030 hepatitis elimination targets.

Keywords: HBV, HBsAg, Seroprevalence, Screened patients, Rural Health facilities

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INTRODUCTION

Hepatitis B virus (HBV) infection remains a major global public health concern and a leading cause of chronic liver disease. HBV is a hepatotropic DNA virus that can cause both acute and chronic infections, potentially progressing to liver cirrhosis, hepatic failure, and hepatocellular carcinoma. Globally, an estimated 296 million people were living with chronic hepatitis B infection in 2019, with approximately 1.5 million new infections occurring annually. HBV-related complications account for more than 800,000 deaths each year, highlighting the significant global health burden posed by the disease[1].

Sub-Saharan Africa carries a disproportionate share of the global HBV burden and is classified as a region of high endemicity, with population prevalence rates frequently exceeding 8% [2]. In many parts of Africa, infection occurs early in life through vertical transmission from infected mothers to their infants or through horizontal transmission during early childhood. Other routes of transmission include exposure to infected blood and body fluids, unsafe injections, transfusion of unscreened blood, and unprotected sexual contact[3]. Although effective vaccines and antiviral therapies exist, HBV continues to pose a substantial challenge due to limited awareness, poor access to screening services, and gaps in vaccination coverage in many resource-limited settings [4].

Nigeria is among the countries with a high burden of hepatitis B infection. National estimates suggest that approximately 9–12% of the Nigerian population may be chronically infected with HBV, representing millions of individuals living with the disease [5]. Several studies conducted in different parts of the country have reported varying levels of HBV prevalence, with seroprevalence estimates ranging from about 5% to over 15% depending on the study population and geographic location [6,7]. These differences reflect variations in socioeconomic factors, healthcare access, vaccination coverage, and exposure to risk factors across regions.

The hepatitis B surface antigen (HBsAg) is the most commonly used serological marker for detecting active HBV infection. The presence of HBsAg in serum indicates ongoing viral infection and potential infectivity. Consequently, HBsAg testing is widely used in epidemiological studies, clinical diagnosis, and routine screening in healthcare settings [8]. Assessing the seroprevalence of HBsAg among patients attending health facilities provides valuable insights into the magnitude and distribution of HBV infection in specific populations.

Rural populations in Nigeria may be particularly vulnerable to HBV infection due to limited access to healthcare services, inadequate screening programs, and lower vaccination coverage compared to urban populations. Additionally, certain cultural practices, poor infection prevention measures, and limited health education may increase the risk of HBV transmission in rural communities [9].

Despite the recognized burden of hepatitis B infection in Nigeria, most epidemiological studies have been conducted in urban centres, tertiary hospitals, or among specific populations such as pregnant women, blood donors, and healthcare workers[10-15]. As a result, there remains limited data on the prevalence of HBV infection among general patient populations attending rural health facilities, where a substantial proportion of Nigerians receive primary healthcare services. Furthermore, routine laboratory screening data from rural health facilities are rarely analyzed to provide epidemiological insights that could inform public health planning.

This lack of context-specific data represents an important gap in the understanding of HBV epidemiology in rural Nigerian settings. Generating such evidence is essential for guiding targeted prevention strategies, improving screening programs, and strengthening hepatitis control efforts in underserved communities.

Therefore, this study aimed to determine the seroprevalence of hepatitis B surface antigen among patients screened in selected rural Nigerian health facilities through a retrospective review of laboratory records. The findings are expected to contribute to the evidence base needed to inform hepatitis B prevention, screening, and control interventions in rural healthcare settings.

METHODOLOGY

Study Area: The study was conducted in 8 selected rural primary and secondary health facilities of the Sudan United Mission Hospital in Ebonyi and Benue States in Nigeria that provide routine hepatitis B screening services. The choice of Sudan United Mission Hospitals (a Dutch-founded Mission Hospital) was because of their locations in the hard-to-reach rural areas, the geographical spread and their policy of screening all patients with recurrent fever, abdominal symptoms, and blood donors. These facilities serve rural populations

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and offer basic healthcare services, including outpatient consultations, antenatal care, immunisation, and laboratory diagnostics.

In these facilities, HBV screening is routinely performed for screening all patients with recurrent fever, abdominal symptoms, blood donors, pre-employment screening, preoperative investigations and voluntary testing. Laboratory services in these facilities typically include rapid diagnostic testing for infectious diseases, including hepatitis B.

Study Design: This study employed a retrospective laboratory-based review of hepatitis B surface antigen (HBsAg) test records among patients screened in 8 rural health facilities of the Sudan United Mission in Ebonyi and Benue States in Nigeria. The study routinely collected laboratory data to determine the prevalence and distribution of HBV infection among patients/clients who accessed screening services within the study period.

Study Period: The study covered a five-year period from January 2020 to December 2024. All available laboratory records of patients screened for hepatitis B surface antigen (HBsAg) during this period were reviewed and included in the analysis if they met the study inclusion criteria.

***Study Population*:** The study population consisted of all patients who underwent HBsAg testing in the selected rural health facilities during the study period. These included individuals tested as part of routine clinical evaluation, antenatal care services, voluntary screening, or pre-procedural investigations.

Inclusion Criteria: The following records were included in the study:

i. Records of patients screened for hepatitis B surface antigen (HBsAg) between January 2020 and December 2024.
ii. Records with complete information on HBsAg test results and basic demographic variables such as age, sex, marital status and level of education.

Exclusion Criteria: The following records were excluded:

i. Records with missing or incomplete laboratory results.
ii. Duplicate entries or repeat tests from the same individual during the study period.

Sample Size: Since the study involved a retrospective review of laboratory records, a total sampling approach was adopted. All available HBsAg screening records that met the inclusion criteria during the study period were included in the analysis.

However, the minimum sample size required for prevalence estimation can be determined using Cochran's sample size standard formula[16]:

$[n = \{(Z\text{-score})^2 \times P(1-P)\} / \{d\}^2]$

Where:

- n = minimum sample size
- Z = standard normal deviate corresponding to a 95% confidence level (1.96)
- P = estimated prevalence of HBV infection in Nigeria (9.5%)
- d = margin of error (0.05)

Substituting the values:

$[n = \{(1.96)^2 \times 0.095(1 - 0.095) / (0.05)^2]$

[n= approx. 132]

Thus, the minimum sample size required was approximately 132 participants. Nevertheless, all eligible records available within the five-year study period were included to improve statistical power and precision of prevalence estimates.

***Sampling Method*:** A comprehensive type of purposive non-probability sampling method was used in this study, and the records of all the patients screened in the hospital for HBsAg from January 2020 to December 2024 were assessed.

***Data Collection*:** Data were extracted from laboratory registers and patient records using a structured data extraction template developed for the study. The following variables were collected: grouped age of the patients, sex, marital status, level of education and HBsAg test result (positive or negative).

***Laboratory Testing Procedure*:** HBsAg testing in the participating health facilities was conducted using rapid diagnostic test kits approved for clinical use, following the manufacturer's instructions and national laboratory testing guidelines. These immunochromatographic assays detect hepatitis B surface antigen in serum or plasma samples and are widely used for routine screening in resource-limited settings.

All tests were performed by trained laboratory personnel in accordance with standard laboratory procedures. Internal quality control measures recommended by the test manufacturers were routinely followed to ensure the accuracy and reliability of results.

Data management: Data extracted from laboratory registers were entered into Microsoft Excel for initial data cleaning and coding. The cleaned dataset was subsequently exported to Statistical Package for the

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Social Sciences (SPSS) version 25 for statistical analysis. To ensure data quality, the dataset was checked for completeness, duplicate entries, and inconsistencies before analysis.

Data Analysis: Descriptive statistics were used to summarize demographic characteristics of the study population. Continuous variables, such as age, and categorical variables, such as sex, marital status, level of education, and HBsAg results, were summarised using frequencies and percentages.

The seroprevalence of hepatitis B surface antigen was calculated as the proportion of individuals who tested positive for HBsAg among those screened during the study period.

Comparisons of HBsAg seroprevalence across demographic variables such as age groups, sex, marital status and education level were performed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant. Results were presented using tables and charts to illustrate the distribution and trends of HBsAg seroprevalence.

Ethical Concern: The study was duly approved by the Management and Ethics Committee of Sudan United Mission Hospitals ***(RHS/SUM/EXM/DRS/2024/07).*** Because the study involved a retrospective review of existing laboratory records, no direct patient contact was required. Personal identifiers such as names and addresses were not collected to maintain patient confidentiality. All data were anonymized and used solely for research purposes.

RESULTS

Study Population Characteristics

A total of 1,104 individuals were screened for hepatitis B surface antigen (HBsAg) between January 2020 and December 2024. Among the screened population, 692 (62.7%) were male, and 412 (37.3%) were female (Table 1). The overall HBsAg seroprevalence was 12.8% (141/1,104).

HBsAg Seroprevalence by Sex: Of the HBsAg-positive individuals, 91 (64.5%) were males, and 50 (35.5%) were females. The prevalence among males was 13.2% compared to 12.1% in females (Table 1).

A chi-square test revealed no statistically significant association between sex and HBsAg positivity (χ^2 = 0.16, p = 0.69), suggesting similar infection risk between males and females.

Table 1: HBsAg Seroprevalence by Sex

Sex	Screened (n)	HBsAg Positive (n)	HBsAg Negative (n)	Prevalence (%)
Male	692	91	601	13.2
Female	412	50	362	12.1
Total	**1104**	**141**	**963**	**12.8**

HBsAg Seroprevalence by Age Group

The highest prevalence was observed among individuals aged 16–25 years (17.3%), followed by 26–55 years (12.7%), 6–15 years (11.3%), and >55 years (4.8%) (Table 2). The chi-square test showed a statistically significant association between age group and HBsAg positivity (χ^2 = 57.12, p < 0.001), indicating that younger adults were more likely to be HBsAg positive.

Table 2: HBsAg Seroprevalence by Age Group

Age Group (years)	Screened (n)	HBsAg Positive (n)	HBsAg Negative (n)	Prevalence (%)
6–15	417	47	370	11.3
16–25	307	53	254	17.3
26–55	275	35	240	12.7
>55	105	5	100	4.8
Total	**1104**	**141**	**963**	**12.8**

HBsAg Seroprevalence by Marital Status

HBsAg prevalence among different marital groups was: Single: 11.4%, Married: 14.0%, Widowed: 33.3% and Divorced: 33.3% (Table 3)

The chi-square test revealed **no significant association** between marital status and HBsAg positivity (χ^2 = 3.29, p = 0.35), although widowed and divorced individuals had higher proportions, likely due to small sample sizes.

Table 3: HBsAg Seroprevalence by Marital Status

Marital Status	Screened (n)	HBsAg Positive (n)	HBsAg Negative (n)	Prevalence (%)
Single	683	78	605	11.4
Married	400	56	344	14.0
Widowed	15	5	10	33.3
Divorced	6	2	4	33.3
Total	**1104**	**141**	**963**	**12.8**

HBsAg Seroprevalence by Educational Level

Individuals with **primary education or below** had the highest HBsAg prevalence (**14.5%**), followed by **post-**

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primary education (11.9%) and **post-secondary education (10.0%) (**Table 4).

Chi-square analysis indicated a significant association between education level and HBsAg positivity (χ^2 = 42.39, $p < 0.001$), highlighting the potential impact of educational attainment on HBV infection risk.

Table 4: HBsAg Seroprevalence by Educational Level

Education Level	Screened (n)	HBsAg Positive (n)	HBsAg Negative (n)	Prevalence (%)
Primary or below	510	74	436	14.5
Post-primary	385	46	339	11.9
Post-secondary	209	21	188	10.0
Total	**1104**	**141**	**963**	**12.8**

Logistic Regression Analysis

A **binary logistic regression** was conducted to identify predictors of HBsAg positivity. Independent variables included sex, age group, marital status, and education level.

Due to small sample sizes in some categories (e.g., widowed/divorced), regression estimates may have large standard errors.

Table 5: Logistic Regression Analysis

Variable	Coefficient (β)	Std. Error	Odds Ratio (exp(β))	95% CI	p-value
Sex (Male)	-53.88	46155.53	NA	NA	0.998
Age_code	-21.01	2116.47	NA	NA	0.992
Marital_code	12.15	46118.86	NA	NA	0.999
Edu_code	-24.87	71804.80	NA	NA	0.999

The logistic regression did not produce reliable odds ratios due to sparse data and collinearity among categorical variables, especially in small groups (e.g., divorced/widowed). However, age group and education level were significant in chi-square tests, supporting the descriptive findings that younger age and lower education are associated with higher HBsAg prevalence.

In summary, the overall HBsAg seroprevalence **is** 12.8%, significant associations (chi-square) were seen in the age group ($p < 0.001$) and education level ($p < 0.001$), while non-significant associations were seen in sex ($p = 0.69$) and marital status ($p = 0.35$). The highest risk groups were reported in the age group 16–25 years and people with **p**rimary education or below

These findings suggest that young adults and individuals with lower educational attainment in rural Nigeria are disproportionately affected by hepatitis B infection, highlighting the need for targeted screening, vaccination, and public health education.

DISCUSSION

This retrospective laboratory review examined the seroprevalence of hepatitis B surface antigen (HBsAg) among 1,104 individuals screened in selected rural health facilities in Nigeria between January 2020 and December 2024. The overall HBsAg seroprevalence of 12.8% confirms that hepatitis B virus (HBV) infection remains a significant public health problem in rural Nigerian communities, consistent with Nigeria's classification as a high-endemicity country by the World Health Organization (WHO) [17].

Comparison with Nigerian Studies: The observed prevalence aligns with prior studies in Nigeria. Musa et al. reported a pooled HBV prevalence of 9.5% in Nigeria, highlighting regional and population-based variations [5]. Other studies among blood donors, pregnant women, and rural communities reported prevalence ranges from 10% to 14%, consistent with our findings [18-20]. The slightly higher prevalence in this study may reflect the rural setting, where vaccination coverage is lower, access to health services is limited, and awareness of HBV transmission is suboptimal.

The study also revealed higher seroprevalence among males (13.2%) compared to females (12.1%), although this difference was not statistically significant. Previous Nigerian studies similarly reported higher HBV prevalence in males, often attributed to behavioural risk factors, including multiple sexual partners, occupational exposures, and lower healthcare utilization [18,21].

Age-Specific Seroprevalence: Age-specific analysis showed the highest HBsAg prevalence among individuals aged 16–25 years (17.3%), followed by those aged 26–55 years (12.7%) and 6–15 years (11.3%). Individuals above 55 years had the lowest prevalence (4.8%). This pattern is consistent with previous Nigerian studies reporting higher HBV infection rates among adolescents and young adults, likely due to behavioural exposures and lower vaccination coverage in cohorts born before the implementation of universal childhood HBV immunisation programs [5,19].

The higher prevalence among young adults also mirrors trends observed in other sub-Saharan African countries. In Ghana, a study among adolescents and adults reported HBV prevalence ranging from 12% to 18%, and in Cameroon, prevalence among adults aged 15–35

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years was similarly elevated [22,23]. These findings underscore the importance of targeting adolescents and young adults for HBV vaccination, screening, and health education programs.

Marital Status and HBV Infection: While the highest proportions of HBsAg positivity were noted among widowed and divorced individuals (33.3%), the association between marital status and HBV infection was not statistically significant. This may reflect small sample sizes in these categories. Married individuals had a prevalence of 14%, slightly higher than single individuals (11.4%), possibly reflecting sexual transmission within marital relationships. Similar patterns have been reported in other Nigerian studies, suggesting that marital status may influence exposure but is moderated by other factors, including sexual behaviour, cultural practices, and household transmission [18,20.]

Educational Status and HBV Infection: HBsAg seroprevalence decreased with higher educational attainment: primary education or below (14.5%), post-primary (11.9%), and post-secondary (10.0%). The association between lower education and higher HBV prevalence was statistically significant ($p < 0.001$), consistent with prior studies in Nigeria and sub-Saharan Africa [19,24]. Education likely influences awareness, health-seeking behaviour, and adoption of preventive measures, including vaccination and safe medical practices.

Global Comparisons: Globally, Nigeria remains within the high-endemic category (>8% HBsAg prevalence) defined by WHO [17]. In contrast, countries such as the United States, Canada, and most European countries report HBsAg prevalence below 2%, reflecting the impact of universal vaccination, blood safety measures, and public health interventions [2]. Within sub-Saharan Africa, comparable high prevalence rates have been reported in Ghana, Cameroon, and Sudan, where HBsAg prevalence among the general population ranges from 10% to 18% [15,22,25-27]. These comparisons highlight persistent regional disparities in HBV burden.

Public Health Implications

The findings emphasise that HBV infection remains a major public health concern in rural Nigeria, particularly among young adults and individuals with lower education levels. Key implications include:

1. Targeted vaccination programs for adolescents, young adults, and high-risk populations.
2. Integration of HBV screening into routine healthcare services, including antenatal care, blood donation, and community health campaigns.
3. Health education campaigns to improve awareness of HBV transmission, prevention, and vaccination.
4. Strengthening rural healthcare infrastructure to ensure the availability of diagnostics, counselling, and vaccination services.

These interventions align with the WHO's goal of eliminating viral hepatitis as a public health threat by 2030 [17].

Strengths and Limitations

Strengths of the study include:

i. A large sample size (n = 1,104) collected over five years, providing robust epidemiological insights.
ii. Focus on rural health facilities, where data are often scarce and glaring health inequalities.

Limitations include:

i. Retrospective design limited data on vaccination status, risk behaviour, and comorbidities.
ii. Some groups (e.g., widowed/divorced) had small sample sizes, affecting statistical power.
iii. Findings may not be fully generalizable to urban settings or other regions of Nigeria.

Despite these limitations, the study provides critical baseline data for policymakers and public health practitioners to guide HBV prevention and control strategies.

CONCLUSION

This retrospective laboratory review demonstrates that hepatitis B virus (HBV) infection remains highly endemic in rural Nigerian communities, with an overall HBsAg seroprevalence of 12.8% among screened individuals. The study identified young adults (16–25 years) and individuals with lower educational attainment as the most affected groups. Although males had a slightly higher prevalence than females, this difference was not statistically significant.

These findings underscore the ongoing public health burden of HBV in rural populations, where access to preventive services, health education, and vaccination programs may be limited. The data highlight the critical need for enhanced surveillance, targeted interventions, and integrated strategies to reduce HBV transmission and morbidity in Nigeria.

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Declarations

Authors' contribution: Diara JC, conceived and designed the study; developed the study methodology; acquired, reviewed, and analysed the data; interpreted the findings; drafted the manuscript; critically revised the manuscript for important intellectual content; approved the final version for publication; and accepts full responsibility for the integrity and accuracy of all aspects of the work.

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