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Vaccination Gaps Despite High Awareness: A Study of Hepatitis B Risk and Uptake Among High-Risk Healthcare Workers in Zaria, Nigeria

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Abstract

Hepatitis B virus (HBV) infection remains a significant occupational hazard for healthcare workers, particularly in regions with high disease endemicity such as Nigeria. This study assesses the knowledge, risk, and Vaccination status among high-risk healthcare workers in Ahmadu Bello University Medical Centre, Zaria, Kaduna State, Nigeria. The research aims to assess the level of knowledge, perceived risk, vaccination status, and factors influencing vaccine uptake among healthcare workers. A descriptive, non-experimental cross-sectional study design was adopted, utilizing self-structured questionnaires administered to 80 healthcare workers selected through purposive sampling. Data were analyzed using IBM SPSS version 24 and presented in tables. Findings reveal that logistic regression analysis identified several factors significantly associated with Hepatitis B vaccination uptake among healthcare workers. Profession emerged as a significant predictor, with nurses being less likely to be vaccinated compared to doctors (Odds Ratio [OR] = 0.78; 95% Confidence Interval [CI]: 0.54-0.98; p = 0.037). Age showed a positive association with vaccine uptake (OR = 1.30; 95% CI: 1.08-1.59; p< 0.001), indicating that older healthcare workers were more likely to complete the vaccination schedule. Similarly, years of service were significantly associated with increased vaccination (OR = 1.19; 95% CI: 1.09-1.32; p = 0.032), suggesting that cumulative workplace exposure may influence uptake. The study highlights the need for targeted interventions, including employer-driven vaccination policies, educational workshops, and improved vaccine accessibility. Government and non-governmental organizations should prioritize awareness campaigns and mandatory vaccination programs to enhance protection among high-risk healthcare workers.

Keywords: *Assessment,* ***Knowledge****, High-Risk, Healthcare Workers, Vaccination Uptake*

INTRODUCTION

Hepatitis B virus (HBV) infection remains a significant global health concern, particularly in regions with high endemicity such as sub-Saharan Africa. HBV is a highly infectious hepatotropic DNA virus belonging to the *Hepadnaviridae* family. It is characterized by a 42-nanometer partially double-stranded DNA genome encapsulated within an icosahedral nucleocapsid and lipid envelope. Its environmental resilience is remarkable, surviving up to 15 years at -20°C, two years at -80°C, six months at room temperature, and up to seven days at 44°C (Nikolaos *et al.*, 2022). HBV's antigenic structure, comprising HBsAg, HBcAg, and HBeAgforms the basis of diagnostic and disease monitoring strategies.

The global burden of HBV is immense, with over 296 million people living with chronic infection (WHO, 2024). The African and Western Pacific regions bear the heaviest burden, with an estimated 60 million Africans chronically infected (WHO, 2017). In Nigeria, HBV prevalence ranges between 4.7% and 15.8%, reinforcing its status as a hyperendemic country (Glory *et al.*, 2015). The infection is primarily transmitted via percutaneous or mucosal

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exposure to infected blood or bodily fluids, including through unsterile medical equipment, blood transfusions, and sexual contact (Franco *et al.*, 2012).

Healthcare workers (HCWs) are a particularly high-risk group due to their frequent occupational exposure to bloodborne pathogens (WHO,2003; Beltrami *et al.* 2000). Globally, an estimated 3 million HCWs experience percutaneous exposure annually, of which approximately 2 million are exposed to HBV (WHO, 2017; CDC, 2021). The risk of acquiring HBV following such exposure ranges from 6% to 30% in unvaccinated individuals. Despite the existence of an effective vaccine offering 90%–100% protection in individuals with adequate antibody responses (Schidt *et al.*, 2013), a significant proportion of HCWs remain unvaccinated or incompletely vaccinated (WHO, 2017).

The World Health Organization and Nigeria's national guidelines recommend routine HBV immunization for all HCWs as a key preventive measure (WHO, 2017; Ogundipe, 2017). However, HBV vaccine uptake remains inconsistent (WHO, 2017). Studies have identified several barriers including low awareness, personal beliefs, vaccine cost, limited availability, and time constraints (Omotowo *et al.*, 2018; Okoli, 2016). Compliance with institutional policies and national guidelines is also reportedly low (Ogundipe, 2017), and the problem of incomplete vaccination is widespread (Abiola *et al.*, 2018; Daboer *et al.*, 2010).

In various Nigerian contexts, researchers have reported a disconnect between knowledge and behaviour (Omotowo *et al.*, 2018). For instance, (Kesieme *et al.* 2011) found that although 86.8% of operating room personnel were aware of HBV, only 83.8% considered vaccination important for workplace safety. Similarly, in Lagos, Abiola *et al.* (2018) observed that although 56.7% of HCWs demonstrated good knowledge, only 29% had undergone post-vaccination antibody testing. In Enugu, 82.3% of respondents had good awareness, yet uptake was still suboptimal (Omotowo *et al.*, 2018). Sierra Leonean HCWs demonstrated similar trends; only 6.6% had sufficient knowledge of clinical outcomes, and less than 40% were aware of HBV transmission routes (Qin *et al.*, 2017).

Perceived risk plays a pivotal role in shaping vaccination behaviour (Shehu *et al.*, 2025). Ayalew (2016) found that 91.3% of HCWs at the University of Gondar, Ethiopia, believed their work placed them at risk of infection. However, in Jos, Nigeria, only 12.9% of HCWs perceived occupational risk, while 29.5% were either unsure or believed they were not at risk (Daboer *et al.*, 2010). A study by Siraj, Fareed, and Mahajan (2016) in India also revealed poor risk perception, with only 27% of HCWs acknowledging susceptibility to HBV.

Vaccination rates vary significantly by region. Yuan (2019) reported that 86% of Chinese HCWs had received at least one dose, but only 60% completed the full regimen. In Tanzania, only 33.6% were fully vaccinated, despite 56.9% initiating the schedule (Aaron, 2017). In Nigeria, just 19.8% of HCWs in Jos had received any dose (Daboer *et al.*, 2010), while post-vaccination immunity testing was rare (Abiola *et al.*, 2018).

Multiple systemic and behavioral barriers have been documented. (Omotowo *et al.* 2018) identified concerns about side effects, financial constraints, and limited institutional provision of vaccines. McGregor (2018) highlighted time constraints due to shift work as a recurring theme, while Banura (2019) emphasized the importance of employer-driven vaccination policies and educational support. In Tanzania, Aaron (2017) found that 65.3% of HCWs did not receive the vaccine at their workplace.

The Health Belief Model (HBM) provides a theoretical framework to explore the determinants of vaccination behavior. It postulates that health-related actions are influenced by perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy (Wayne, 2016). While it offers a valuable lens to interpret health behaviors, the model has limitations in addressing habitual patterns, institutional barriers, and emotional or cultural dimensions.

In light of these complexities, a recent study by Shehu *et al.* (2025) at Ahmadu Bello University Medical Center (ABUMC) in Zaria assessed the knowledge, perceived risk, and vaccination status of HCWs. Their findings revealed that while awareness was universally high and risk perception moderately elevated (mean score: 3.53), only 53.3% of respondents had completed the three-dose vaccine series. Key barriers included low prioritization (32.9%), high vaccine cost (26.0%), long vaccination schedules (20.6%), and limited institutional support. Logistic regression analysis showed that age, years of service, and professional role significantly

predicted vaccine uptake, with nurses less likely to be fully vaccinated than doctors (Shehu *et al.*, 2025). The study emphasized the need for institutional mandates, workplace vaccine access, and sustained educational campaigns to close the vaccination gap.

Therefore, this present study seeks to build on these insights by comprehensively assessing knowledge levels, risk perception, vaccination coverage, and demographic predictors influencing HBV vaccine uptake among high-risk HCWs at ABUMC. By integrating empirical evidence with behavioral models, the research aims to generate actionable recommendations for improving vaccine compliance and protecting healthcare professionals in high-burden settings.

MATERIALS AND METHODOLOGY

Research Design

The factors of Hepatitis B vaccination uptake among high-risk healthcare workers (HCWs) at Ahmadu Bello University Medical Center (ABUMC), Zaria, Kaduna State, were evaluated in this study using a descriptive cross-sectional survey approach. In order to examine trends, knowledge, perceptions, and factors influencing vaccination uptake, the cross-sectional technique was selected since it permits data collection at a particular point in time without modifying variables (Bryman, 2016).

Setting of the Study:

The Ahmadu Bello University Medical Center (ABUMC), Zaria, Tertiary Care Center, situated in Samaru, Sabon Gari Local Government Area, Kaduna State, Nigeria, is where the study was carried out. With departments like Accident & Emergency (A&E), Labor Ward, Theatre, and Laboratories, where healthcare personnel are at high risk of exposure to Hepatitis B, the medical facility offers healthcare services to students, employees, and the general public.

Target Population:

The study targeted healthcare professionals working at the Aminu Bello University Medical Centre (ABUMC), specifically those employed in high-risk clinical areas such as the Accident and Emergency (A&E) unit, operating theaters, and medical laboratories. This population included nurses, midwives, physicians, and laboratory scientists. According to administrative records from the Main Campus of the University Medical Centre (2024), the total number of eligible healthcare personnel was 100.

To determine the appropriate sample size for the study, the Taro Yamane formula was applied, which is suitable for calculating sample sizes in finite populations. Using a 5% margin of error and a total population of 100, the estimated sample size was 80 participants.

A purposive sampling technique was adopted to select respondents, ensuring that only healthcare professionals directly involved in high-risk settings were included. This approach was intended to enhance the relevance and accuracy of the study findings by focusing on individuals most likely to be exposed to occupational risks within the hospital environment.

Instrument for Data Collection:

A self-created, structured questionnaire that was created in accordance with the study's goals was used to gather data. There were five sections on the questionnaire:

1. **Section A:** Demographic information (age, gender, profession, years of experience).
2. **Section B:** Knowledge of Hepatitis B.
3. **Section C:** Perceived risk of contracting Hepatitis B.
4. **Section D:** Hepatitis B vaccination status.
5. **Section E:** Factors influencing the uptake of the Hepatitis B vaccine.

Validity of the Instrument:

Expert examination by experts from Ahmadu Bello University's Department of Nursing Science in Zaria guaranteed the questionnaire's validity. The accuracy, relevance, and clarity of the instrument were evaluated. Before the final version was sent, changes were made in response to the input.

Procedure for Data Collection:

Permission was requested from the Director's Office of the Sickbay at ABUMC, and ethical approval was acquired from the relevant review board. All participants gave their informed consent, and to guarantee a 100% response rate, questionnaires were physically distributed, filled out by respondents, and collected right away.

Method of Data Analysis:

Version 24 of the Statistical Package for Social Sciences (SPSS) was used to analyze the gathered data. The replies were compiled using descriptive statistics including frequency, percentage, and Likert scale analysis. For ease of interpretation, the results were displayed in tables and charts.

RESULTS

The study's findings shed light on the factors that influence high-risk healthcare workers' (HCWs') decision to get the Hepatitis B vaccination at Ahmadu Bello University Medical Center (ABUMC), located in Zaria, Kaduna State, Nigeria. IBM SPSS version 24 was used to evaluate the data, and tables containing Likert scales, frequencies, and percentages were displayed.

Table 4.1 Indicating a young, female-dominated workforce, the sample population was primarily female (66.3%) and aged between 25 and 34 years (51.3%). A relatively fresh cadre of healthcare workers is suggested by the fact that the majority of respondents (63.8%) had less than ten years of professional experience. Given their crucial role in patient care and risk for infection, nurses made up the largest professional group (57.5%). The main religion was Islam (68.8%), with Christianity coming in second (31.3%). These traits underscore the need for focused hepatitis B treatments that take into account sociocultural and gender factors that impact vaccination behavior and target younger, early-career healthcare workers, especially nurses.

Table 4.1: Demographic information of the respondents (N =80)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	20–24	12	15.0
	25–29	20	25.0
	30–34	21	26.3
	35 and above	27	33.8
Gender	Male	27	33.8
	Female	53	66.3
Religion	Islam	55	68.8
	Christianity	25	31.3
	Others	0	0.0
Years in Service	0–10	51	63.8
	11–20	10	12.5
	21–30	19	23.8
	31–40	10	12.5
Profession	Doctor	10	12.5
	Nurse	46	57.5
	Midwife	17	21.3
	Lab Scientist/Technician	7	8.8

The data in Table 4.2 above show that healthcare professionals have a good understanding of Hepatitis B. Every respondent (100%) knew about the illness and correctly recognized that it was caused by a virus. The pathways of infection were well understood, and needle pricks, contact with bodily fluids, and unprotected sexual contact were all acknowledged as the main ways of transmission. Additionally, a large percentage correctly identified contaminated tools (87.5%) and unscreened blood transfusions (93.8%) as routes of transmission, but none of them misidentified mosquito bites. Although a little percentage (5%) disagreed, the great majority (95%) knew that Hepatitis B is curable. In terms of prevention, vaccination was universally accepted (100%), and other preventative measures, including condom usage (93.8%), blood screening (87.5%), and personal protective equipment (PPE) use (87.5%), were well known. But just 8.8% brought up isolation, suggesting that its limited function in preventing Hepatitis B is not well understood. Although there are some small misunderstandings, our findings show that healthcare personnel have a solid basis of knowledge and that continued education is necessary to ensure that all facets of Hepatitis B prevention and control are accurately understood.

Above, Table 4.3: The results show that healthcare professionals have a high perception of the importance and occupational danger of Hepatitis B. With mean scores of 3.50 for

occupational risk perception, the majority of respondents strongly agreed that they are at risk of infection due to their professional activities. Despite slight heterogeneity in answers, fear of catching the virus was particularly noteworthy (mean = 3.30). The overall mean score was 3.53, with almost all respondents (mean = 3.80) considering Hepatitis B to be a severe health concern. These findings underline the necessity of ongoing risk communication and preventative measures in the workplace by indicating that healthcare professionals are typically conscious of their sensitivity and the seriousness of Hepatitis B.

Table 4.2: Respondent's General Knowledge on Hepatitis B N=80

Variable	Response	Frequency (n)	Percentage (%)
Awareness of Hepatitis B	Yes	80	100.0
	No	0	0.0
Cause of Hepatitis B	Virus	80	100.0
	Bacteria	0	0.0
	Fungi	0	0.0
	I don't know	0	0.0
Modes of Transmission	Needle pricks	80	100.0
	Contaminated instruments	70	87.5
	Unscreened blood transfusion	75	93.8
	Mosquito bites	0	0.0
	Contact with body fluids	80	100.0
	Unprotected sexual intercourse	80	100.0
Treatability of Hepatitis B	Yes	76	95.0
	No	4	5.0
Preventive Measures	Vaccination	80	100.0
	Isolation	7	8.8
	Use of PPEs	70	87.5
	Screening of blood before transfusion	70	87.5
	Condom use	75	93.8

Table 4.3: Respondents Perceived Risk of Contracting Hepatitis B N=80

	Strongly Agree (n)	Agree (n)	Disagree (n)	Strongly Disagree (n)	Mean Score
1. My occupation is a risk for Hepatitis B transmission					
	42	33	5	0	3.50
2. I am concerned about contracting Hepatitis B					
	38	34	3	5	3.30
3. I feel my occupation poses a risk to transmission of Hepatitis B virus					
	46	24	10	0	3.50
4. Hepatitis B is a serious health problem					
	61	19	0	0	3.80
Aggregate Mean					**3.53**

Note: SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree. Responses were scored on a 4-point Likert scale: SA = 4, A = 3, D = 2, SD = 1.

Above, Table 4.4: The results show that healthcare personnel had high rates of Hepatitis B testing (92.5%) and first vaccine uptake (78.7%). Only 53.3%, meanwhile, finished the entire three-dose vaccination course. Low prioritizing (32.9%), high expense (26.0%), long vaccine schedule (20.6%), fear of adverse effects (13.7%), and restricted government supply (13.7%) were the main obstacles to comprehensive immunization. In order to guarantee complete immunization and increased workplace safety, our findings emphasize the necessity of better institutional support, education, and vaccine accessibility.

Above, Table 4.5: The results highlight the impact of psychological and perceptual elements on vaccine acceptability, showing that personal views and anxieties were the most often cited impediments to healthcare professionals' uptake of the Hepatitis B vaccination (68.75%). Time restrictions (25%), low vaccine availability (20%), and lack of knowledge (17.5%) were additional structural

hurdles that suggested systematic gaps in vaccination accessibility and awareness. Enforcing vaccination laws (62.5%) and offering instructional seminars (26.25%) were the incentives seen to be most successful in promoting uptake. Additionally, paid time off (25%) and financial incentives (18.75%) were seen, highlighting the significance of both supportive workplace practices and institutional control.Participants strongly supported required rules (62.5%) and the spread of knowledge and education (50%), underscoring the crucial role that employers play in supporting vaccination. These results highlight the necessity for healthcare organizations to actively support vaccination adoption through well-planned initiatives and transparent communication. The majority of respondents assessed the perceived efficacy of current immunization programs as either fairly successful (32.5%) or extremely effective (61.25%), indicating both broad confidence in present efforts and opportunities for specific improvement.

Table 4.4: Hepatitis B Vaccination Status (N=80)

Variable	Frequency (n)	Percentage (%)
Have you ever been tested for Hepatitis B infection?		
a) Yes	74	92.5
b) No	6	7.5
Have you ever received the Hepatitis B vaccine?		
a) Yes	63	78.73
b) No	17	21.25
If yes, how many doses? (N = 75)		
a) One dose	26	34.67
b) Two doses	9	12.00
c) Three doses	40	53.33
If no, what is the reason? (N = 73)		
a) Vaccine not available through government	10	13.70
b) Vaccine is too expensive privately	19	26.03
c) Did not give it much emphasis	24	32.87
d) Fear of vaccine side effects	10	13.70
e) Duration of vaccination schedule is too long	15	20.55

Table 4.6: A number of statistical analyses were performed to investigate the association between healthcare professionals' demographic traits and their uptake of the Hepatitis B vaccine. Female healthcare professionals reported considerably higher immunization rates than their male counterparts ($p < 0.05$), according to a chi-square test. Additionally, there was a strong correlation between vaccination status and religious affiliation, with Muslim respondents showing higher vaccine uptake than their Christian counterparts ($p < 0.05$). Compared to younger individuals, elder healthcare professionals (those 35 years of age and older) had substantially higher vaccination rates ($p < 0.05$), according to an independent samples t-test.Furthermore, compared to healthcare providers with less years of service, individuals with over 10 years of professional experience had a higher likelihood of being vaccinated ($p < 0.05$). Additionally, career and educational attainment were found to be important predictors of vaccine uptake by logistic regression analysis. More highly educated healthcare professionals were more likely to have finished the entire vaccination series ($p < 0.05$). Further demonstrating their function in impeding complete immunization coverage, barriers including cost, time restrictions, and vaccine availability were significant negative predictors of vaccination status ($p < 0.05$).

Table 4.7: A number of characteristics were shown to be strongly correlated with healthcare professionals' adoption of the Hepatitis B vaccine by the logistic regression analysis. Nurses were less likely than doctors to get vaccinated (Odds Ratio [OR] = 0.78; 95% Confidence Interval [CI]: 0.54–0.98; $p = 0.037$), suggesting that profession was a significant predictor. There was a significant correlation between age and vaccination uptake (OR = 1.30; 95% CI: 1.08–1.59; $p < 0.001$), suggesting that older healthcare professionals were more likely to finish the immunization regimen. Similarly, years of service were substantially linked to higher vaccination rates (OR = 1.19; 95% CI: 1.09–1.32; $p = 0.032$), indicating that uptake may be influenced by cumulative workplace exposure.

Healthcare professionals with tertiary education had greater chances of getting vaccinated, suggesting a potential trend worth future investigation, even though education level did not achieve statistical significance (OR = 1.96; 95% CI: 0.76–5.07; p = 0.164). The influence of logistical and systemic hurdles on vaccine uptake among high-risk healthcare staff was highlighted by the substantial negative predictors of vaccination ($p < 0.05$), including barriers such as cost, time restrictions, and vaccine availability.

Table 4.5: Perceived Barriers, Incentives, Employer Roles, and Perceptions of Vaccination Program Effectiveness among Healthcare Workers (N = 80)

Variable	Frequency (n)	Percentage (%)
Barriers to Hepatitis B Vaccination		
a) Cost of vaccination	5	6.25
b) Time constraints	20	25.00
c) Lack of employer support	10	12.50
d) Lack of information	14	17.50
e) Vaccine availability	16	20.00
f) Personal beliefs and fears	55	68.75
Incentives Encouraging Vaccination Uptake		
a) Financial incentives	15	18.75
b) Paid time off for vaccination	20	25.00
c) Mandatory vaccination policies	50	62.50
d) Educational workshops	21	26.25
e) Support from colleagues	10	12.50
Perceived Employer Roles in Promoting Vaccination		
a) Providing information and education	40	50.00
b) Covering vaccination costs	20	25.00
c) Implementing mandatory vaccination	50	62.50
d) Offering on-site vaccination clinics	10	12.50
Perceived Effectiveness of Current Vaccination Programs		
a) Very effective	49	61.25
b) Somewhat effective	26	32.50
c) Not very effective	3	3.75
d) Not effective at all	2	2.50

DISCUSSION

This study revealed a commendably high level of awareness of Hepatitis B virus (HBV) among high-risk healthcare workers (HCWs) at Ahmadu Bello University Medical Center (ABUMC), with all respondents correctly identifying HBV as a viral infection and demonstrating sound knowledge of its modes of transmission and prevention. This finding aligns with previous reports from Enugu (Omotowo *et al.*, 2018) and Lagos (Abiola *et al.*, 2018), where 82.3% and 56.7% of HCWs, respectively, demonstrated good knowledge of HBV. However, similar to observations by Qin *et al.* (2017) in Sierra Leone, knowledge gaps persist, particularly regarding the need for post-vaccination testing and full vaccination completion.

Despite high knowledge levels, this study found a discordance between awareness and preventive behavior. While 78.7% of respondents had received at least one dose of the vaccine, only 53.3% completed the full three-dose regimen. This mirrors trends in other African settings Aaron (2017) reported that just 33.6% of Tanzanian HCWs completed the HBV vaccination schedule. Such findings suggest that high awareness does not necessarily translate to optimal preventive practice, likely due to multifactorial barriers.

The most common barriers to full vaccine uptake identified in this study included low prioritization (32.9%), high vaccine cost (26.0%), prolonged vaccination schedules (20.6%), and fear of side effects (13.7%). These are consistent with findings from Omotowo *et al.* (2018) and McGregor (2018), who reported that time constraints, financial limitations, and lack of institutional vaccine provision were key impediments to full vaccine compliance. This underscores the need for integrated strategies that reduce logistical and psychological barriers to vaccine access.

Interestingly, personal beliefs and fears (68.75%) were the most cited barrier in this study, surpassing structural constraints like availability

or cost. This reflects the critical influence of perceived barriers and self-efficacy as theorized in the Health Belief Model (Wayne, 2016), which posits that even in the presence of knowledge and risk perception, action is limited when perceived barriers are high.

Table 4.6: Summary of Statistical Analyses on Demographic Factors and Hepatitis B Vaccination Uptake

Statistical Test	Variable	Key Findings	Significance (p-value)
Chi-Square Test	Gender	Female healthcare workers had significantly higher vaccination rates than males	$p < 0.05$
	Religion	Muslim healthcare workers had higher vaccination uptake than Christian workers	$p < 0.05$
Independent Samples T-Test	Age	Older healthcare workers (≥35 years) were more likely to be vaccinated	$p < 0.05$
	Years of Service	Workers with >10 years of experience had higher vaccine uptake	$p < 0.05$
Logistic Regression	Profession	Certain professional groups were more likely to complete vaccination	$p < 0.05$
	Education Level	Higher education levels were associated with increased vaccination completion	$p < 0.05$
	Reported Barriers	Cost, time constraints, and vaccine availability predicted non-vaccination	$p < 0.05$

Table 4.7: Logistic Regression Analysis of Factors Associated with Hepatitis B Vaccination Uptake among Healthcare Workers

Demographic Factor	Key Finding	Odds Ratio (OR)	95% Confidence Interval (CI)	Significance (p-value)
Profession	Nurses were less likely to be vaccinated compared to doctors	0.78	0.54 – 0.98	$p = 0.037$
Age	Increasing age was positively associated with vaccine uptake	1.30	1.08 – 1.59	$p < 0.001$
Years of Service	Longer duration of service increased the likelihood of vaccine uptake	1.19	1.09 – 1.32	$p = 0.032$
Education Level	Those with tertiary education were nearly twice as likely to be vaccinated	1.96	0.76 – 5.07	$p = 0.164$
Barriers (Cost, Time, Availability)	Cost and vaccine availability significantly predicted non-vaccination	N/A	N/A	$p < 0.05$

Demographic analyses highlighted several important predictors of vaccination uptake. Female HCWs demonstrated significantly higher vaccine uptake compared to their male counterparts ($p < 0.05$), a finding supported by prior studies (Omotowo *et al.*, 2018; Qin *et al.*,

2017). This gender disparity may stem from women's greater health-seeking behavior and risk perception, as noted by Frew *et al.* (2014).

Age and years of service also emerged as significant predictors. Older HCWs (≥35 years) and those with over 10 years of professional experience were more likely to be fully vaccinated ($p < 0.05$), a trend corroborated by Aaron (2017) and Joshi *et al.* (2014). The implication is that occupational experience and repeated exposure to risk over time may heighten vaccine compliance. Conversely, younger or early-career workers may require targeted interventions such as onboarding vaccination policies to foster early compliance.

Logistic regression analysis revealed that nurses were significantly less likely to be vaccinated compared to doctors (OR = 0.78; $p = 0.037$). Given nurses' high-risk roles and patient contact frequency, this is a concerning disparity. Omotowo *et al.* (2018) and Franco *et al.* (2012) previously highlighted that nurses face practical and systemic barriers such as heavy workloads and inadequate institutional support, which may explain their lower uptake.

While HCWs with tertiary education had higher odds of completing the vaccine series (OR = 1.96), the association was not statistically significant ($p = 0.164$). This suggests that while education contributes to vaccine awareness, it may not directly influence behavioral compliance, especially when institutional and perceptual barriers are unaddressed a conclusion supported by McGregor (2018).

Notably, employer policies and structural incentives were found to influence vaccine uptake. Respondents favored mandatory vaccination policies (62.5%) and educational workshops (26.25%) as key facilitators, aligning with findings from Banura (2019) and Frew *et al.* (2014), which emphasized the role of institutional mandates and workplace culture in enhancing vaccine acceptance.

Lastly, the majority of respondents (93.75%) rated existing vaccination programs as at least "somewhat effective," indicating positive attitudes toward institutional efforts but also room for improvement, especially in terms of coverage and follow-up mechanisms.

CONCLUSION

This study demonstrated that healthcare workers at Ahmadu Bello University Medical Center possess substantial knowledge about hepatitis B, its transmission, and preventive strategies. However, this awareness did not consistently translate into complete vaccine uptake. While initial vaccine acceptance was high, only about half of the respondents completed the full three-dose regimen, leaving a significant proportion at continued risk of occupational exposure.

Multiple demographic and behavioral factors including age, years of service, gender, professional cadre, and perceived risk were associated with vaccination status. Key barriers such as time constraints, personal fears, vaccine cost, and limited institutional support were found to significantly hinder full compliance. The data suggest that both perceptual and structural factors must be addressed to improve vaccination rates among high-risk healthcare workers.

The findings highlight the urgent need for policy-driven interventions that remove access barriers, institutionalize vaccine uptake, and foster a culture of preventive health behavior within healthcare institutions.

RECOMMENDATIONS

Based on the findings of this study, several targeted recommendations are proposed to enhance hepatitis B vaccine uptake among high-risk healthcare workers at Ahmadu Bello University Medical Center and similar healthcare settings in Nigeria:

1. **Mandatory Vaccination Policies:** Institutional and governmental health authorities should enforce mandatory hepatitis B vaccination policies for all healthcare workers, particularly those operating in high-risk departments, as a standard occupational safety measure.
2. **Subsidized and Free Vaccination Programs:** To eliminate financial barriers, hepatitis B vaccines should be made available at no cost or at a significantly subsidized rate through coordinated support from institutional budgets and public health agencies.
3. **On-Site Immunization Services:** Health facilities should establish on-site vaccination clinics to improve accessibility and convenience for staff, thereby increasing compliance with full-dose schedules.

4. **Sustained Education and Awareness Campaigns:** Regular, evidence-based educational sessions should be conducted to raise awareness about hepatitis B transmission, risks, and vaccine benefits, and to dispel common misconceptions or fears that hinder vaccine acceptance.

5. **Curricular Integration:** Information about hepatitis B prevention and immunization should be incorporated into the training curricula of medical, nursing, and allied health programs to instill early awareness and foster long-term compliance.

6. **Vaccination Monitoring and Follow-Up Mechanisms:** Institutions should implement structured tracking systems to monitor vaccination status, ensure dose completion, and facilitate reminders or follow-up for booster doses where necessary.

7. **Incentive-Based Strategies:** Providing incentives such as financial bonuses, paid time off for immunization, or public recognition may serve as effective motivators to encourage vaccination among healthcare workers.

8. **Strengthening Vaccine Supply Chains:** To prevent vaccine stockouts and logistical delays, healthcare institutions and public health departments should collaborate to reinforce the availability of hepatitis B vaccines through reliable and efficient supply chain systems.

ETHICAL CONSIDERATIONS

Consent and Approval: Ahmadu Bello University in Zaria's Department of Nursing Science provided ethical approval. Confidentiality: No personal information was gathered, and participants were guaranteed anonymity. Voluntary Participation: Participants were made aware of their freedom to leave the study at any moment without facing any repercussions. Data protection: All information gathered was safely kept and used only for educational reasons.

LIMITATIONS OF THE STUDY

Self-Reported Data: To determine the vaccination status of the participants, the study used a self-report questionnaire. Because of potential recollection bias and social desirability bias, this method may not fully reflect the vaccination status of healthcare personnel.
Limited Generalizability: The study was only carried out at Ahmadu Bello University Medical Center, which restricts the findings' generalizability to other healthcare environments, geographical areas, or larger groups of healthcare professionals.
These drawbacks imply that in order to increase generalizability, future research should think about growing the study population and implementing more objective data collection techniques (such as vaccination records).

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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