

Original Article

Prevalence and Associated Risk Factors of Hepatitis B Virus Infection Among Healthcare Professionals in a Tertiary Care Hospital in Nigeria: A Cross Sectional Study

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***Correspondence:** Dr. Ayotunde B. OmotosoEmail: omotoso.abo@unilorin.edu.ng**ABSTRACT**

This study investigated the prevalence and risk factors of hepatitis B virus (HBV) infection among healthcare professionals (HCPs) in a tertiary care hospital in Nigeria. Of the 355 participants, 7.3% were infected with HBV, with nurses having a highest prevalence rate of 7.2%. Multivariate analysis identified age group 30-39 and a history of needle-stick injury as independent risk factors for HBV infection. Only 40.3% of HCPs had received complete HBV vaccination, with 31.0% reporting incomplete vaccination and 28.2% having had no vaccination. The study highlights the importance of implementing comprehensive HBV vaccination programs and strict adherence to infection control guidelines to prevent occupational transmission of HBV among HCPs in Nigeria. The findings also emphasize the need for increased awareness of the risk factors associated with HBV infection among HCPs. These insights can guide the development of effective public health policies aimed at reducing the burden of HBV infection in the healthcare sector.

Keywords: Hepatitis B virus, Hospital care professionals, Prevalence, Needle-stick.**INTRODUCTION**

Hepatitis B virus (HBV) infection and its associated consequences represent a significant public health concern worldwide.¹ In 2021, the World Health Organization (WHO) reported that approximately 257 million people were living with chronic hepatitis B infection, (defined as testing positive for hepatitis B surface antigen for a duration of six months or longer after the initial test). This high prevalence of chronic HBV infection was associated with an estimated 887,000 deaths, primarily resulting from liver cirrhosis and liver cancer.^{1,2} Despite the availability of a safe and highly

effective vaccine since 1981 that provides 98-100% protection against HBV infection, the prevalence of this disease remains alarming in certain regions.² According to WHO, the Western Pacific and African Regions have the highest prevalence rates of HBV infection, affecting 6.2% and 6.1% of the adult population, respectively.² In Nigeria, the prevalence of HBV infection is also significant, with a national survey reporting a rate of 12.7%.³ In regions with high endemicity, such as our environment, (Nigeria), HBV is commonly transmitted from mother to child during childbirth (vertical transmission), or through exposure to infected blood and blood products.³ Other routes of transmission include needle-stick injuries,

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tattooing, and sexual contact.⁴ Healthcare professionals (HCPs) are at higher risk of acquiring and transmitting HBV infection in the healthcare setting through two main pathways: from infected patients to HCPs and from infected HCPs to uninfected patients.⁵ Injuries from sharp objects, such as needle-stick injuries, are one of the most frequently reported occupational accidents in healthcare settings.^{5,6}

According to a study, needle-stick injuries have been experienced by approximately 80% of healthcare professionals (HCPs).⁶ The Hepatitis B virus is capable of surviving outside the human body for up to seven days, during which time it can infect a susceptible host.¹⁻⁴ HCPs who come into contact with patients, their blood, or other body fluids are at a higher risk of acquiring HBV infection. This risk is four times higher than that of the general population. According to the WHO, about 6% of HCPs are exposed to bloodborne HBV infections each year, which corresponds to approximately 660,000 HBV infections in HCPs worldwide.⁴ In developing countries, 40-65% of HBV infections in HCPs are attributed to percutaneous occupational exposure.⁵⁻⁷

Currently, there is paucity of data on the prevalence of HBV infection among HCPs in Ilorin Kwara. However, a previous study reported the HCP's prevalence of HBV infection in Ilorin as 5.5%.¹⁹ The objective of this study is to determine the prevalence of HBV infection and identify the associated risk factors among HCPs.

MATERIALS AND METHODS

Study Design: A Cross-sectional study

Participants: Healthcare professionals who closely interact with patients or their body fluids. These include doctors, nurses, and laboratory technologists.

Sampling Method: Proportionate stratified sampling method

Sample Size: A total of 386 participants were recruited in this study, and they were divided into three population with regards to profession, each stratum's population was taken into account, and the sample size of each stratum was proportional to its population size when viewed against the entire

population.

Laboratory Analysis: Venous blood samples were obtained from each participant and centrifuged at 3000 rpm for 5 minutes to obtain clear plasma. A one-step rapid immunochromatographic test to detect HBs-antigen, HBe-antigen, anti-HBc antibodies, and anti-HBe-antibodies in the sera of the participants. The testing process involves the chromatographic movement of mouse monoclonal antibodies/antigens-colloid gold conjugate and samples along the nitrocellulose membrane. This process results in visible bands forming in the test region, indicating the presence of antibody-antigen-antibody gold complex. Before sample application, neither the test nor control lines should be visible. The control band serves as an internal/procedural control. To interpret the test results, the appearance of only one band in the control region with no band in the test region indicates a negative result for HBsAg, HBeAg, and Anti-HBs wells. In contrast, the appearance of bands in both the test and control regions indicates a positive result. For Anti-HBe and Anti-HBc wells, the appearance of only one band in the control region with no band in the test region indicates a positive result, while the appearance of bands in both the test and control regions indicates a negative result.¹⁹

Statistical Analysis: Data obtained from the study were analyzed using SPSS (version 21.0, SPSS Inc. Chicago, IL), and the Pearson Chi-square test determined relationships between participants' sociodemographic characteristics and HBV marker detection rates. Multivariate analysis was carried out for five possible risk factors, including age, gender, occupation, history of needle-stick injury, and history of vaccination uptake. Differences were considered statistically significant when the P-value was less than 0.05.

RESULTS

Out of the 385 HCPs recruited for the study, 355 questionnaires with completed data were analyzed, resulting in a response rate of 92.2%. Of the 355 HCPs with complete data, 149 (42%) were physicians, 180 (50.7%) were nurses, and 26 (7.3%) were laboratory technicians. The participants' age and sex were summarized in Table 1, with a mean

age of 39.8 years (95% CI:

39.60 - 40.0 years) and an inter-quartile range (IQR) of 24 - 58 years. Additionally, more than 250 (71.0%) participants were females- Majority of the participants were noticed to be females constituting 250 (71.0%) of the total participants. Among the 355 HCPs, the positivity rates of the five serological markers for HBV infection, namely HBsAg, Anti-HBs, HBeAg, Anti-HBe, and Anti-HBc, were 7.3%, 51.8%, 0%, 7.3%, and 9.9%, respectively (Table 2). Similarly, the prevalence of hepatitis B infection among the 355 HCPs was 7.3% (26/355) with evidence of current infection, as shown by positivity of HBsAg, anti-HBe, and anti-HBc. The 95% confidence interval for this proportion was 25.8-26.2. Out of the 35 participants (9.9%) who had anti-HBc antibodies, seven participants (2.0%) with a confidence interval of 1.8% to 2.2% had evidence of past hepatitis B infection (positive for both anti-HBs and anti-HBc), while two participants (0.56%) only had anti-HBc antibodies. This information is displayed in Table 3.

According to the data presented in Table 4, nurses accounted for 50.0% (13) of the healthcare professionals (HCPs) who tested positive for HBsAg. Although the prevalence of HBV infection differed among various HCPs, there was no significant difference observed ($p = 0.682$, Chi-squared test = 0.7655). However, the analysis showed a significant difference in the prevalence of HBV infection between male and female participants. The prevalence was found to be higher in males, as shown in Figure 1 ($p = 0.004$, Chi-squared test = 8.3994). Although the highest seroprevalence of HBsAg was observed in the 30-39 age group, there were no statistically significant differences in the prevalence of HBsAg across various age groups ($p = 0.5203$, Chi-squared test = 2.2596) as shown in table 5. Of all the participants in the study, 241 individuals (67.9%) reported having experienced needle stick injuries. Among healthcare professionals (HCPs) who were diagnosed with hepatitis infection, 24 (92.3%) had a history of needle stick injuries (table 6).

In this survey, the prevalence of complete vaccine uptake against hepatitis B was found to be 40.3%.

Hundred (100) individuals (28.2%) reported no prior vaccination against hepatitis B, out of which 10 (2.8%) were found to be HBsAg seropositive. As shown in Table 6, a similar seroprevalence rate of 2.8% was also observed among those who did not complete their HBV vaccine schedule. Furthermore, a significant association was found between the prevalence of HBV infection and the uptake of the HBV vaccine (P -value = 0.03, Chi-squared test = 8.6424).

Table 1: Descriptive statistics of participants

Healthcare Group	95% CI mean age	Male (%)	Female (%)	Total
Medical doctors	31.8	86 (57.7)	63 (42.3)	149
Nurses	46.5	5 (2.8)	175 (97.2)	180
Laboratory technologists	39.9	12 (46.2)	14 (53.8)	26
Total	39.8	103(29.0)	252 (71.0)	355

Table 2: Positivity rate of hepatitis B infection serological markers among the participants

HBVserology markers	Positive (%)	Negative (%)
HBsAg	26 (7.3)	329 (92.7)
HBeAg	0 (0)	355 (100)
Anti-HBe	26 (7.3)	329 (92.7)
Anti-HBc	35 (9.9)	320 (90.1)

Table 3: Prevalence of resolved HBV infection according to Anti-HBs and Anti-HBc

Anti-HBs	Anti-HBc	Anti -HBc	Total
	Positive (%)	Negative (%)	
Positive (%)	7 (3.9)	174 (96.1)	181 (67.9)
Negative (%)	28 (16.1)	146 (83.9)	174 (27.9)
Total	35(9.9)	320 (92.7)	355 (100)

Table 4: of HBV according to healthcare professional's group

Healthcare professional group	HBsAg positive	HBsAg negative
Medical doctors	10 (6.7)	139 (93.3)
Nurses	13 (7.2)	167 (92.8)
Laboratory technologists	3 (11.5)	23 (88.5)
Total	26 (7.3)	329 (92.7)

(2-0.7655, $p=0.682$)

Table 5: prevalence of HBV according to participants age group

Age group	HBsAg positive (%)	HBsAg negative (%)	Total
<30	4 (4.7)	81 (95.3)	85
30 -39	10 (10.4)	86 (89.6)	96
40 -49	6 (7.0)	80 (93.0)	86
>49	6 (6.8)	82 (93.2)	88

Table 7: Prevalence of HBV infection by vaccine uptake

Complete vaccination	HBV positive (%)	HBsAg positive (%)	HBsAg negative (%)	Total
No vaccine	10 (10.0)	90 (90.0)	100 (28.2)	
Yes	5 (3.5)	138 (96.5)	143 (40.3)	
No	10 (9.1)	100 (90.1)	110 (31.0)	
Don't know	1 (0.0)	1 (100.0)	2 (0.6)	
Total	26 (7.3)	239 (92.7)	355 (100)	

2-8.6424, P-value 0.3

DISCUSSION

This study provides valuable insights into the prevalence and risk factors associated with HBV infection among healthcare professionals in Nigeria. From this study, 7.3% of the HCPs were infected with HBV which is similar to the prevalence rate reported in other studies conducted among healthcare professionals in Nigeria.^{2,4,9} However, some studies have reported higher prevalence rates, such as 13.7%, 11.2%, 10.6% respectively.^{2,22,26}

It was shown from this study that needle stick injuries are a common occurrence among HCPs accounting for 67.9% among the participants. In addition, a high proportion of HCPs with hepatitis infection (92.3%) reported having had needle stick injuries in the past. This result is consistent with previous studies that have shown that needle stick injuries are a significant occupational hazard for HCPs, and can lead to the transmission of bloodborne pathogens such as hepatitis B and C.^{20,21,27} A study among HCPs in low and middle-income countries found the prevalence to range between 8.8% to 38.7%, with higher rates reported among certain groups such as nurses and laboratory technicians.²⁰ Another study estimated that 16,000 hepatitis B virus (HBV) infections, 66,000 hepatitis C virus (HCV) infections, and 200-500 HIV infections occur each year among HCPs worldwide as a result of occupational exposure to bloodborne pathogens.²¹

Table 6: Prevalence of HBV infection by the history of needle stick injury

History of needle stick injury	HBsAg positive (%)	HBsAg negative (%)	Total
Yes	24 (6.8)	217 (61.1)	241 (67.9)
No	1 (0.3)	98 (27.6)	99 (27.9)
Don't know	1 (0.3)	14 (3.9)	15 (4.2)
Total	26 (7.3)	329 (92.7)	355 (100)

2-8.2885, P-value .01598.2885,

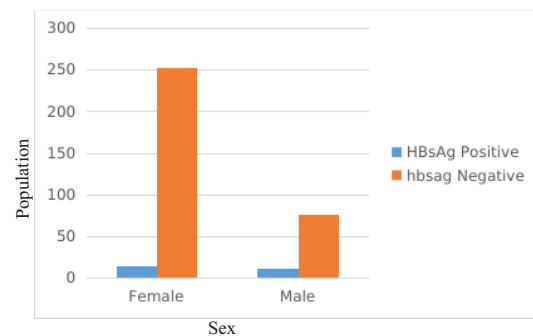


Figure 1: Prevalence of HBV infection according to sex

The high proportion of HCPs with hepatitis infection who reported having had needle stick injuries in the past highlights the importance of implementing effective measures to prevent such injuries, such as providing HCPs with appropriate personal protective equipment, ensuring safe injection practices, and offering education and training on infection prevention and control. These measures have been shown to be effective in reducing the incidence of needle stick injuries and bloodborne pathogen transmission among HCPs.^{20,21}

This study found a significant association between the prevalence of HBV infection and the uptake of the HBV vaccine, which is consistent with previous studies that have reported that vaccination against HBV is effective in reducing the prevalence of the infection among HCPs.^{5,12,14}

The study shows that a high proportion (51.8%) of the participants had protective antibodies against the hepatitis B virus due to vaccination, as indicated by the presence of the anti-HBs antibodies, small proportion had evidence of past hepatitis B virus infection, as indicated by presence of both anti-HBs and anti-HBc antibodies, though

the presence of anti-HBs antibodies alone may not necessarily indicate past infection, as these antibodies may persist for many years after infection or vaccination.^{22,23}

Many studies have shown that vaccination against HBV is highly effective in producing protective antibodies and reducing the incidence of HBV infection. A study by McMahon *et al.* (2011) found that the incidence of HBV infection among Alaskan native people decreased by 93% following the introduction of a universal HBV vaccination program. Another study by Hutin *et al.* (2003) found that the incidence of acute HBV infection in healthcare workers decreased by 89% following the implementation of a comprehensive infection control program that included HBV vaccination.^{22,23}

From this study, male participants had a higher prevalence of HBV infection compared to their female counterparts which is consistent with reports from previous studies.^{11,12} The reason for this gender difference is not entirely clear, but it could be attributed to differences in occupational exposure or immune response to the vaccine between males and females.¹²

The result also shows that some participants are negative for HBsAg but positive for HBV with the presence of anti-HBc, a phenomenon referred to as Occult HBV infection. The presence of anti-HBc in these individuals suggests that they have been exposed to the virus at some point in their lives. The mechanisms behind the absence of HBsAg in occult HBV infection are not fully understood, but several possibilities have been proposed.²⁴

It has been shown in previous studies that the absence of HBsAg in occult HBV infection can be due to various mechanisms, including the formation of immune complexes, mutations that inhibit HBsAg expression, and changes in HBsAg antigenicity.²⁴ These mechanisms highlight the complexity of HBV infection and the need for continued research to improve diagnosis and treatment of this virus.^{15,20,22,24}

The limitation of this study includes the cross-sectional design, which limits causal inference and the possibility of recall bias, as participants were

asked to recall past events. Despite these limitations, the findings from this study highlight the need for continued efforts to improve vaccination coverage among HCPs and strengthen infection control practices to prevent occupational exposure to blood-borne pathogens. The results underscore the significance of enforcing extensive HBV immunization initiatives and strict adherence to infection control protocols as crucial steps in preventing the spread of HBV among healthcare professionals (HCPs) in Nigeria. Consequently, this study offers significant information that can direct the establishment of efficient public health strategies that aim to prevent HBV infection among HCPs.^{15,23}

CONCLUSION

The findings from this study emphasize the importance of implementing comprehensive HBV vaccination programs and strict adherence to infection control guidelines as essential measures in preventing occupational transmission of HBV among HCPs in Nigeria. This study thus provides valuable insights that can guide the development of effective public health policies aimed at reducing the burden of HBV infection in the healthcare sector.

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