

# EPIDEMIOLOGY OF HEPATITIS B VIRUS INFECTION: PREVALENCE, VACCINE COVERAGE AND ITS BARRIERS IN KATAGUM LOCAL GOVERNMENT AREA, BAUCHI STATE NIGERIA

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## ABSTRACT

Hepatitis B Virus (HBV) remains a major global health challenge, particularly in developing countries where vaccination coverage is low. This study aimed to assess the prevalence of HBV infection, knowledge, attitudes, and vaccine uptake among patients in Katagum Local Government Area Bauchi State, Nigeria. A total of 385 patients were recruited for the study. Blood samples were collected and tested for HBV surface antigen (HbsAg) using a rapid detection kit. Demographic data, vaccination status, and knowledge of HBV were obtained through structured questionnaires. Data were analyzed using descriptive and inferential statistics. The overall prevalence of HBV was 3.9%, with a higher rate in males (2.6%) compared to females (1.3%). Adults aged 25–64 years had the highest prevalence (2.6%), while no cases were recorded among individuals above 65 years. Rural residents had a higher prevalence (2.34%) than urban residents (1.56%). Vaccination coverage was 43.38%, with higher uptake among urban residents (23.38%) and males (35.06%). Marital status ( $p = 0.049$ ) and place of residence ( $p = 0.000$ ) were significantly associated with vaccine uptake. Knowledge of HBV was significantly linked to vaccination status ( $p = 0.031$ ), as were attitudes toward the disease and its prevention ( $p < 0.001$ ). The main barriers to vaccination were lack of awareness (42.20%), fear of side effects (22.94%), and negative attitudes toward vaccination (20.64%). The study highlighted a moderate HBV prevalence and suboptimal vaccination coverage in Katagum LGA, Bauchi State. There is a need for intensified awareness campaigns, improved vaccine accessibility, and targeted interventions to increase HBV vaccination rates, particularly in rural areas and among vulnerable groups.

**Keywords:** HBV, Vaccination, Knowledge, Azare, Awareness.

## INTRODUCTION

Hepatitis B virus (HBV) infection remains a significant public health challenge worldwide, particularly in regions with high endemicity such as sub-Saharan Africa. The virus primarily affects hepatocytes, leading to a spectrum of liver diseases ranging from acute hepatitis to chronic infection, cirrhosis, and hepatocellular carcinoma (HCC) (Lim *et al.*, 2020). Globally, an estimated 2 billion people have been infected with HBV, with approximately 350 million individuals suffering from chronic infection (WHO, 2021).

Each year, nearly 50 million new cases are reported, contributing significantly to morbidity and mortality (Kim *et al.*, 2022). The prevalence of HBV infection varies by geographic region, with the highest rates recorded in Asia and Africa, where more than 8% of the population is estimated to be chronic carriers (Tawiah *et al.*, 2021).

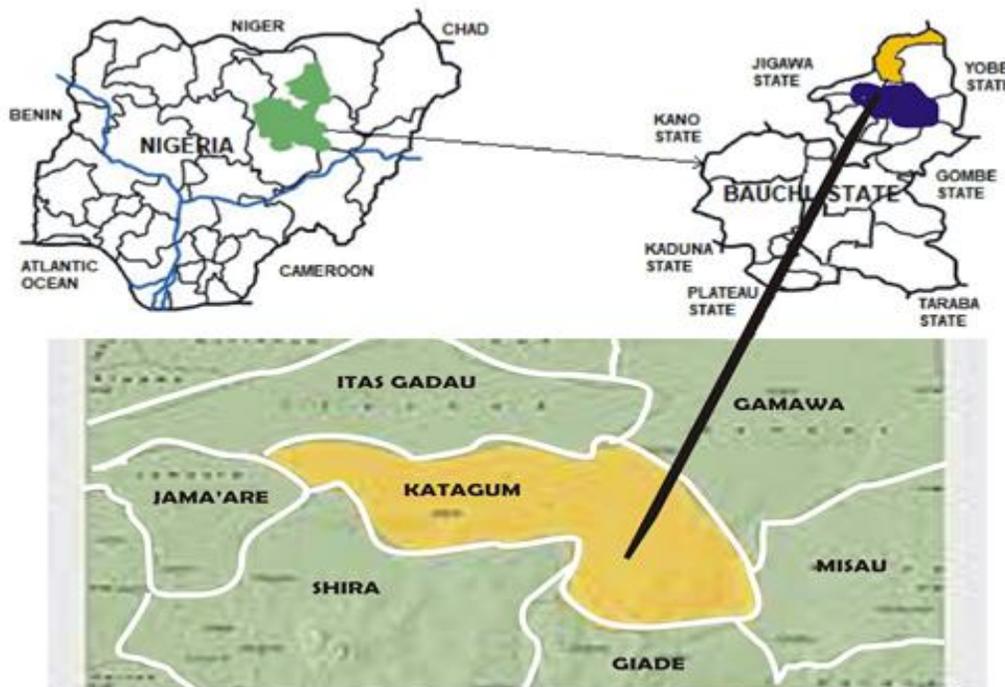
Transmission occurs through perinatal, horizontal, and parenteral routes, with variations depending on regional epidemiology. In areas of high endemicity, vertical transmission from mother to child and early childhood exposure are the most common routes, whereas in regions with lower prevalence, transmission is predominantly through unprotected sexual contact, intravenous drug use, and blood transfusions (Pennap *et al.*, 2019).

Clinical manifestations of HBV infection range from asymptomatic cases to severe liver disease. The virus has an incubation period of approximately 90 days, and acute infection often presents with symptoms such as fatigue, jaundice, abdominal pain, nausea, and dark urine (Omatola *et al.*, 2020). However, many infected individuals remain asymptomatic, leading to under-diagnosis and continued transmission. The chronic form of the disease, particularly in individuals infected at birth or in early childhood, increases the risk of long-term complications, including liver failure and HCC (Geta *et al.*, 2021).

Despite the availability of a safe and effective HBV vaccine, uptake remains suboptimal in many parts of Nigeria, particularly in rural communities. Barriers to vaccination include limited awareness, inadequate healthcare infrastructure, vaccine hesitancy, and financial constraints (Isaac *et al.*, 2021). Regular screening and early detection play a crucial role in reducing the burden of HBV infection, as timely intervention can prevent progression to severe liver disease. Various studies have reported varying HBV prevalence rates across Nigeria, emphasizing the need for updated epidemiological data to guide targeted public health interventions (Bello *et al.*, 2013; Oti *et al.*, 2021). Given these concerns, this study aimed to assess the prevalence of HBV infection among patients in Katagum Local Government Area, Bauchi State. The study also examined vaccination coverage, knowledge, attitudes, and factors influencing vaccine uptake. The findings would contribute to ongoing efforts to improve HBV prevention, enhance vaccination strategies, and inform health policies in Nigeria.

## MATERIALS AND METHODS

### Study Area



**Figure 1:** Map of the Study Area

Katagum Local Government Area (LGA) is situated in Bauchi State, Nigeria. The LGA has its headquarters in Azare, which serves as the administrative and commercial center. It covers a total area of approximately 1,435.6 square kilometers (km<sup>2</sup>), making it one of the larger local government areas in Bauchi State. As of 2015, the population of Katagum LGA was estimated to be 335,836 people. It is predominantly rural, with agriculture being a significant economic activity. Major cities in Katagum include Azare, Chinade, Madara, Gambaki and Bulkachuwa (Klein *et al.*, 2017).

### Study Design and Population

A cross-sectional descriptive study was conducted among patients at Extreme Hospital Azare Katagum Local Government Area, Bauchi State, Nigeria. Patients of various age groups and sociodemographic backgrounds with signs and symptoms of hepatitis B virus infection, and willing to participate in the study were included, while, those with no clinical presentations of the infection, or not willing to participate were excluded. Ethical approval was obtained from research and ethics committee of the hospital, and the patients participated voluntarily

### Sample Size Determination

The sample size was calculated using Cochran's formula (Cochran, 1963) for cross-sectional studies. Prevalence of 50% was taken as there is no published document was obtained in the study area. Precision of 5% and 95% confidence level were used for the study. Therefore, three hundred and eighty five (385) patients with signs and symptoms of hepatitis B virus infection were recruited in the

study.

$$n = \frac{z^2pq}{d^2}$$

Where "n" is the sample size

"Z" is 95% confidence level, and equals to 1.96

"p" is prevalence

"q" equals to "1-p"

"d" is precision (Ahmad, 2024).

### Data Collection Methods:

To assess knowledge, attitudes, and vaccine coverage among the patients, 385 structured questionnaires were distributed and retrieved. Also, laboratory Tests were conducted on the patients' blood samples, to determine HBV prevalence using HBsAg rapid test kits.

### Procedure for HBsAg Detection

For the hepatitis B surface antigen (HBsAg) detection a rapid HBsAg detection kit was used, following the manufacturer's instructions. About 2–5 mL of venous blood was collected from the patients into a sterile tube. The blood sample was allowed to clot at room temperature and centrifuged at 3,000rpm for 10 minutes to separate the serum or plasma, which were used for HBsAg testing (WHO, 2015).

The HBsAg rapid test kit was kept at room temperature (20–30°C) on a flat surface. The test device was labeled with the patient's identification code (Chaudhry *et al.*, 2019). About 2–3 drops (60–100 µL) of the serum was using a pipette dispensed into the

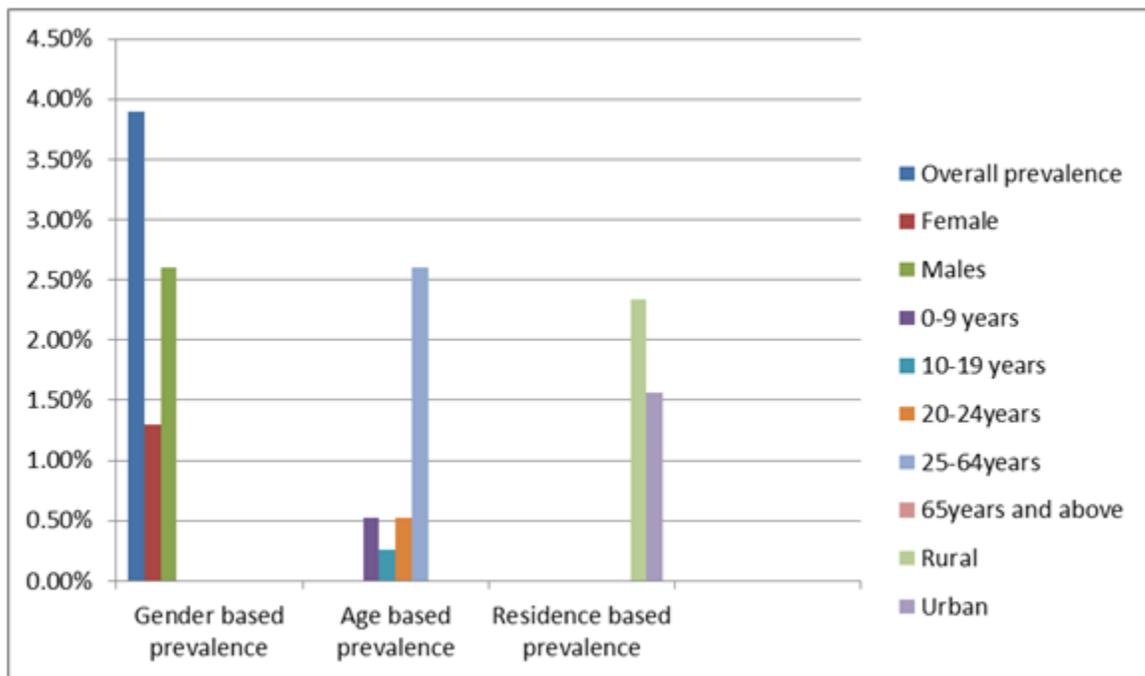
sample well of the test device. About 1–2 drops of the provided buffer solution was added to facilitate the reaction. The test was allowed to run undisturbed for 15–20 minutes (Kumar *et al.*, 2020). Positive results were identified with two distinct red/pink lines appeared—one in the test region (T) and one in the control region (C), while, negative result with only one red/pink line appeared in the control region (C). While, invalid results were identified with no visible line in the control region (C), regardless of the test line appearance (WHO, 2015).

**Data Analysis**

Descriptive statistics using SPSS version 23 were conducted for prevalence, knowledge, attitudes, and vaccine coverage. Inferential statistics- chi-square test was used for association analysis.

**RESULTS**

This study assessed the prevalence of Hepatitis B Virus (HBV) infection, knowledge and attitudes toward the disease and vaccination, vaccine coverage, and factors influencing these aspects. The findings indicated an overall HBV prevalence of 3.9% in Katagum Local Government Area, Bauchi State, with a higher rate in males (2.6%) compared to females (1.3%). Age-based prevalence was 0.52% among children (0–9 years), 0.26% among adolescents (10–19 years), 0.52% among young adults (21–24 years), and 2.6% among adults (25–64 years), with no cases recorded in individuals above 65 years. Prevalence was also higher among rural residents (2.34%) compared to urban residents (1.56%) (Figure 1).



**Figure 1:** Prevalence of Hepatitis B Virus Infection in the study Area

Among the 385 respondents, 167 (43.38%) had received the HBV vaccine, while 218 (56.62%) were unvaccinated. Of those vaccinated, 35.06% were males, and 8.31% were females. The vaccination coverage was 4.68% among children (0–9 years), 4.16% among young adults (20–24 years), and 34.55% among adults (25–64 years), while no adolescents (10–19 years) or elderly individuals (above 65 years) were vaccinated. Regarding marital status, 22.60% of unmarried (single) respondents and 20.78% of married individuals were vaccinated, while none of the widowed or

divorced respondents received the vaccine. Among the vaccinated individuals, 15.32% were civil servants, 2.60% were farmers, 1.30% were traders, 20.00% were students, and 4.16% were engaged in other occupations. Vaccination rates were higher among urban residents (23.38%) compared to rural residents (20.00%). Statistically, marital status ( $p = 0.049$ ) and residence ( $p = 0.000$ ) were significantly associated with vaccine uptake (Table 1).

**Table 1:** Demographic Characteristics and Hepatitis B Vaccination Status of the Patients

Variables	Vaccinated (%)	Not vaccinated (%)	Total (%)	X <sup>2</sup>	p-value
Gender:					
Males	135(35.06)	162(42.08)	296(77.14)	2.284	0.131
Females	32(8.31)	57(14.81)	89(23.12)		
Age:					
0-9 years	18(4.68)	15(3.90)	33(8.57)	5.535	0.137
10-19 years	0(0.00)	5(1.30)	5(1.30)		
20-24 years	16(4.16)	22(5.71)	38(9.87)		
25-64 years	133(34.55)	176(45.71)	309(80.26)		
Above 65 years	0(0.00)	0(0.00)	0(0.00)		
Marital status:					
Single	87(22.60)	127(32.99)	214(55.58)	6.044	0.049*
Married	80(20.78)	86(22.34)	166(43.12)		
Widowed	0(0.00)	5(1.30)	5(1.30)		
Divorced	0(0.00)	0(0.00)	0(0.00)		
Occupation:					
Civil servant	59(15.32)	70(18.18)	129(33.51)	6.115	0.191
Farmer	10(2.60)	25(6.49)	35(9.09)		
Trader	5(1.30)	5(1.30)	10(2.60)		
Student	77(20.00)	87(22.60)	164(42.60)		
Others	16(4.16)	31(8.05)	47(12.21)		
Residence:					
Urban	90(23.38)	158(41.04)	248(64.42)	14.249	0.000*
Rural	77(20.00)	60(15.58)	137(35.58)		

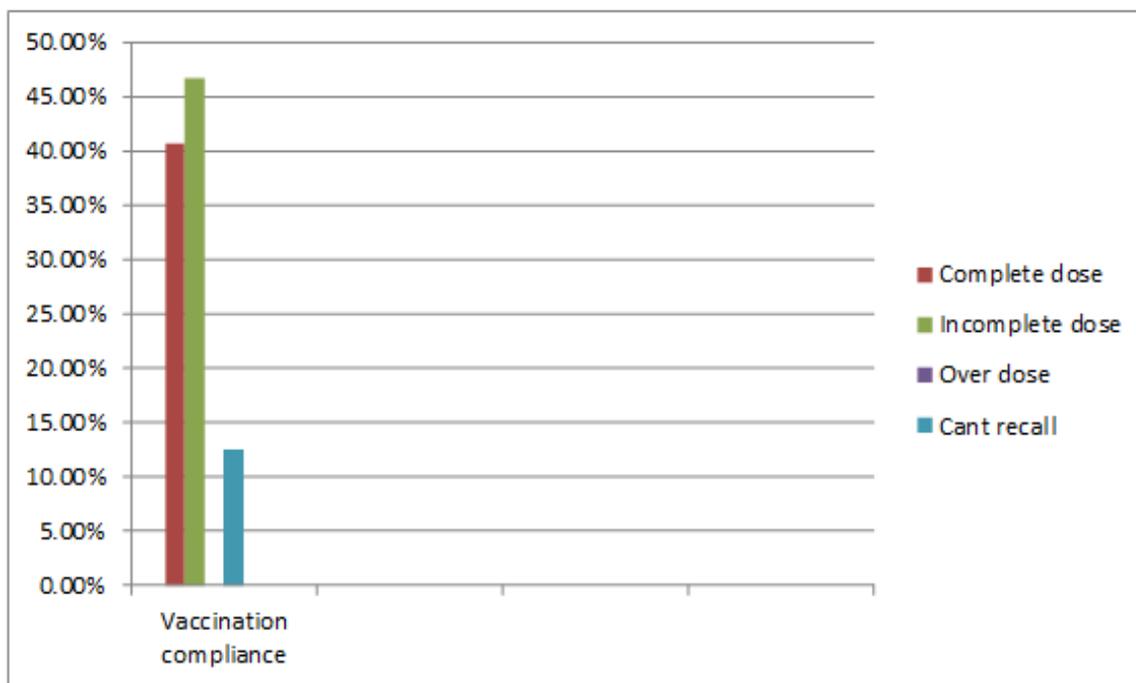
The study also found that 146 (37.92%) of those who had knowledge of HBV were vaccinated, while 171 (44.42%) were not. Among those lacking knowledge, 21 (5.45%) were vaccinated, and 47 (12.21%) were unvaccinated. When asked about the cause of HBV, 33.77% of vaccinated respondents correctly identified it as a viral infection, while 2.60% believed it was caused by bacteria, another 2.60% attributed it to witchcraft, and 4.42% were unsure. Additionally, 24.68% of vaccinated respondents were aware of HBV transmission modes, whereas 18.70% lacked this knowledge. All vaccinated respondents (43.38%) recognized HBV as a serious and preventable disease. A total of 42.08% of respondents agreed

to undergo screening if a free test was available, accept the vaccine if offered for free, and acknowledged vaccination as a preventive measure, while 1.30% disagreed. Statistical analysis showed that knowledge of HBV ( $p = 0.031$ ), its causative agent ( $p = 0.000$ ), transmission modes ( $p = 0.006$ ), and prevention ( $p = 0.005$ ) were significantly associated with vaccine uptake. Similarly, attitudes toward HBV ( $p = 0.000$ ), willingness to undergo screening ( $p = 0.000$ ), acceptance of the vaccine ( $p = 0.000$ ), and belief in its preventive role ( $p = 0.000$ ) were also significantly associated with vaccine uptake (Table 2).

**Table 2:** Knowledge, Attitude and Vaccine Uptake of the Respondents

Variables	Vaccinated (%)	Not vaccinated (%)	Total (%)	X <sup>2</sup>	p-value
<b>Have you heard of Hepatitis B?</b>					
Yes	146(37.92)	171(44.42)	317(82.34)	6.943	0.031*
No	21(5.45)	47(12.21)	68(17.66)		
<b>What do you think causes Hepatitis B?</b>					
Virus	130(33.77)	136(35.32)	266(69.09)	21.683	0.000*
Bacteria	10(2.60)	30(7.79)	40(10.39)		
Witchcraft	10(2.60)	40(10.39)	50(12.99)		
I don't know	17(4.42)	12(3.12)	29(7.53)		
<b>Do you know how Hepatitis B is transmitted?</b>					
Yes	95(24.68)	156(40.52)	251(65.19)	7.485	0.006*
No	72(18.70)	62(16.10)	134(34.81)		
<b>Can Hepatitis B be prevented?</b>					
Yes	167(43.38)	207(53.77)	374(97.14)	7.865	0.005*
No	0(0.00)	11(2.86)	11(2.86)		
<b>Do you think Hepatitis B is a serious disease?</b>					
Yes	167(43.38)	172(44.68)	339(88.05)	39.035	0.000*
No	0(0.00)	15(3.90)	15(3.90)		
I don't know	0(0.00)	31(8.05)	31(8.05)		
<b>Would you go for screening if a free test is offered?</b>					
Yes	162(42.08)	178(46.23)	340(88.31)	22.245	0.000*
No	5(1.30)	30(7.79)	35(9.09)		
Not sure	0(0.00)	10(2.60)	10(2.60)		
<b>Would you accept the vaccine if offered for free?</b>					
Yes	162(42.08)	173(44.94)	335(87.01)	27.420	0.000*
No	5(1.30)	25(6.49)	30(7.79)		
Not sure	0(0.00)	20(5.19)	20(5.19)		
<b>Do you believe vaccination can prevent Hepatitis B?</b>					
Yes	162(42.08)	163(42.34)	325(84.42)	36.749	0.000*
No	5(1.30)	26(6.75)	31(8.05)		
Not sure	0(0.00)	29(7.53)	29(7.53)		

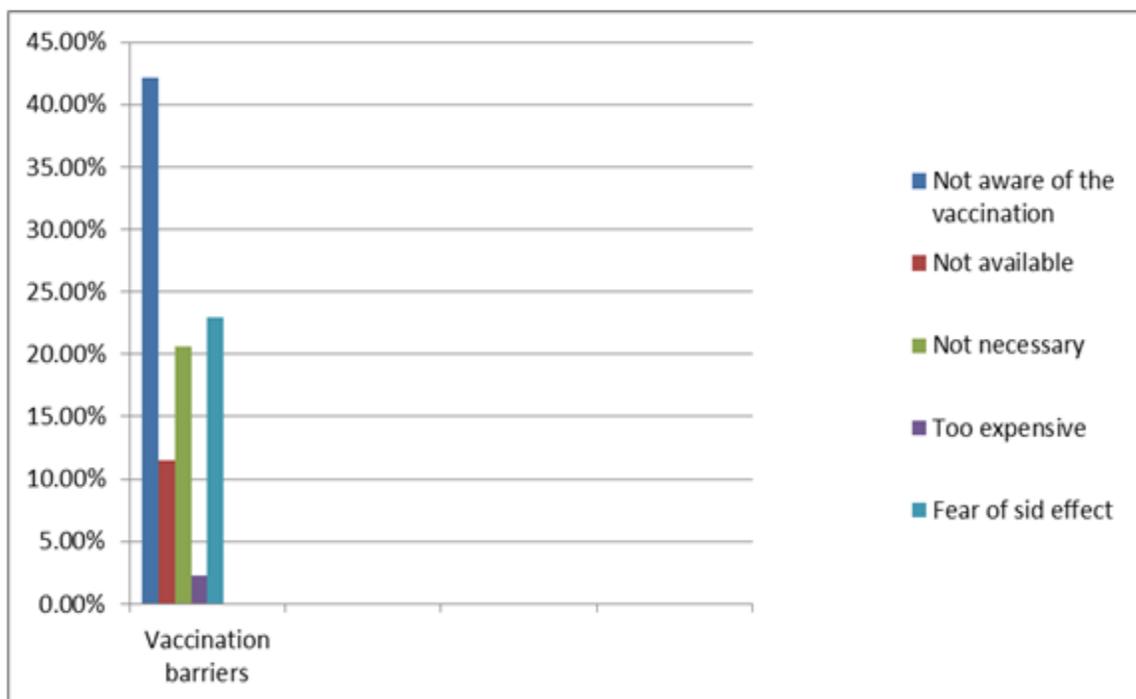
Regarding vaccination completeness, 40.72% of respondents had received the full dose, 46.71% had incomplete doses, and 12.57% could not recall the number of doses they received. None of the respondents had received an overdose (Figure 2).



**Figure 2:** Hepatitis B Vaccination Compliance of the Respondents

Several barriers to vaccination were identified. The most common reason for non-vaccination was a lack of awareness (42.20%), followed by vaccine unavailability in certain areas (11.47%),

negative attitudes toward vaccination (20.64%), high vaccine costs (2.29%), and fear of side effects (22.94%) (Figure 3).



**Figure 3:** Barriers Against Hepatitis B Vaccination

## DISCUSSION

This study provided valuable insights into the prevalence of Hepatitis B Virus (HBV) infection, public knowledge and attitudes toward the disease and its vaccination, vaccine coverage, and associated factors in Katagum Local Government Area (LGA), Bauchi State, Nigeria. The observed HBV prevalence of 3.9% in Katagum LGA is lower than previously reported rates in other Nigerian regions, such as 13.3% in Keffi, Nasarawa State (Grace *et al.*, 2010), 4.9% in Port Harcourt (Ejele & Ujele, 2004), 10.3% in Jos, Plateau State (Siresena *et al.*, 2002), and 21.3% in Ibadan (Olegbayo *et al.*, 2003). Additionally, studies in Jos reported prevalence rates of 23.9% and 15.1% (Uneke *et al.*, 2005; Egah *et al.*, 2007). The lower prevalence in Katagum LGA may be attributed to regional variations in risk factors, the effectiveness of public health interventions, and differing levels of community awareness which could help in mitigating the infection.

The higher prevalence among males (2.6%) compared to females (1.3%) aligns with some reports but contradicts others. For instance, Tella *et al.* (2021) reported a higher prevalence among females (22%) than males (16.7%). This variation may be influenced by differences in study populations, sociocultural practices, and risk exposure, such as higher engagement of males in high-risk behaviors like traditional scarification, barbering with unsterilized instruments, and multiple sexual partnerships (Bayo *et al.*, 2023). Age-wise, the highest prevalence was observed among adults aged 25–64 years (2.6%), consistent with studies indicating that sexually active adults have the highest HBV burden (Uneke *et al.*, 2005; Dawaki & Kawo, 2006; Chang, 2007). The slightly higher prevalence in rural areas (2.34%) compared to urban areas (1.56%) may reflect disparities in healthcare access, health education, and vaccination coverage. This aligns the findings of Ibrahim *et al.* (2021) who identified location-based inequities in vaccine accessibility, coverage and uptake.

The vaccination rate of 43.38% observed in this study is slightly above Nigeria's estimated national average. According to the World Health Organization (WHO), in 2017, only 42% of Nigerian infants received the third dose of the HBV vaccine, suggesting suboptimal immunization efforts. The relatively higher vaccination coverage in this study may be attributed to localized immunization campaigns, increased public awareness, or differences in the study population. However, a notable gender disparity was observed, with higher vaccination coverage among males (35.06%) than females (8.31%), and a higher uptake in urban residents (23.38%) than in rural residents (20.00%). These findings align with previous studies highlighting gender- and location-based inequities in vaccine accessibility and uptake (Ibrahim *et al.*, 2021).

A significant association was observed between knowledge of HBV and vaccination status. Among respondents with knowledge of HBV, 37.92% were vaccinated, compared to only 5.45% of those without knowledge. This underscored the critical role of education and awareness in promoting vaccine uptake. All vaccinated respondents recognized HBV as a serious and preventable disease, demonstrating the positive impact of accurate health information on preventive behaviors. Similar findings have been reported elsewhere. For instance, a study among medical students in Bosaso, Somalia, found that despite 73.7% of respondents having above-average knowledge of HBV and 95.9% recognizing vaccination as a preventive measure, only 2.8% were fully

immunized (Ali *et al.*, 2023). The difference between this study and the findings of Ali *et al.* (2023) might be attributed to variations in attitudes, risk perception, and vaccine accessibility.

The primary barriers to vaccination identified in this study were lack of awareness (42.20%), fear of side effects (22.94%), negative attitudes toward vaccination (20.64%), vaccine unavailability in certain areas (11.47%), and high vaccine costs (2.29%). These findings align with previous studies identifying similar obstacles to HBV vaccine uptake in Nigeria and other low-resource settings (Ali *et al.*, 2023). Addressing these barriers through community-targeted education campaigns, improving vaccine availability, and subsidizing vaccine costs could significantly enhance vaccination rates. Notably, the challenge of vaccine unavailability and cost is not unique to Nigeria. A study in Tanzania found that only 12% of healthcare workers had received at least one dose of the HBV vaccine, with barriers including high costs and a lack of clear vaccination guidelines (Nagu *et al.*, 2017). These structural barriers highlight the need for robust health policies promoting free or subsidized HBV vaccination programs.

Further, a recent report on mandatory HBV vaccination in sub-Saharan Africa identified significant implementation challenges, including dosing inconsistencies, lack of post-vaccination immunity testing, and ethical considerations regarding mandatory immunization (Aremu *et al.*, 2025). These findings support the present study's observation that 46.71% of participants had incomplete vaccine doses, raising concerns about vaccine adherence and long-term protection. Inadequate vaccine adherence has been linked to suboptimal immune responses, leaving individuals vulnerable to HBV infection despite partial immunization (Zampino *et al.*, 2015).

The findings of this study underscored the need for intensified public health interventions to improve HBV vaccination coverage, especially among women and rural populations. Educational campaigns emphasizing HBV transmission, severity, and the benefits of vaccination should be expanded. Moreover, strategies such as mobile vaccination units and integration of HBV vaccination with routine immunization services could bridge the gap in vaccine accessibility.

## Conclusion

This study provided critical insights into HBV prevalence, vaccination coverage, and barriers to the vaccination among patients attending Extreme Hospital, Azare. The findings revealed a relatively low prevalence of HBV (3.9%) compared to other regions in Nigeria. However, the vaccination rate remains suboptimal, with significant disparities based on gender, residence, and marital status. Knowledge and attitudes toward HBV strongly influenced vaccine uptake, but misinformation, fear of side effects, and lack of awareness posed major barriers. To improve HBV control in Katagum LGA, targeted public health strategies are needed, including community-based awareness programs, expanded vaccination campaigns, and policies addressing vaccine accessibility and affordability. Strengthening health education and integrating HBV screening into routine hospital visits could further enhance prevention efforts. Addressing these gaps will be crucial in reducing HBV transmission and achieving better health outcomes in the region.

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