**Original Research Article**

**Prevalence of Hepatitis B Virus Infection and Associated Risk Factors among Patients Attending Selected Tertiary Health Facilities in Nasarawa State, Nigeria**

ABSTRACT

**Background:** An estimate by the WHO in 2022 has it that 254 million people were living with chronic hepatitis B infection with a reported death of 1.1 million individuals. In Nigeria, hepatitis B virus (HBV) infection remains a critical public health challenge. This challenge is exacerbated by factors such as limited access to healthcare, inadequate vaccination coverage, and high-risk behaviours. In Nasarawa State, the disease prevalence ranges from 7.8% to 13.63%. These figures highlight the burden of hepatitis B in Nasarawa State.

**Aim:** The present study focused on determining the Prevalence of Hepatitis B Virus Infection and Associated Risk Factors among Patients Attending Selected Tertiary Health Facilities in Nasarawa State, Nigeria.

**Study Design:** The study was a cross-sectional study.

**Place and Duration of Study:** The study was conducted at the Federal Medical Centre, Keffi, and Federal University Teaching Hospital, Lafia, in Nasarawa State, Nigeria from June 2024 to December 2024.

**Materials and Methods**: This cross-sectional study was conducted from June to December 2024 using simple random sampling with ELISA and Rapid Diagnostic Test (RDT) techniques. The study areas included the Federal Medical Centre Keffi (FMCK) and Federal University Teaching Hospital (FUTH) Lafia, Nasarawa State. Patients attending FMCK and FUTH Lafia participated in the study. Participants above five years who were not immunized with the HBV vaccine in the last month were included, while those below five years or recently vaccinated within the last month were excluded.

**Results**: Out of the 200 samples tested, an overall prevalence of 11.5% and 9.5% was recorded for ELISA and RDT techniques, respectively. Rural settlers had a higher prevalence of 18.4% compared to urban settlers, 6.5%. There was no association between HBV prevalence and age, gender, marital status, senatorial districts, vaccination, and use of alcohol ( *P*>.05)

**Conclusion**: The overall prevalence of HBV infection in the study was found to be 9.5% using RDT and 11.5% using ELISA methods. These figures are higher than the national prevalence. The study highlights occupational and environmental risk factors including unsafe practices which contribute to the transmission of the virus. Therefore, we recommend enhanced HBV awareness creation, the need to strengthen safe blood transfusion policy, and increased access to affordable healthcare, particularly for people living in rural areas within the State.

**Keywords:** Prevalence; Hepatitis B Virus Infection; Risk factors; Tertiary Healthcare Facilities; Nasarawa

**1.0 Introduction**

Hepatitis B virus (HBV) is a *Hepadnavirus* that infects liver cells (Busayo *et. al*., 2021).

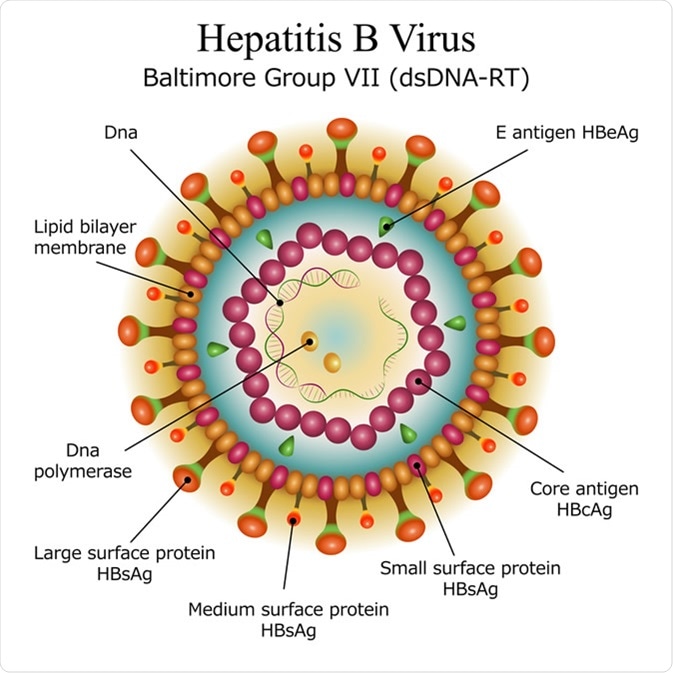


Figure 1: Diagram of Hepatitis B Virus (Tsukuda, S., and Watashi, K. 2020).

Hepatitis B is an infectious disease of global significance, with a significant health burden in Africa, resulting in complications such as cirrhosis and liver cancer associated with the infection (Onubi *et al*., 2023). According to the latest global estimation, approximately 2 billion people worldwide have evidence of past or present HBV; 296 million individuals are chronically infected and almost 820,000 result in annual deaths from HBV-related liver disease. The overall prevalence of HBsAg is 3.9% of the human population; however, it varies from country to country and depends on the complex interplay of behavioural, environmental, economic, geopolitical, and host factors (DiFilippo & [Navas](https://pubmed.ncbi.nlm.nih.gov/?term=Navas%20MC%5BAuthor%5D), 2023). Hepatitis B contributes to an estimated 820,000 deaths every year, and an estimated 3.6% of the global population, including over 6 million children under the age of 5, is affected by chronic HBV infection (Busayo *et al*., 2021; CDC, 2022). In Africa, approximately 65 million people live with chronic HBV infection, with an estimated prevalence of 6.2% (WHO, 2021; WHO, 2024). New infection rates are highest among children, and transmission predominantly occurs from mother to child (Ajuwon *et al.*, 2021). Nigeria, with an overall prevalence of 13.6%, is considered a high-prevalence country. Though estimates of HBV cases are inconsistent, and therefore additional clarity is required to manage HBV-associated public health challenges (Busayo *et al.*, 2021). In Africa, Nigeria is ranked as one of the countries that is hyper-endemic for HBV infection (> 8%). Approximately nine in ten Nigerians who live with chronic HBV are unaware of their infection status and are missing from the global public health statistics due to a lack of resources, awareness, and political will to address Nigeria’s HBV plight (Busayo *et al.*, 2021). Consequently, Nigeria has one of the highest rates of HBV-attributable cancer in West Africa, with an age-standardized incidence estimate of 2.6 to < 5.1 cases per 100,000 persons (Akabuike *et al*., 2024). Hepatocellular carcinoma is a highly aggressive cancer with limited treatment options, often lacking in resource-constrained settings (Suresh *et al*., 2020). The lack of affordable diagnostics—for example, the specialized immunoassays and nucleic acid tests, as well as the out-of-pocket cost for vulnerable populations- constitutes potential barriers to eliminating viral hepatitis B in Nigeria, thus making HBV a significant threat to public health. Furthermore, clinical and epidemiological research on HBV infection in Nigeria is developing but has not been able to attract appropriate funding and investment (Busayo *et al.*, 2021; Spearman *et al*., 2023).

In Nasarawa State, Nigeria, the prevalence of HBV infection is seen to vary across different communities within the State, with some areas reporting rates as high as 14% and 16.8% (Kingsley *et al.,* 2023; Onubi *et al.,* 2023). Di Filippo & Navas, (2023) documented three epidemiological patterns of HBV infection based on prevalence rate: a region with a prevalence greater than 8% is categorized as a region of high endemicity while a region with a prevalence of 2-8% is termed Intermediate endemicity and low endemicity regions are regions with a prevalence of less than 2%. To determine HBV infection, patients are screened at serological and molecular levels (Nagpal *et al*., 2021). This study focuses on the prevalence of the Hepatitis B virus and associated risk factors among patients attending tertiary health facilities in Nasarawa State, Nigeria. This study seeks to provide information that will guide public health policies and interventions to reduce the transmission of HBV and improve health outcomes in the region.

**2.0 Materials and Methods**

**2.1 Study Design:** The study was a cross-sectional study using RDT screening and ELISA techniques for the diagnosis of Hepatitis B Surface Antigen (HBsAg).

**2.2 Study Area and Population:** The study areas for this research work were the Federal Medical Centre (FMC) Keffi and Federal University Teaching Hospital (FUTH) Lafia, Nasarawa State, Nigeria. Nasarawa State is located in the North Central geopolitical zone also referred to as the Middle Belt region of Nigeria. It is located between latitude 7° 45′ and 9° 25’ N of the equator and between longitude 7° and 9° 37′ E of the Greenwich meridian. It has boundaries with Kaduna state in the North, Plateau State in the East, Taraba and Benue states in the South, Kogi State and the Federal Capital Territory to the West. The 2006 population Census estimated a population of about 1,826,883 and a total land area of 26,875.59 square kilometres, with a density of about 67 persons per square kilometre comprising 13 Local Government Areas as shown in Figure 1 (About Nasarawa State, 2025).



Figure 2: Map of Nasarawa State, highlighting the study areas in blue (Comfort *et al*., 2025).

**2.3 Study Participants**

Patients attending the various selected health facilities gave consent to participate in the study by signing the consent form (after adequate information concerning the study) and filling out the questionnaire**.**

**2.4 Inclusion Criteria**

Participants who were above 5 years and had not been immunized in the last one month with HBV Vaccine

**2.5 Exclusion Criteria**

Participants who were below 5 years old and those who recently took HBV vaccines were excluded from the study.

**2.6 Sample Size**

The sample size for this study was determined using the formula by Busayo *et al*. (2021).

**N= Z2pq/d2**

Where N= Minimum sample size

Z= Standard normal distribution at 95% confidence interval = 1.96

P= prevalence of HBV in previous studies = 13.6% = 0.136

q= (1-p) = 0.864

d= precision or margin of error= 5% = 0.05

Substituting the values in the formula;

N= Z2pq/d2 will mean

N = 1.962 × 0.125 × (1-0.136) / 0.052

N = 3.8416 × 0.136 × 0.864 / 0.0025

N = 0.4514 / 0.0025

N = 180. 56

However, 10% attrition of 180.56 = 18.10

Therefore N = 180.56 + 18.10 = 198.66

It was rounded up to 200 to increase the chances of detection

N = 200

**2.7 Data Analysis:** The Chi-square (X2) test was performed for all the data to check for a relationship in detecting HBV Infection using the statistical package for Social Sciences (SPSS) Version 21.0. The differences were considered significant only when *P* ≤ 0.05.

**2.8 Specimen Collection**

A total of 200 blood specimens were collected between June and December 2024, according to the venepuncture method described by Cheesbrough (2006). The arm of the individual was tied with a tourniquet, the position of a vein was disinfected with a 70% alcohol swab, and about two millilitres (2ml) of blood specimen was collected from each consenting participant using a labelled sterile vacutainer. All specimens collected were transported in a cold box to the laboratory for analysis.

**2.9 Socio-demographic Characteristics**

Using adapted questionnaires, the Socio-demographic characteristics of the respondents were recorded, which included age, gender, marital status, occupation, residency, senatorial district, vaccination history, blood transfusion history, history of unsterilized instrument use, history of unsafe dental/surgical procedures and alcohol consumption.

**2.10 Test Procedure**

Testing was done for the presence of HBsAg using the “DIALAB DIAQUICK” HBsAg Dipstick rapid screening kits manufacturer’s manual. Both HBsAg positive and negative samples were properly labelled and marked. Re-testing of the samples was done using the “DIALAB” HBsAg Sensitive ELISA kit as the gold standard ELISA technique. For this, 100μL of the sample to be tested was incubated with 200μL peroxidase enzyme-conjugated antibody, followed by washing and the addition of 50μL tetramethylbenzidine (TMB) substrate solution.

The binding of conjugate and subsequent peroxidase activity is proportional to the presence of HBsAg. The colorimetric reaction was stopped by the addition of 50μL stop solution A and solution B, respectively. The plate reader was calibrated with the blank well, and absorbance of the formed product was measured at 450/620nm within 10 minutes after stopping the reaction, resulting in qualitative and quantitative determination of HBsAg. A Chi-square (X2) test was performed for all the data to check for a relationship in detecting HBV Infection using the statistical package for social sciences (SPSS) Version 21.0. The differences were considered significant only when P ≤ 0.05.

**3.0 Results and Discussion**

**3.1 Prevalence of HBV using RDT and ELISA Techniques**

Out of the 200 samples screened for HBsAg, 19(9.5%) and 23(11.5%) tested positive using the RDT and ELISA method respectively while 181(90.5%) and 177(88.5%) using the RDT and ELISA method respectively (*P*> .05) (Table 1).

**3.2.1 Sociodemographic Characteristics of the Patients Attending Selected Tertiary Healthcare Facilities in Nasarawa State**

Regarding the participant’s age category, a prevalence of 10.2% was recorded among those aged <20 – 29, 9% for those aged 30 – 39 years, 10% for those aged 40–49 years and 33.3% for those >50 years. Females had a higher prevalence 14% compared to males 10.8%. Concerning marital status; the singles had a higher prevalence 13.7% compared to the married participants 9.1%. There was no participation among those who were widowed/divorced (P *> .05*) (Table 2).

Regarding the participant’s occupation and residency, farmers had the highest prevalence 33.3% followed by students 14.1%, housewives 7.1% and civil servants 4.3%, while the least was recorded among those with business as their occupation 2.3% (P=.05) While the distribution of the virus was 124(6.5%) among the urban settlers and 76(18.4%) among the rural settlers (P=.05) (Table 3).

**3.2.2 Prevalence of HBV among Senatorial Districts in Nasarawa State, Nigeria**

The study participants were recruited from the three senatorial districts of the state with Nasarawa West having a higher prevalence of 14.4% followed by Nasarawa South at 5.6% and Nasarawa North at 4% (*P* > .05)(Table 4).

**3.2.3 Patients Status Regarding Vaccination History, Blood Transfusion History, Use of Unsterilized Instrument, Unsafe Dental/Surgical Procedure and Alcohol Consumption.**

Out of the 200 participants, 86(4.7%) were vaccinated; and 114(16.7%) were not vaccinated (P>.05). While 12(50%) had received a blood transfusion before, 188(9%) had never been transfused blood (P=.05). Also, 36(30.5%) had shared unsterilized instruments before, while 188(7.3%) had never shared unsterilized instruments with others (P=.05). Furthermore, participants who had experienced unsafe dental or surgical procedure showed an infection rate of 23(30.4%), while participants who had never experienced unsafe dental or surgical procedure showed a prevalence of 177(9%) (P=.05) The distribution of HBV Infection among those who consume alcohol was 20(15%) while those who did not take alcohol was 180(11.1%) (P>.05) (Table5).

Table 1: Prevalence of HBV using RDT and ELISA Techniques among Patients Attending Selected Tertiary Healthcare Facilities in Nasarawa State

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Methods | Total samples examined | No. Positive/percentage | No. Negative/percentage | *P*-Value |
| RDT | 200 | 19 (9.50%) | 181 (90.50%) | 0.625 |
| ELISA | 200 | 23 (11.50%) | 177 (88.50%) |  |

Despite the implementation of a successful vaccine in several countries, the eradication of hepatitis B virus (HBV) is still a challenge. HBV Infection remains hyper-endemic in Nasarawa State. Out of the 200 samples tested, an overall prevalence of 9.5% and 11.5% was recorded using RDT and ELISA techniques, respectively. Our findings correlate with the report by Egbe *et al*. (2023) and Innocent *et al*. (2022), who recorded 10.6% and 9.6% prevalence in Nasarawa State, respectively. Also, reports from other parts of Nigeria and Africa correlate with our findings such as 10% reported by Olayiwola & Lanlehin. (2022) in Oyo, Nigeria, 10. 9% by Cookey *et al*. (2022) in Port-Harcourt, Nigeria and 10.1% by Nwodo *et al*. (2023) in Bayelsa, Nigeria. Furthermore, a prevalence of 8.4% was reported by Evenge *et* *al.* (2023) in Cameroon and 9.2% by Kinfe *et al.* (2021) in Ethiopia. However, a lower prevalence has been reported such as 6.0% by Adegbamigbe *et al*. (2022) and 7.8% reported by Abel *et al*. (2024). The overall prevalence obtained in this study is however, lower compared with 16.66% reported by Agulebe *et al.* (2024) in Benue, 16.6% reported by Ndubuisi *et al*. (2022) and 14% reported by Onubi *et al.* (2023) both in Nasarawa State. Mohammed *et al*. (2022) in Ethiopia also reported a higher prevalence of 27.4%. Based on findings, a high endemicity of HBV exists in Nasarawa State. This is probably due to the lifestyle of the people where a majority is unto farming, share unsterilized instruments, and live in rural settlements where there is little or no knowledge about the virus as well as access to quality and affordable healthcare facilities is scarce (Ndubuisi *et al*., 2022; Egbe *et al*., 2023; Ebel *et al.,* 2024). The differences in prevalence in this study may be attributed to a variety of factors such as geographical and cultural factors, level of awareness, and compliance with preventive measures among others (Egbe *et al*., 2023).

Table 2: Sociodemographic Characteristics of HBV among Patients Attending Selected Tertiary Healthcare Facilities in Nasarawa State, Nigeria

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Characteristics | No. of Participants examined  (n=200) | No. Positive | HBV Prevalence (%) | P – Value |
| Age (years) |  |  |  |  |
| <20-29 | 88 | 9 | 10.20 | 0.054 |
| 30-39 | 67 | 6 | 9.00 |  |
| 40-49 | 30 | 3 | 10.00 |  |
| >50 | 15 | 5 | 33.30 |  |
| Gender |  |  |  |  |
| Male | 157 | 17 | 10.80 | 0.765 |
| Female | 43 | 6 | 14.00 |  |
| Marital Status |  |  |  |  |
| Married | 99 | 9 | 9.10 | 0.403 |
| Single | 101 | 14 | 13.70 |  |
| Widow/Divorced | 0 | 0 | 0.00 |  |

Regarding the age differences among the participants, a prevalence of 10.2% was recorded among those <20-29 years, 9 % among 30-39 years, 10% among 40-49 years and 33.3% among those >50 years. However, there was no association between age and HBV transmission (*P*> .05). The varying prevalence among different age groups has also been previously reported (Cookey *et al*., 2022; Nwodo *et al*., 2023; Agulebe *et al*., 2024; Akabuike *et al*., 2024; Larebo *et al*., 2025). Also, there was no significant difference regarding gender (*P*> .05). It was observed that females had a higher prevalence of 14% than males 10.8%. Similarly, there was no significant association between HBV transmission and gender (*P*>.05). Reports with a higher prevalence among females compared to males have been documented in other parts of Nigeria, across the continent and globally (Upadhyay *et al*., 2020; Balegha, *et al*., 2021; Cookey *et al*., 2022; Olayiwola & Lanlehin, 2022; Al-Matary and Al-Gashaa, 2022; Nwodo *et al*., 2023). Regarding the marital status of participants, those who were single had a higher prevalence of 13.7% compared to those who were married at 9.1%. This is consistent with the report by Abel *et al*. (2024), Evenge *et al*. (2023) and Olayinka *et al*. (2016). Conversely, Cookey *et al*. (2022), Adegbamigbe *et al*. (2022) Mohammed *et al*. (2022) and Esther *et al*. (2024) reported a higher prevalence among those who are married. These reports suggest that regional factors, engagement in high-risk behaviour: such as unprotected sexual activity, having multiple sex partners, tattooing, traditional circumcision, and other varying cultural practices may play a role in the transmission of the virus (Ahmad *et al*., 2020; Ottevanger *et al*., 2021; Anka *et al*., 2023; Akabuike *et al*., 2024).

Table 3: Patient’s Occupation and Residency among Patients Attending Selected Tertiary Healthcare Facilities in Nasarawa State, Nigeria

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Characteristics | No. of the Participant’s examined  (n=200) | No. Positive | HBV Prevalence  (%) | P – Value |
| Occupation |  |  |  |  |
| Civil Service | 47 | 2 | 4.30 | 0.0009 |
| Business | 44 | 1 | 2.30 |  |
| Students | 71 | 10 | 14.10 |  |
| Farming | 24 | 8 | 33.30 |  |
| House Wife | 14 | 1 | 7.10 |  |
| Residency |  |  |  | 0.017 |
| Urban | 124 | 8 | 6.50 |  |
| Rural | 76 | 14 | 18.40 |  |

In this study, farmers had the highest prevalence of 33.3% followed by students at 14.1%, housewives at 7.1% and civil servants at 4.3%, while the least was recorded among those with business as their occupation 2.3% (*P*=.05). Business people showed low prevalence in this work probably because they have less exposure to high-risk environments and they tend to have greater access to healthcare services, including vaccination and screening, which could reduce their risk of HBV infection. At the same time, the farmers have the greatest prevalence of HBV infection. This could be connected with their poor access to quality healthcare, poor socioeconomic status, poor awareness of the virus, and their involvement in high-risk jobs with sharp and unsterilized farm tools, which could serve as means of transmission to other handlers of the same tools (Martyn *et al*., 2023; Li *et al*., 2024; Kasse *et al*., 2025).

There was a significant association between residency and rate of infection (*P*=.05), where the rural settlers in Nasarawa State had a prevalence of 18.4%, while the urban settlers had a prevalence of 6.5%. This agreed with Nyalika. (2021) and Zhao *et al.* (2021), report that HBV infection is endemic in rural communities compared to the urban areas. The association of the virus with the occupation and residency of the studied population could indicate poor access to HBV vaccination, awareness, and access to healthcare. Additionally, poor sanitation standards and unsafe medical and agricultural practices in rural areas might have significantly increased the HBV transmission risks in these populations (CDC, 2021; WHO, 2024).

Table 4: Prevalence of HBV among Senatorial Districts in Nasarawa State, Nigeria

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Characteristics | No of the Participants examined  (n=200) | No. Positive | HBV Prevalence  (%) | P – Value |
| Senatorial District |  |  |  |  |
| Nasarawa North | 25 | 1 | 4.00 | 0.152 |
| Nasarawa South | 36 | 2 | 5.60 |  |
| Nasarawa West | 139 | 20 | 14.40 |  |

The burden of HBV Infection in the Nasarawa West Senatorial District was found to be higher 14.4% compared to other Senatorial Districts in the State. This high prevalence in the Nasarawa West Senatorial District might be influenced by factors such as high population density, huge market opportunities, proximity to the Federal Capital Territory (FCT), Abuja Nigeria and several tertiary institutions situated in the region resulting in migration and mobility of individuals (About Nasarawa State, 2025).

Table 5.Patient status with regards to Vaccination, Blood Transfusion, Unsterilized Instrument, Unsafe Dental/Surgical Procedure and Alcohol Use

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Risk Factor | No of the Participants examined (n=200) | No. Positive | HBV Prevalence (%) | P - Value |
| Vaccination |  |  |  |  |
| Yes | 86 | 4 | 4.70 | 0.158 |
| No | 114 | 19 | 16.70 |  |
| Blood Transfusion |  |  |  |  |
| Yes | 12 | 6 | 50.00 | 0.00012 |
| No | 188 | 17 | 9.00 |  |
| Unsterilized Instrument |  |  |  |  |
| Yes | 36 | 11 | 30.50 | 0.00024 |
| No | 164 | 12 | 7.30 |  |
| Unsafe Dental/Surgical Procedure |  |  |  |  |
| Yes | 23 | 7 | 30.40 | 0.0074 |
| No | 177 | 16 | 9.00 |  |
| Alcohol |  |  |  |  |
| Yes | 20 | 3 | 15.00 | 0.883 |
| No | 180 | 20 | 11.10 |  |

There was no correlation between HBV; vaccination and use of alcohol (P >.05) respectively. However, blood transfusions, sharing of unsterilized instruments and unsafe dental/surgical procedures were significant risk factors that likely contributed to the elevated transmission rates of HBV observed in the studied populations (*P*= .05). This result agrees with the report of Ezeilo *et al*. (2018) in Enugu Metropolis, Nigeria and Oshun & Odeghe (2023) in Lagos Nigeria. Several risk factors such as multiple sex partners, the practice of homosexuality, presence of tattoos or tribal marks, body piercing, sharing of personal items such as toothbrushes, too much alcohol intake, history of any liver disease, blood transfusion, intravenous drug use, dental procedure, and history of surgery have been documented from previous studies to have an association with HBV infection (Ezeilo *et al*., 2018; Hussein, 2018; Rajamoorthy *et al*., 2019; Xu *et al*., 2021; Oshun & Odeghe, 2023).

**4.0 Conclusion**

The overall prevalence rate of HBV infection in this study was found to be 9.5% using RDT and 11.5% using ELISA methods with a high prevalence rate among participants who had received blood transfusion, farmers and participants aged >50 years. The study highlights occupational and environmental risk factors such as sharing of unsterilized instruments, unsafe blood transfusion, and unsafe dental and surgical procedures for HBV transmission in Nasarawa State. We therefore recommend a targeted awareness campaign, the need to strengthen safe blood transfusion policy, and increased access to affordable healthcare, particularly for people living in rural areas within the State. It is also recommended that public health officials and policymakers develop targeted strategies for specific sociodemographics to address the HBV burden effectively in the study population.

**Consent**

Written consent was obtained from all subjects after explaining in detail the entire research protocol.

**Ethical Approval**

Institutional ethical approval was obtained from the Health Research Ethics Committee of the Federal Medical Centre Keffi, Nasarawa State (FMC/KF/HREC/02644/24).

**Disclaimer**

Author(s) hereby declare that NO generative AI technologies such as large language models (chatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

**REFERENCES**

Abel, A. G., Shamarina, S., Hisham, M. N. M. N., & Hafiz, A. R. A. (2024). Prevalence and Associated Risk Factors of Hepatitis B Virus Infection in Lafia Metropolis, Nasarawa State, Nigeria. *African Journal of Infectious Diseases*, *19*(1), 45–56. <https://doi.org/10.21010/Ajidv19i1.6>

About Nasarawa State 2025. <https://nasarawastate.gov.ng/about-nasarawa-state/>

Adegbamigbe, O. J., Yusuf, M., Durowade, K. A., Oguntoye, O. O., & Ogundare, Y. (2022). Exposure to patients' sample and prevalence of Hepatitis B and C virus infection among healthcare workers in a Nigerian Tertiary Hospital. *Annals of African medicine*, *21*(4), 322–326. https://doi.org/10.4103/aam.aam\_44\_21

Agulebe, C.J., Maanongun, M.T., Nombur, L.I., & Abu, P.O. (2024). Prevalence of Hepatitis B Virus Infection among Antenatal Care Attendee in Makurdi, Benue State, Nigeria: A 6-year Review of Tertiary Hospital Records. *Asian Research Journal of Gynaecology and Obstetrics*, *7*(1), 207–218. https://doi.org/10.9734/arjgo/2024/v7i1228

Ahmad, A. E., Bakari, A. G., Musa, B. O. P., Mustapha, S. K., Abdullahi, I. N., Tahir, M. I., Jamoh, B. Y., Olatunji, A. O., Maishanu, S. H., Hali, B., Hawkins, C. A., Sagay, A. S., & Olayinka, A. T. (2020). Distribution of hepatitis B virus-positive individuals in Zaria, Nigeria, according to risk-associated practices. *Calabar Journal of Health Sciences*, *3*, 25–30. https://doi.org/10.25259/cjhs\_7\_2019

Akabuike, O. M., Aworh, M. K., Uzoebo, N. L., Erwat, J., Agukwe, O., Ngong, K., Dangana, A., Enwerem, K., & Abdullahi, I. N. (2024). Evaluating hepatitis B screening, prevalence, vaccination coverage, and linkage to care in Abuja, Nigeria: insights from a cross-sectional study. *BMC Public Health*, *24*(1). https://doi.org/10.1186/s12889-024-21017-3

Al-Matary, A. M., & Al Gashaa, F. A. S. (2022). Comparison of different rapid screening tests and ELISA for HBV, HCV, and HIV among healthy blood donors and recipients at Jibla University Hospital Yemen. *Journal of medicine and life*, *15*(11), 1403–1408. <https://doi.org/10.25122/jml-2022-0051>

Angbalaga, G. A., Shohaimi, S., MohdNadzir , M. N. H., & Ab Rahman, A. H. (2024). Prevalence and Associated Risk Factors of Hepatitis B Virus Infection in Lafia Metropolis, Nasarawa State, Nigeria. *African Journal of Infectious Diseases (AJID)*, *19*(1), 45–56. [https://doi.org/10.21010/Ajid v19i1.6](https://doi.org/10.21010/Ajid%20v19i1.6)

Anka, A. U., Musa, B. O. P., Mustapha, S. K., Ella, E. E., Hassan, A., Umar, K., Ahmad, A. E., Mohammed, M., Musa, S, Tahir, M. I., and Saidu, H. (2023): Pattern of Seroprevalence And SocioDemographic Distribution of Hepatitis B Virus Infection Among Potential Blood Donors Attending Ahmadu Bello University Teaching Hospital-Zaria, Nigeria BJMLS 8(1): 69 - 78

Babara, L. V., do Espirito-Santo, M. P., Costa, V. D., Marques, V. A., Villar, L. M., Lewis-Ximenez, L. L., Lampe, E., & Mello, F. C. A. (2019). Genetic Diversity of the Hepatitis B Virus Subgenotypes in Brazil. *Viruses*, *11*(9), 860. <https://doi.org/10.3390/v11090860>

Balegha, A. N., Yidana, A., &Abiiro, G. A. (2021). Knowledge, attitude and practice of hepatitis B infection prevention among nursing students in the Upper West Region of Ghana: A cross-sectional study. *PloS one*, *16*(10), e0258757. <https://doi.org/10.1371/journal.pone.0258757>

[Busayo I. Ajuwon](https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-021-06800-6), [Isabelle Yujuico](https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-021-06800-6), [Katrina Roper](https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-021-06800-6), [Alice Richardson](https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-021-06800-6), [Meru Sheel](https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-021-06800-6) & [Brett A. Lidbury](https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-021-06800-6) (2021): Hepatitis B virus infection in Nigeria: a systematic review and meta-analysis of data published between 2010 and 2019. *BMC Infect Dis* 21, 1120. <https://doi.org/10.1186/s12879-021-06800-6>

Centers for Disease Control and Prevention. (2022). Viral Hepatitis Surveillance Report – United States. https://www.cdc.gov/hepatitis-surveillance-2022/about/index.html. Published April 2024. Accessed [March 2025].

Cheesbrough M. District laboratory practice in tropical countries. Low-price edition. Cambridge University Press, USA. 2006; 297-298.

Cookey, N. I. T., Odenigbo, N. K. C., Okonko, N. B. J., & Okonko, N. I. O. (2022). Prevalence of HBsAg among patients attending a tertiary hospital in Port Harcourt, Nigeria. *International Journal of Life Science Research Archive*, *3*(2), 125–134. https://doi.org/10.53771/ijlsra.2022.3.2.0124

Di Filippo Villa, D., & Navas, M. C. (2023). Vertical Transmission of Hepatitis B Virus-An Update. *Microorganisms*, *11*(5), 1140. https://doi.org/10.3390/microorganisms11051140

Egbe, K. A., Ike, A., & Egbe, F. (2023). Knowledge and burden of hepatitis B virus in Nasarawa State, Nigeria. *Scientific African*, 22, e01938. <https://doi.org/10.1016/j.sciaf.2023.e01938>

Esther Ijeoma, N.-E., Altraide, B.A.O., Solomon, E. N., Awopola, J. I., & Mkpe, A. (2024). Sero-prevalence and associated factors of hepatitis B virus infection among antenatal women at booking in a tertiary hospital. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*, *13*(5), 1098–1105. https://doi.org/10.18203/2320-1770.ijrcog20241049

Evenge, C. N. N., Menkem, E. Z., Ngounou, E., Watching, D., Nembu, E. N., Luma, W. S., Seukep, A. J., Taksinkou, F. D. B., & Boyom, F. F. (2023). Prevalence of hepatitis B and associated factors in the Buea Regional Hospital, Cameroon. *Heliyon*, *9*(7), e17745. https://doi.org/10.1016/j.heliyon.2023.e17745

Ezeilo, M.C., Engwa, G.A., Iroha, R.I. and Odimegwu, D.C. (2018) Seroprevalence and Associated Risk Factors of Hepatitis B Virus Infection among Children in Enugu Metropolis. Virology, 9. <https://doi.org/10.1177/1178122X18792859>

Hussein, N. R. (2018). Risk factors of hepatitis B virus infection among blood donors in Duhok city, Kurdistan Region, Iraq. *DOAJ (DOAJ: Directory of Open Access Journals)*, *9*(1), 22–26. <https://doi.org/10.22088/cjim.9.1.22>

Imtiaz, A., Mishra, A., Poddar, C. K., Chaudhary, P. K., & Singh, M. N. (2017). Sensitivity comparison of Elisa and rapid screening techniques for the detection of HBsAg among chronic liver disease (CLD) patients in a tertiary care hospital, South Bihar, India. *Journal of Evolution of Medical and Dental Sciences*, *6*(71), 5045+. <https://link.gale.com/apps/doc/A509015552/AONE?u=anon~d6b384ed&sid=googleScholar&xid=ee4cdfcb>

Innocent, I. G., Kuleve, M. I., Ajugwo, G. C., Anekwe, I. I., & Fadayomi, V. K. (2022). Prevalence of hepatitis B and C infections among pregnant women at Dalhatu Araf Specialist Hospital Lafia, Nasarawa State, Nigeria. *Journal of Advances in Microbiology*, 22(7), 138. <https://journaljamb.com/index.php/JAMB/article/view/666>

Jaldo, M. M., Joffe, M. W., & Zemedkun, E. S. (2025). Prevalence of hepatitis B virus and associated factors among blood donors in Hossana blood bank catchment area, Southern Ethiopia. *BMC Infectious Diseases*, *25*(1). https://doi.org/10.1186/s12879-025-10550-0

Kasse, T., Solomon, T., Mesfin, A., Lonsako, A. A., Orkaido, O., Agegnehu, Y., & Haile, A. (2025). Awareness and infection prevention practices of hepatitis B virus among informal caregivers in public hospitals of Addis Ababa, Ethiopia, 2024: a cross-sectional study. *BMC Infectious Diseases*, *25*(1). https://doi.org/10.1186/s12879-025-10477-6

Khatoon, R., & Jahan, N. (2016). Evaluation of seroprevalence of Hepatitis B virus infection among patients attending a hospital of semi-urban North India using rapid immunoassay test. *The Nigerian postgraduate medical journal*, *23*(4), 209–214. <https://doi.org/10.4103/1117-1936.196263>

Kinfe, H., Sendo, E. G., & Gebremedhin, K. B. (2021). Prevalence of Hepatitis B Virus Infection and Factors Associated with Hepatitis B Virus Infection Among Pregnant Women Presented to Antenatal Care Clinics at Adigrat General Hospital in Northern Ethiopia. *International Journal of Women S Health*, *Volume 13*, 119–127. <https://doi.org/10.2147/ijwh.s280806>

Larebo, Y. M., Anshebo, A. A., Behera, S. K., & Gopalan, N. (2025). Prevalence of hepatitis B virus infection and associated factors among adults intrafamilial household contacts attending antenatal care clinics in the Central Ethiopian region: from pregnant women index cases. *Virology Journal*, *22*(1). https://doi.org/10.1186/s12985-025-02633-w

Li, C., Thapa, D., Mi, Q., Gao, Y., & Fu, X. (2024). Disparities in hepatitis B virus healthcare service access among marginalised poor populations: a mixed-method systematic review. *Infectious Diseases of Poverty*, *13*(1). <https://doi.org/10.1186/s40249-024-01225-0>

Malu, A. O., Achinge, G. I., Utoo, P. M., Kur, J. T., & Obekpa, S. A. (2020). Prevalence of Hepatitis B Surface Antigen and Antibodies to Hepatitis C in the General Population of Benue State, Central Nigeria. *The American journal of tropical medicine and hygiene*, *102*(5), 995–1000. <https://doi.org/10.4269/ajtmh.19-0649>

Martyn, E., Eisen, S., Longley, N., Harris, P., Surey, J., Norman, J., Brown, M., Sultan, B., Maponga, T. G., Iwuji, C., Flanagan, S., Ghosh, I., Story, A., & Matthews, P. C. (2023). The forgotten people: Hepatitis B virus (HBV) infection as a priority for the inclusion health agenda. *eLife*, *12*, e81070. <https://doi.org/10.7554/eLife.81070>

Mohammed, H., Eshetie, A., & Melese, D. (2022). Prevalence of hepatitis B virus and associated risk factors among adults patients at Dessie referral and Kemise general hospitals in northeastern Ethiopia. *Health science reports*, *5*(3), e659. <https://doi.org/10.1002/hsr2.659>

Mohammed, N. H. I., Sarah, N. A., & Rinmecit, N. P. G. (2020). Genotypic characterization of hepatitis B virus among human immunodeficiency virus patients at a tertiary health care facility in North Central Nigeria. *World Journal of Advanced Research and Reviews*, *6*(2), 187–192. https://doi.org/10.30574/wjarr.2020.6.2.0132

Musa, B. M., Bussell, S., Borodo, M. M., Samaila, A. A., & Femi, O. L. (2015). Prevalence of hepatitis B virus infection in Nigeria, 2000-2013: a systematic review and meta-analysis. *Nigerian journal of clinical practice*, *18*(2), 163–172. <https://doi.org/10.4103/1119-3077.151035>

Nagpal, B., Kumari, J., & Mehta, J. (2021). Comparison of Accuracy of ELISA Technique and RAPID Screening Techniques for the Diagnosis of Hepatitis B Surface Antigen (HBsAg).*Journal of Microbiology* 2021; 5 (2): 1 -3. <https://www.alliedacademies.org/microbiology-current-research/>

Ndubuisi, J. C., Aisha, M., Ugboaja, I. C., & Ubani, C. D. (2022). Prevalence of hepatitis B virus among students of Faculty of Natural and Applied Sciences, Nasarawa State University, Keffi Nasarawa State Nigeria. *South Asian Journal of Parasitology*, *5*(3), 86–90. <https://journalsajp.com/index.php/SAJP/article/view/125>

Nwodo, M.U., Etim, N.G., Sawyer, W.E., Onyia, O.I., Izah, S.C. (2023) Prevalence of Hepatitis B Virus Infection in Tertiary Health Insitutions in Bayelsa State, Nigeria. Ann Clin Med Microbiol 6(1): 1030.  [https://doi.org/10.47739/2578-3629.medicalmicrobiology.1030](https://www.jscimedcentral.com/jounal-article-info/Annals-of-Clinical-and-Medical-Microbiology/Prevalence-of-Hepatitis-B-Virus-Infection-in-Tertiary-Health-Insitutions-in-Bayelsa-State,-Nigeria-11455)

Nyalika, B. S. (2021). Prevalence and Associated Factors of Hepatitis B Surface Antigen (HBsAg) among People Living with HIV (PLWHIV) Attending at CTC Mawenzi Regional Hospital Kilimanjaro, Northern Tanzania. *Advances in Infectious Diseases*, *11*(02), 216–231. https://doi.org/10.4236/aid.2021.112020

Olakunde, B. O., Adeyinka, D. A., Olakunde, O. A., Uthman, O. A., Bada, F. O., Nartey, Y. A., Obiri-Yeboah, D., Paintsil, E., & Ezeanolue, E. E. (2021). A systematic review and meta-analysis of the prevalence of hepatitis B virus infection among pregnant women in Nigeria. *PLoS ONE*, *16*(10), e0259218. https://doi.org/10.1371/journal.pone.0259218

Olayinka, A. T., Oyemakinde, A., Balogun, M. S., Ajudua, A., Nguku, P., Aderinola, M., Egwuenu-Oladejo, A., Ajisegiri, S. W., Sha'aibu, S., Musa, B. O., Gidado, S., & Nasidi, A. (2016). Seroprevalence of Hepatitis B Infection in Nigeria: A National Survey. *The American journal of tropical medicine and hygiene*, *95*(4), 902–907. <https://doi.org/10.4269/ajtmh.15-0874>

Olayiwola, J. O., & Lanlehin, F. C. (2022). Prevalence of Hepatitis B Virus Surface Antigen (HBsAg) among the Out-patients in a Tertiary Institution in Nigeria. *Microbiology Society*. https://doi.org/10.1099/acmi.0.000538.v1

Onubi, J., Eseigbe, P., Agyema, J. P. A., &Chima, A. A. G. (2023). Seroprevalence of Hepatitis B and C Virus Infections among Healthcare Seekers at a Tertiary Health Facility in North-Central Nigeria: A Retrospective Study. *West African journal of medicine*, *40*(12), 1355–1361.

Oshun, O.P & Odeghe, E. (2023). Seroprevalence of Hepatitis B Virus Infection and Associated Risk Factors among Apparently Healthy Individuals in Lagos. *Annals of Tropical Pathology* 14 (1): 11-15

Ottevanger, M. –., Boyd, A., Prins, M., Van Der Helm, J., Zijlmans, C., Hindori-Mohangoo, A., Harkisoen, S., Hermelijn, S., Brinkman, K., Codrington, J., Roosblad, J., Kort, S., Dams, E., Van De Laar, T., & Vreden, S. (2021). Differences in prevalence of hepatitis B virus infection and genotypes between ethnic populations in Suriname, South America. *Virology*, *564*, 53–61. https://doi.org/10.1016/j.virol.2021.09.005

Rajamoorthy, Y., Taib, N. M., Mudatsir, M., Harapan, H., Wagner, A. L., Munusamy, S., Rahim, K. A., & Radam, A. (2019). Risk behaviours related to hepatitis B virus infection among adults in Malaysia: A cross-sectional household survey. *Clinical Epidemiology and Global Health*, *8*(1), 76–82. https://doi.org/10.1016/j.cegh.2019.04.011

Shedain, P. R., Devkota, M. D., Banjara, M. R., Ling, H., & Dhital, S. (2017). Prevalence and risk factors of hepatitis B infection among mothers and children with hepatitis B infected mother in upper Dolpa, Nepal. *BMC Infectious Diseases*, *17*(1). https://doi.org/10.1186/s12879-017-2763-4

Spearman, C. W., Afihene, M., Ally, R., Apica, B., Awuku, Y., Cunha, L., Dusheiko, G., Gogela, N., Kassianides, C., Kew, M., Lam, P., Lesi, O., Lohouès-Kouacou, M. J., Mbaye, P. S., Musabeyezu, E., Musau, B., Ojo, O., Rwegasha, J., Scholz, B., Shewaye, A. B., … Gastroenterology and Hepatology Association of sub-Saharan Africa (GHASSA) (2017). Hepatitis B in sub-Saharan Africa: strategies to achieve the 2030 elimination targets. *The lancet. Gastroenterology & hepatology*, *2*(12), 900–909. <https://doi.org/10.1016/S2468-1253(17)30295-9>

Spearman, C. W., Andersson, M. I., Bright, B., Davwar, P. M., Desalegn, H., Guingane, A. N., Johannessen, A., Kabagambe, K., Lemoine, M., Matthews, P. C., Ndow, G., Riches, N., Shimakawa, Y., Sombié, R., Stockdale, A. J., Taljaard, J. J., Vinikoor, M. J., Wandeler, G., Okeke, E., Sonderup, M., … Hepatitis B in Africa Collaborative Network (HEPSANET) (2023). A new approach to prevent, diagnose, and treat hepatitis B in Africa. *BMC global and public health*, *1*(1), 24. <https://doi.org/10.1186/s44263-023-00026-1>

Tsukuda, S., & Watashi, K. (2020). Hepatitis B virus biology and life cycle. Antiviral research, 182, 104925. https://doi.org/10.1016/j.antiviral.2020.104925

Uche, E. I., Chukwukaodinaka, N. E., Akinbami, A. A., Adeyemi, O. I., Hassan, A. O., Bamiro, R. A., Ibrahim, I. N., Suleiman, A. M., Augustine, B., &Anaduaka, D. C. (2022). Common hepatitis B virus genotypes among blood donors in Lagos, Nigeria. *Nigerian Postgraduate Medical Journal* 29(3):p 228-235, Jul–Sep 2022. | DOI: 10.4103/npmj.npmj\_19\_22

Umego, C. F., Mboto, C. I., Asitok, A. D., Osaji, L. C., George, U. E., Edet, U. O., Mbim, E. N., Faleye, T. O., Adewumi, O. M., &Adeniji, J. A. (2022). Circulation of hepatitis B virus genotype-E among outpatients in tertiary hospitals in the Niger-Delta region of Nigeria. *African health sciences*, *22*(1), 511–520. <https://doi.org/10.4314/ahs.v22i1.60>

Upadhyay, D. K., Manirajan, Y., Iqbal, M. Z., Paliwal, N., & Pandey, S. (2020). A Survey on Medical, Dental, and Pharmacy Students' Knowledge, Attitude, and Practice about Hepatitis B Infection in a Private Medical University of Malaysia. *Journal of research in pharmacy practice*, *9*(3), 128–134. <https://doi.org/10.4103/jrpp.JRPP_20_8>

World Health Organization. (2021). Global progress report on HIV, viral hepatitis and sexually transmitted infections. https://iris.who.int/bitstream/handle/10665/341412/9789240027077-eng.pdf?sequence. Accessed 8 March 2025.

World Health Organization. (2024): Guidelines for the prevention, diagnosis, care and treatment for people with chronic hepatitis B infection. https://www.who.int/publications/i/item/9789240090903

Xu, H. Q., Wang, C. G., Zhou, Q., & Gao, Y. H. (2021). Effects of alcohol consumption on viral hepatitis B and C. *World Journal of Clinical Cases*, *9*(33), 10052–10063. https://doi.org/10.12998/wjcc.v9.i33.10052

Zhao, X., Shi, X., Lv, M., Yuan, B., & Wu, J. (2021). Prevalence and factors associated with hepatitis B virus infection among household members: a cross-sectional study in Beijing. *Human Vaccines & Immunotherapeutics*, *17*(6), 1818–1824. <https://doi.org/10.1080/21645515.2020.1847951>