

Determinants of Adult Hepatitis B Vaccine Uptake in a High-Endemic Setting

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Abstract

Background

Adult hepatitis B virus (HBV) vaccination remains a critical yet underutilized component of viral hepatitis prevention in many high-endemic settings. Although infant HBV vaccination has been widely integrated into national immunization programmes, adult vaccination often depends on individual awareness, healthcare access, and provider recommendation. Community-based evidence on the determinants of adult HBV vaccine uptake is needed to inform adult immunization strategies in resource-constrained settings.

Objective

To examine the individual- and health-system level factors associated with adult HBV vaccine uptake in a community-based population in a high-endemic setting and identify priorities for strengthening adult vaccination programmes.

Methods

We conducted a community-based cross-sectional survey among adults in Minna, Nigeria, using multistage sampling. Data on sociodemographic characteristics, HBV-related knowledge, healthcare access, and vaccination status were collected using interviewer-administered questionnaires. Modified Poisson regression with robust variance estimation was used to identify factors independently associated with vaccine uptake, with adjusted prevalence ratios (aPRs) and 95% confidence intervals (CIs) reported.

Results

Among 426 participants, 167 (39.2%) had received at least one dose of HBV vaccine, and 38.5% had completed the vaccination series. In bivariate analyses, vaccine uptake was significantly associated with education, occupation, residence type, ward, religion, HBV knowledge, and health worker recommendation (all $p < 0.05$), whereas gender and marital status were not associated. In multivariable analysis, moderate knowledge (aPR 14.82; 95% CI 4.37–50.30), high knowledge (aPR 14.49; 95% CI 4.25–49.40), and health worker recommendation (aPR 3.37; 95% CI 1.90–5.98) were independently associated with vaccine uptake.

Conclusions

Adult HBV vaccination coverage remained suboptimal in this community-based population. Vaccine uptake was independently associated with modifiable individual- and health system-level factors, particularly HBV knowledge and healthcare worker recommendation, highlighting opportunities to strengthen provider-initiated vaccination, improve community awareness, and expand access to adult vaccination services. These findings provide community-based evidence to support the design and prioritization of adult immunization programmes in high-endemic settings. Owing to the cross-sectional design, the observed associations should not be interpreted as causal.

Introduction

Hepatitis B virus infection is a major cause of chronic liver disease, cirrhosis, and hepatocellular carcinoma globally (1, 2). The World Health Organization estimates that 240 million people were living with chronic hepatitis B infection in 2024, leading to approximately 1.1 million annual deaths(1, 2). Although highly effective recombinant vaccines providing long-lasting protection have been accessible for decades(3, 4), adult vaccination coverage remains suboptimal in low- and middle-income regions(5). This disparity is especially pronounced where adult vaccination is not supported by a universal, routinely funded public health platform, placing responsibility for vaccine access largely on individuals(4, 6). This sub-Saharan African challenge is mirrored across several neighbouring nations where adult and healthcare worker immunization strategies face identical roadblocks(7, 8). Across the subcontinent, institutional gaps and passive policy frameworks leave high-risk groups and large segments of the adult population unprotected(9).

Nigeria represents a high-burden setting with a national hepatitis B prevalence exceeding 8%(5). While the country has made important progress by integrating the vaccine into childhood routine immunization schedules, adult vaccination is far less standardized(5). Instead, adult uptake relies on a fragmented mix of individual health literacy, ad-hoc occupational screening, clinical contact, personal affordability, and direct provider recommendation(6, 10). Suboptimal coverage and screening gaps have been extensively documented across various groups in Nigeria. This includes regional variations and steep drop-offs in vaccine completion in Abuja, sub-provincial gaps in Lagos, and high rates of unvaccinated health professionals in Ondo and Sokoto(6, 11, 12). There are also significant vulnerabilities among key groups such as women of childbearing age who face compounding issues of poor awareness and localized vaccine stockouts (10). Large-scale national surveys among healthcare personnel similarly underscore that professional exposure does not automatically guarantee full protection (13). Collectively, these findings suggest that barriers to adult HBV vaccination extend beyond vaccine availability and include broader health-system, socioeconomic, and service-delivery challenges.

Despite these insights, evidence on adult hepatitis B vaccination in community populations remains comparatively limited, as most available studies have been conducted among healthcare workers or facility-attending populations. This distinction is programmatically important because adults with limited engagement with formal health services are less likely to benefit from opportunistic screening or provider-initiated vaccination. Consequently, interventions developed solely from institutional

populations may inadequately reflect the barriers experienced by the broader community. Community-based evidence is therefore needed to distinguish whether low vaccine uptake primarily reflects limited awareness, financial constraints, geographic inaccessibility, inconsistent vaccine availability, missed opportunities for healthcare worker recommendation, or low perceived risk, thereby enabling more targeted adult immunization strategies(14–16).

This study addresses this evidence gap by examining adult HBV vaccine uptake and its associated individual-, geographic-, and health system-level determinants among community-dwelling adults in Minna, Niger State, Nigeria. By evaluating factors that may facilitate or hinder vaccination in a non-institutional population, the study aims to generate evidence that can help prioritize interventions to strengthen adult immunization programmes in high-endemic settings. Consistent with the cross-sectional design, the analysis focuses on estimating vaccination prevalence and identifying independent correlates of uptake rather than establishing causal or temporal relationships.

Methods

Study Design and Setting

This cross-sectional community survey was conducted among adult residents of Minna metropolis, Niger State, Nigeria, from July to August 2025 using an electronic data collection tool, KoboCollect v2025.2.3. Minna metropolis is located in the Chanchaga Local Government Area of Niger State, with an estimated population of about 552,000 people, mostly migrants from neighbouring rural areas. It is administratively divided into eleven (11) political and electoral wards. The analytic dataset included participants from five selected wards: Minna Central, Limawa A, Nassawa B, Tudun Wada, and Makera. The study was designed to estimate the prevalence of adult HBV vaccine and identify factors associated with vaccination in a community-based adult population.

Sample Size and Sampling

The sample size was estimated using Fisher's formula. A minimum sample size of 385 was estimated using a conservative expected prevalence of 50% because specific long-term adult HBV vaccination data for the study area were unavailable. After allowing for a 10% non-response rate, the target recruitment size was 424 participants. The final analytic dataset contained 426 completed responses.

A multi-stage sampling technique was used. In stage 1, the 11 wards in Chanchaga Local Government Area within Minna metropolis were categorized into urban, semi-urban, and rural strata, comprising four urban, five semi-urban, and two rural wards. Simple random sampling was used to select two urban wards, two semi-urban wards, and one rural ward. In stage 2, lists of communities or polling units within each selected ward were obtained from www.govote.ng, and seven communities per ward were selected systematically using a randomly chosen starting point and a fixed sampling interval. In stage 3, households in selected communities were physically counted and numbered, after which 12 households

per community were selected by systematic random sampling. In stage 4, one eligible adult aged 18 years or older was randomly selected from each selected household using the Kish grid method.

Participants

Adults aged 18 years or older were eligible if they had lived in Minna metropolis for at least three years. Residents who were temporarily visiting or in transit through Minna were excluded. Children and adolescents younger than 18 years were also excluded.

Variables

An interviewer-administered questionnaire adapted from a previous study was used to collect data(11). The primary outcome was “vaccinated against HBV”, defined as self-reported receipt of at least one HBV vaccine dose. The secondary vaccination outcome was “full vaccination”, defined as self-reported receipt of at least three doses. The number of doses was recoded as one dose, two doses, or three or more doses. Dates of first vaccination were recorded as month/year and reported by calendar year. Vaccination status and dose history were self-reported; vaccination cards were not available to verify reported vaccination. Socio-demographic variables included age, gender, marital status, education level, occupation, religion, residence type, ward, and duration of stay in the community. Education was categorized as no formal education, religious-only education, primary, secondary, or tertiary. Occupation was consolidated into business, civil servant, farmer, housewife, artisan/handwork, and other.

HBV knowledge was assessed using nine items covering cause, airborne transmission, sexual transmission, sharp-object transmission, mother-to-child transmission, asymptomatic infection, complications, vaccine preventability, and the need for a complete dose schedule. "Don't know" responses were recoded as incorrect. Knowledge scores ranged from 0 to 9 and were categorized as low (0–3), moderate (4–6), and high (7–9). Attitudes were assessed using six Likert-type items: perceived seriousness of HBV, perceived personal risk, vaccine safety, vaccine effectiveness, trust in health workers, and social approval. Responses were scored from 1 to 5 and averaged, then categorized as negative (< 2.5), neutral (2.5–3.5), and positive (> 3.5).

Health-service exposure was measured as whether a doctor, nurse, or other health worker had recommended HBV vaccination. Perceived barriers were measured using multi-select items, including cost, lack of awareness or information, fear of side effects, distance to health facilities, vaccine unavailability, belief that vaccination was unnecessary, and distrust in healthcare. Participants also reported the main factor most likely to encourage vaccination.

Statistical Analysis

Data cleaning and analysis were performed in Python using pandas, NumPy, Scipy.stats, matplotlib, seaborn, and statsmodels. Categorical variables were summarized using frequencies and percentages.

Continuous variables were summarized using means, standard deviations, medians, and interquartile ranges. Missingness was assessed descriptively, and analyses were conducted using complete-case data for variables included in each analysis. The prevalence of ever vaccination and full vaccination was estimated as the proportion of all participants reporting each outcome. Annual first-dose counts were calculated among vaccinated participants with parseable vaccination dates. These counts describe the distribution of reported first-dose years within the surveyed vaccinated participants and should not be interpreted as population-level annual incidence or coverage.

Pearson chi-square tests were used to evaluate bivariate associations between vaccine uptake and categorical predictors. Because vaccine uptake was common (> 10%), odds ratios were not used as the primary measure of association. Unadjusted prevalence ratios were calculated from cross-tabulated counts where appropriate. A multivariable modified Poisson regression model with a log link and robust sandwich standard errors was fitted to estimate adjusted prevalence ratios (aPRs) and 95% confidence intervals for age, gender, education level, residence type, ward, knowledge level, and health worker recommendation. No-formal-education and primary-education categories were collapsed in the adjusted model because no vaccinated participants were observed in the no-formal-education category. This modeling strategy was selected because logistic regression odds ratios would overstate associations for a common cross-sectional outcome. Statistical significance was assessed at $\alpha = 0.05$. All analyses were complete-case for the variables used in each table. No survey weights were applied in the available notebook; therefore, estimates should be interpreted as sample estimates rather than design-weighted population estimates.

Ethical Approval and Accordance

Ethical approval was obtained from the Niger State Health Research Ethics Committee (ERC PAN/2025/07/50). The study was conducted in accordance with the ethical principles and guidelines of the Niger State Health Research Ethics Committee and applicable regulations for research involving human participants. All participants provided oral informed consent before participation.

Clinical Trial Number

Not applicable.

Results

Participant Characteristics

The analytic sample included 426 adults. Mean age was 45.6 years (SD 9.4; range 25–70), and participants had lived in their communities for a mean of 17.1 years (SD 9.8). Most participants were male (70.7%), married (97.2%), Muslim (93.2%), and urban residents (83.3%). Nearly half had tertiary education (45.8%), followed by secondary education (28.2%) and primary education (20.2%). The most

common occupations were business (34.3%), civil service (20.4%), farming (17.6%), and housewife (16.2%). Participants were approximately evenly distributed across the five wards. (Table. 1)

Table 1
Socio-demographic characteristics of the participants

Variable	Category	N	%
Gender	male	301	70.7
Gender	female	125	29.3
Marital Status	married	414	97.2
Marital Status	single	8	1.9
Marital Status	divorced	2	0.5
Marital Status	separated	1	0.2
Marital Status	widowed	1	0.2
Education Level	Tertiary	195	45.8
Education Level	Secondary	120	28.2
Education Level	Primary	86	20.2
Education Level	No Formal Education	13	3.1
Education Level	Religious Only	12	2.8
Occupation	business	146	34.3
Occupation	civil Servant	87	20.4
Occupation	farmer	75	17.6
Occupation	housewife	69	16.2
Occupation	artisan/handwork	27	6.3
Occupation	other	17	4
Residence Type	urban	355	83.3
Residence Type	rural	71	16.7

HBV Vaccine Uptake

Overall, 167 participants (39.2%) reported receiving at least one dose of HBV vaccine, while 259 (60.8%) had never been vaccinated. Full vaccination, was reported by 164 participants (38.5% of the total sample). Among the 167 participants who had initiated vaccination, 164 (98.2%) reported receiving three or more doses, two reported one dose, and one reported two doses (Fig. 1). The evidence of vaccination was based on self-report by participants.

All vaccinated participants had first-dose dates. Reported first-dose years ranged from 2020 to 2025. Annual first-dose counts were 9 in 2020, 15 in 2021, 34 in 2022, 62 in 2023, 46 in 2024, and 1 in 2025. The highest number of reported first doses occurred in 2023 (Fig. 2).

Bivariate Correlates of Vaccine Uptake

Vaccine uptake did not differ materially by gender: 40.8% of female participants and 38.5% of male participants reported vaccination (chi-square = 0.107, $p = 0.744$) (Table 2). Marital status was also not statistically associated with uptake (chi-square = 2.304, $p = 0.680$), although some marital-status categories contained very small numbers.

Education showed a strong gradient in uptake (chi-square = 155.877, $p < 0.001$). Uptake was 70.8% among participants with tertiary education, 16.7% among those with secondary education, 5.8% among those with primary education, 33.3% among those with religious-only education, and 0.0% among those with no formal education. Using secondary education as a pragmatic reference category, tertiary education was associated with substantially higher vaccination prevalence (unadjusted PR 4.25; approximate 95% CI 2.82–6.40). The zero uptake in the no-formal-education group precludes stable ratio estimation without continuity correction. Occupation was associated with uptake (chi-square = 77.786, $p < 0.001$). Vaccination prevalence was highest among civil servants (77.0%), followed by other occupations (58.8%), artisan/handwork (37.0%), business (32.2%), housewife (29.0%), and farmers (16.0%). Compared with farmers, civil servants had higher vaccination prevalence (unadjusted PR 4.81; approximate 95% CI 2.83–8.19). Residence type was strongly associated with uptake (chi-square = 32.273, $p < 0.001$). Urban residents had higher uptake than rural residents (45.4% vs 8.5%; unadjusted PR 5.37; approximate 95% CI 2.47–11.64). Religion was statistically associated with uptake (chi-square = 4.088, $p = 0.043$), with higher uptake among Christian participants than Muslim participants (58.6% vs 37.8%; unadjusted PR 1.55; approximate 95% CI 1.11–2.16). This association should be interpreted cautiously because the Christian subgroup was small ($n = 29$), and religion may be confounded by ward, occupation, education, or access to health services.

Table 2
Bivariate associations with HBV vaccine uptake

Predictor	Reference category	Vaccinated n/N (%)	Unadjusted PR	95% CI	Chi-square	p-value
Gender	Male	Female: 51/125 (40.8%); Male: 116/301 (38.5%)	NA	NA	0.107	0.744
Education level	Secondary	Tertiary: 138/195 (70.8%); Secondary: 20/120 (16.7%); Primary: 5/86 (5.8%); Religious only: 4/12 (33.3%); No formal: 0/13 (0.0%)	See text	Approximate	155.877	< 0.001
Occupation	Farmer	Civil servant: 67/87 (77.0%); Farmer: 12/75 (16.0%); Others reported in text	4.81	2.83–8.19	77.786	< 0.001
Residence type	Rural	Urban: 161/355 (45.4%); Rural: 6/71 (8.5%)	5.37	2.47–11.64	32.273	< 0.001
Marital status	Married	Sparse categories	NA	NA	2.304	0.68
Knowledge level	Low	Low: 4/224 (1.8%); Moderate: 106/130 (81.5%); High: 57/72 (79.2%)	See text	Approximate	277.587	< 0.001
Health worker recommendation	No	Yes: 153/170 (90.0%); No: 14/256 (5.5%)	16.46	9.87–27.45	302.742	< 0.001

NB: Pearson χ^2 tests were used for bivariate comparisons. Unadjusted prevalence ratios (PRs) and approximate 95% confidence intervals are presented where applicable. Sparse cells prevented stable estimation for some categories.

Knowledge, Attitudes, and Health Worker Recommendation

The mean HBV knowledge score was 3.45 out of 9 (SD 2.60; median 2.0). Most participants had low knowledge (224/426, 52.6%), while 130 (30.5%) had moderate knowledge and 72 (16.9%) had high knowledge. Vaccine uptake was strongly associated with knowledge level (chi-square = 277.587, $p < 0.001$). Uptake was 1.8% among participants with low knowledge, 81.5% among those with moderate knowledge, and 79.2% among those with high knowledge. Compared with low knowledge, both moderate and high knowledge groups had markedly higher vaccination prevalence, although the very low number vaccinated in the low-knowledge category produced wide approximate confidence intervals (Table 3).

Table 3
Knowledge Level and Health Care Worker Recommendation

knowledge_level	Not Vaccinated	Vaccinated	Total	Vaccinated %
Low (0–3)	220	4	224	1.8
Moderate (4–6)	24	106	130	81.5
High (7–9)	15	57	72	79.2
$\chi^2 = 277.587$, $df = 2$, $p = 0.0000 \rightarrow$ Significant ($p < 0.05$)				
HCW recommended the vaccine	Not Vaccinated	Vaccinated	Total	Vaccinated %
no	242	14	256	5.5
yes	17	153	170	90
$\chi^2 = 302.742$, $df = 1$, $p = 0.0000 \rightarrow$ Significant ($p < 0.05$)				

The mean attitude score was 3.43 out of 5 (SD 1.22; median 4.17). Overall, 254 participants (59.6%) had positive attitudes, 30 (7.0%) had neutral attitudes, and 142 (33.3%) had negative attitudes. A total of 170 participants (39.9%) reported that a health worker had recommended HBV vaccination, while 256 (60.1%) reported no such recommendation. Health worker recommendation was the strongest observed correlate of uptake (chi-square = 302.742, $p < 0.001$): 90.0% of participants who received a recommendation were vaccinated compared with 5.5% of those who did not (unadjusted PR 16.46; approximate 95% CI 9.87–27.45). This association should not be interpreted causally because vaccination may also increase recall of recommendation, and both may be linked to healthcare access (Table 3).

Multivariable Modified Poisson Regression

In the adjusted modified Poisson regression model, knowledge level and health worker recommendation remained strongly associated with HBV vaccine uptake. Compared with participants with low knowledge, those with moderate knowledge had substantially higher vaccination prevalence (aPR 14.82; 95% CI 4.37–50.30; $p < 0.001$), as did those with high knowledge (aPR 14.49; 95% CI 4.25–49.40; $p < 0.001$). Participants who reported health worker recommendation had higher vaccination prevalence than those without recommendation after adjustment for socio-demographic and geographic covariates (aPR 3.37; 95% CI 1.90–5.98; $p < 0.001$). The strong bivariate associations for residence type and ward were attenuated after adjustment. Urban residence was not independently associated with uptake after accounting for ward, education, knowledge, and health worker recommendation (aPR 0.95; 95% CI 0.61–1.49; $p = 0.826$). Age and gender were also not independently associated with vaccination. Tertiary education showed a higher adjusted prevalence than secondary education, but the confidence interval included the null (aPR 1.24; 95% CI 0.99–1.56; $p = 0.065$) (Table 4).

Table 4
Multivariable modified Poisson regression for HBV vaccine uptake

Predictor	aPR	95% CI	p-value
Age, per year	1.01	1.00-1.01	0.131
Male vs female	0.92	0.81–1.06	0.248
Primary/no formal education vs secondary	0.9	0.45–1.81	0.769
Tertiary education vs secondary	1.24	0.99–1.56	0.065
Urban vs rural residence	0.95	0.61–1.49	0.826
Moderate knowledge vs low	14.82	4.37–50.30	< 0.001
High knowledge vs low	14.49	4.25–49.40	< 0.001
Health worker recommendation, yes vs no	3.37	1.90–5.98	< 0.001

Barriers and Facilitators

The most frequently endorsed barrier was lack of awareness or information ($n = 352$). Other reported barriers were vaccine unavailability ($n = 57$), distance to health facility ($n = 40$), fear of side effects ($n = 35$), belief that vaccination was unnecessary ($n = 30$), distrust in healthcare ($n = 26$), and cost ($n = 22$). These multi-select barrier counts are not mutually exclusive and should be interpreted as perceived barriers in the full sample rather than as exclusive reasons among the unvaccinated (Fig. 3).

The most frequently reported facilitator was recommendation by a trusted health worker ($n = 168$), followed by public awareness campaigns ($n = 139$), family or community influence ($n = 73$), more accessible vaccination sites ($n = 38$), and free vaccination ($n = 8$). Among unvaccinated participants, the leading main reason for non-vaccination was lack of awareness ($n = 131$), followed by cost ($n = 37$), absence of health worker recommendation ($n = 31$), fear of needles or side effects ($n = 20$), distance to

vaccination site (n = 16), vaccine unavailability (n = 15), perceived low risk (n = 7), and distrust of vaccines (n = 2) (Fig. 4).

Discussion

The global commitment to eliminate viral hepatitis as a public health threat by 2030 has renewed attention to hepatitis B vaccination as one of the most effective strategies for preventing new infections and reducing long-term disease burden. Despite the availability of a safe and highly effective vaccine, progress toward this goal remains uneven, particularly in low- and middle-income countries where adult vaccination has received far less programmatic attention than childhood immunization(2). In Nigeria, where HBV remains highly endemic, evidence on population-level adult vaccine uptake and its determinants is still limited, creating an important gap for policy and practice. To our knowledge, this study is among the first community-based investigations in Nigeria to examine adult HBV vaccination uptake and its correlates in the general population, thereby providing community-based evidence on the individual- and health system-level factors associated with adult HBV vaccine uptake, thereby helping to prioritize interventions for adult immunization programmes in high-endemic settings(5).

The findings of this study demonstrate relatively low adult HBV vaccine uptake, consistent with previous reports from Nigeria and other low- and middle-income settings. Direct comparisons, however, should be interpreted cautiously because studies differ in their target populations, sampling frames, and definitions of vaccination uptake or completion(5). Previous Nigerian studies have largely focused on healthcare workers or facility-based populations, where occupational exposure and institutional access to vaccination are greater than in the general community(6, 11, 13). Although awareness campaigns in Lagos reported vaccine uptake of 57.7%(12), broader community-based studies continue to reveal substantial gaps. Likewise, despite an exceptionally high first-dose uptake during a public health campaign in Abuja, completion declined markedly to 43.9%(5). Similar gaps have also been reported among healthcare workers, with substantial proportions remaining either unvaccinated or incompletely vaccinated despite their occupational risk (6, 11, 13).

In contrast, among participants in our study who had initiated vaccination, almost all reported completing the three-dose series. This comparatively high completion rate should be interpreted in the context of the study population. Most participants were recruited from Minna, a predominantly semi-urban setting, and a large proportion had at least secondary or tertiary education and were employed as civil servants or in other formal occupations. These characteristics may have facilitated better health literacy, greater access to healthcare services, more stable employment, and improved opportunities to complete scheduled vaccinations compared with populations drawn from more rural or socioeconomically disadvantaged settings. Nevertheless, because vaccination status was self-reported and the study was cross-sectional, this observation should be interpreted cautiously and confirmed in future studies using documented vaccination records.

The broader regional evidence reinforces these findings. In New Delhi, India, 93.3% of adults were reported not to have received even a single dose, and only 4.4% were fully vaccinated(17). Despite this, 85.5% expressed willingness to be vaccinated, underscoring the gap between demand and delivery. In Somalia, a strikingly higher adherence rate of 81.9% among adults was reported, but with disparities: hospital staff and university students had significantly lower odds of completion, while male gender and urban residence were strong positive predictors(18). Collectively, these studies suggest that differences in adult HBV vaccination are driven less by vaccine efficacy than by variation in access to vaccination opportunities, health-system engagement, and socioeconomic context.

Geographic and residential variations were substantial in the bivariate analysis, with urban residents demonstrating significantly higher vaccine uptake than rural residents. However, these associations were attenuated after multivariable adjustment, suggesting that the observed geographic differences were largely explained by underlying differences in education, health literacy, access to healthcare, and health worker recommendation rather than place of residence itself.

The strong associations observed for knowledge level and health worker recommendation highlight the importance of both individual awareness and healthcare engagement in promoting adult vaccination. Lack of awareness was the most frequently reported barrier, consistent with findings among women of childbearing age in Nigeria and other African settings where inadequate knowledge continues to limit vaccine uptake(8, 10). However, the very large adjusted prevalence ratios observed for knowledge should be interpreted cautiously. Knowledge may not solely precede vaccination; individuals who have already been vaccinated are also more likely to have received counselling and health education during the vaccination process. Consequently, the observed association may partly reflect reverse causation, which cannot be disentangled within the cross-sectional design. This finding should therefore be interpreted as identifying an important marker of vaccine uptake rather than demonstrating that increasing knowledge alone will necessarily increase vaccination.

Receiving a recommendation from a health worker remained one of the strongest independent correlates of vaccination. A provider recommendation reduces uncertainty regarding vaccine safety, increases perceived susceptibility, and creates a direct opportunity for vaccination during healthcare encounters(6, 17). These findings support wider adult vaccination literature advocating a shift from passive, patient-initiated vaccination towards provider-initiated vaccination strategies(10). Unlike educational attainment or socioeconomic position, healthcare worker recommendation is directly modifiable through health-system policy and clinical practice. Embedding routine vaccination assessment and recommendation into primary care and other outpatient services therefore represents an immediately actionable strategy for improving adult HBV vaccine uptake.

These findings have important implications for adult hepatitis B vaccination policy and implementation in resource-constrained high-endemic settings. Adult vaccination programmes should move beyond reliance on self-initiated demand by integrating provider-initiated vaccination counselling into routine clinical encounters, including outpatient clinics, antenatal and family health services, community

screening programmes, and occupational health services(5, 10, 12). At the same time, educational interventions should be complemented by structural improvements, including improved vaccine availability, outreach services for underserved communities, and strategies that reduce financial barriers to vaccination. Such integrated approaches are likely to improve both vaccine uptake and equitable access among adults.

Strengths

The study provides community-level data on adult HBV vaccine uptake from five wards in Minna, includes multiple domains relevant to vaccine behavior, and distinguishes initiation from complete vaccination. The analysis also avoids odds-ratio interpretation for a common outcome by estimating adjusted prevalence ratios using modified Poisson regression with robust standard errors. By including adults from the general community rather than healthcare or facility-based populations, the study addresses an important evidence gap in adult HBV vaccination research in Nigeria.

Limitations

Several limitations require explicit acknowledgment. First, the cross-sectional design precludes inference about temporality or causality. The study estimates prevalent vaccination status and associations measured at one time point. Second, vaccination history was self-reported and was not verified using vaccination cards; self-report may introduce recall error, misclassification, and social desirability bias. Third, only 167 participants had vaccination-date variables because dates were applicable only among vaccinated participants. Fourth, the analysis notebook does not show survey weighting, cluster adjustment, or design-based variance estimation; estimates should therefore be interpreted as sample estimates rather than design-weighted population estimates for Minna metropolis. Fifth, although multi-stage sampling was used, non-response patterns and household-level replacement procedures require explicit reporting to assess selection bias and generalizability. Sixth, several subgroup analyses include sparse cells, particularly marital status, religion, and no formal education, which limits precision. Seventh, the trend analysis is based only on reported first-dose years among vaccinated participants and cannot estimate annual vaccine incidence or population coverage over time.

Public Health Implications

The findings of this study carry direct, actionable implications for shifting adult hepatitis B prevention programmes in high-endemic settings from a passive, demand-driven model to an active, system-initiated strategy. First, the low population-level prevalence of vaccine uptake underscores that relying entirely on self-initiated adult demand is insufficient. Public health agencies should move toward structural interventions that institutionalize provider-initiated vaccination counseling during routine clinical contacts, such as antenatal care, family planning, and general outpatient visits. By leveraging these existing clinical touchpoints, the health system can systematically convert passive willingness into actual uptake without the need for expensive new infrastructure.

Second, the data reveals a critical mismatch between public awareness and structural delivery. While expanding localized health literacy is essential to improve overall knowledge and attitudes, educational campaigns alone cannot overcome the primary barriers identified here: out-of-pocket costs and geographic distance. For policymakers, this means that public funding must be balanced between communication strategies and tangible delivery mechanisms. This includes subsidizing the cost of the adult vaccine series and deploying mobile or community-based outreach units to bridge the gap for rural and lower-education populations.

Finally, the stark drop-off rates between initial dose uptake and full compliance documented in similar cohorts highlight a major vulnerability in current public health campaigns. Monitoring and evaluation frameworks must be redesigned to measure program success by three-dose completion rates rather than first-dose attendance. Future adult vaccination strategies must pair community screening with robust tracking, digital reminders, and clear linkage-to-care protocols to ensure that individuals who initiate the series are supported through full immunization compliance.

Conclusions

This study demonstrates that adult HBV vaccination remains suboptimal in a community population and identifies healthcare worker recommendation and HBV knowledge as key modifiable factors associated with vaccine uptake. The study identifies healthcare worker recommendation as a pivotal, modifiable health-system lever for improving adult HBV vaccination uptake in community populations. Addressing this gap will require sustained investment in public awareness, stronger health system commitment, and equitable access to vaccination services. Future research should employ robust approaches to vaccination verification to strengthen monitoring and evaluation efforts.

Declarations

Data and Code Availability Statement

The analysis code, the reproducible modified Poisson script, and the de-identified analytic dataset are available upon request.

Consent to Publish

Not applicable.

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The authors received no funding for this study.

Author Contributions

M.A. wrote the main manuscript text; S.A. and I.S. are responsible for data collection and the data analysis; Y.E and M.O reviewed and provided the final manuscript for this paper

Competing Interests

The authors declare no competing interests.

Clinical Trial Number: Not applicable.

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Figures

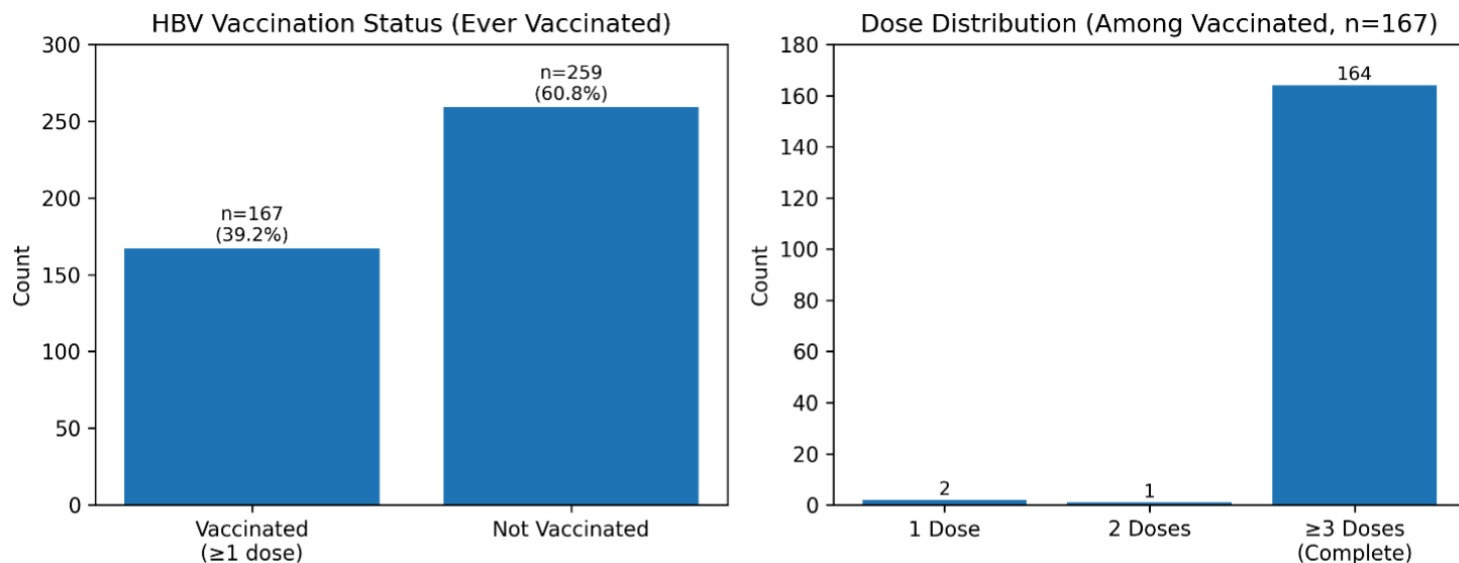


Figure 1

HBV vaccine uptake status among adult participants. The bar chart (left) shows the proportion of vaccinated and unvaccinated, while the chart on the right shows the dose distribution: 1 dose, 2 doses and 3 doses.

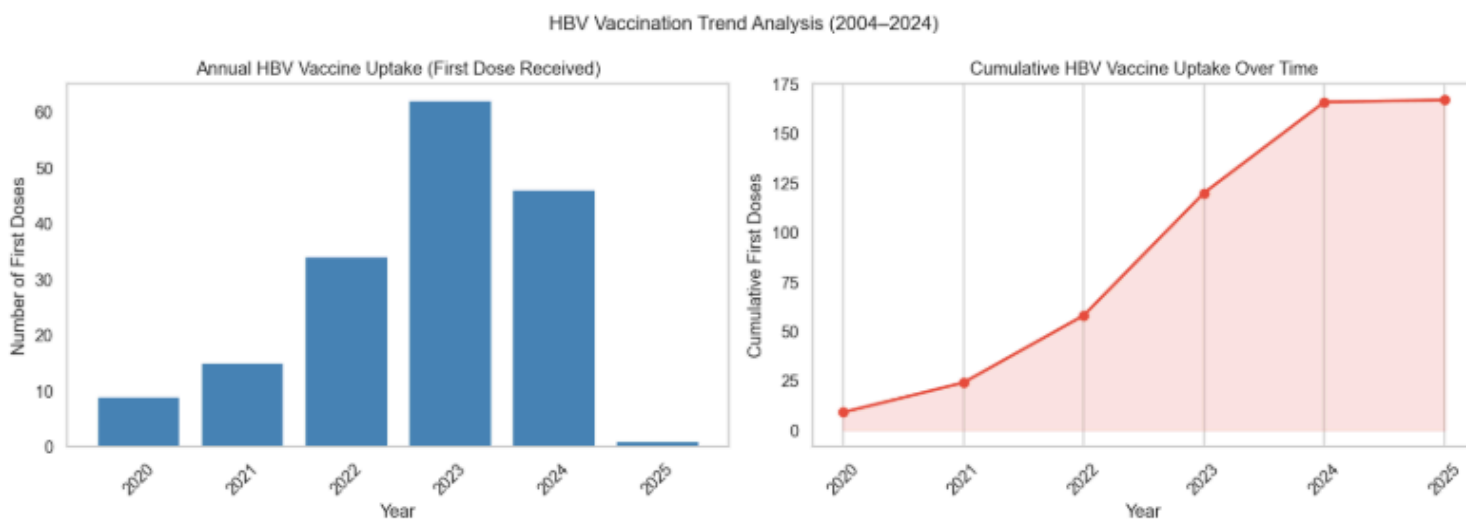


Figure 2

Trend analysis showing the first HBV vaccine dose among vaccinated participants.

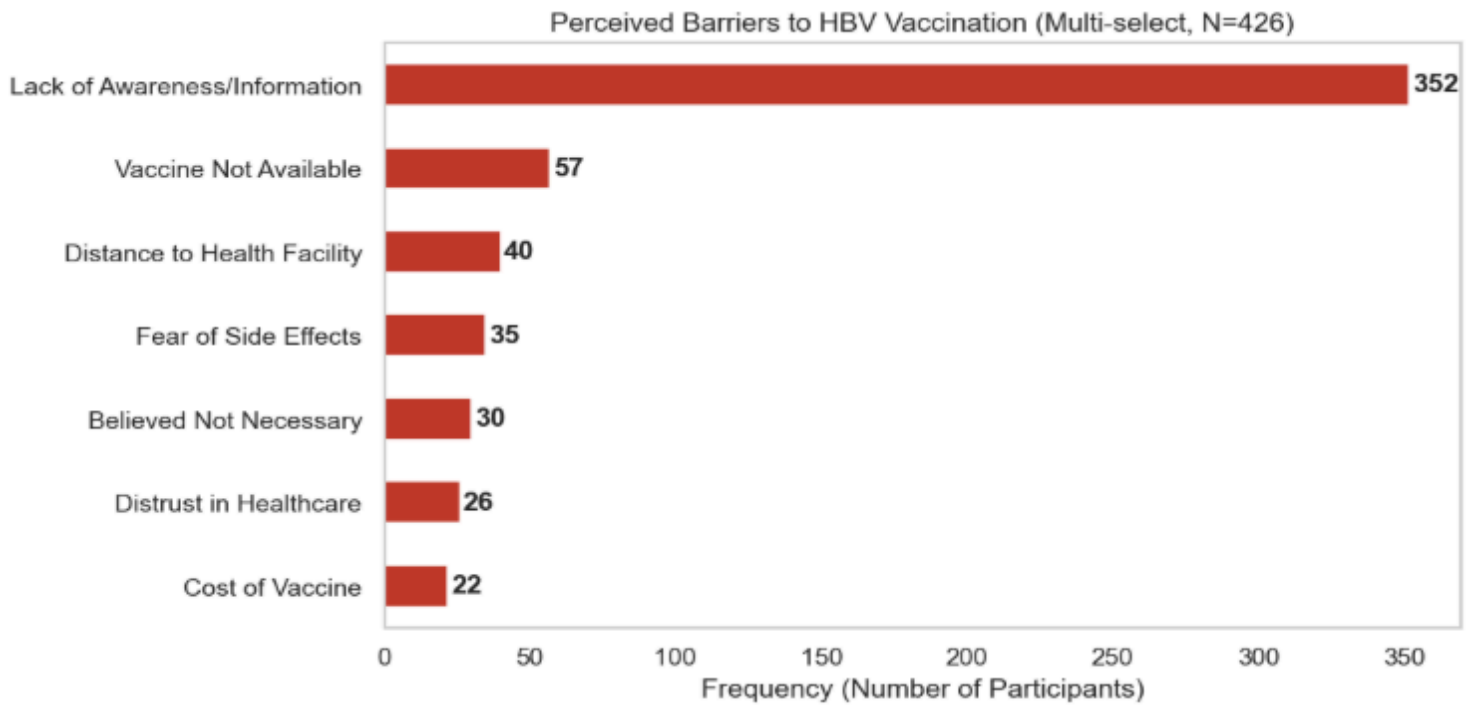


Figure 3

Perceived barriers to HBV vaccination using multi-select responses

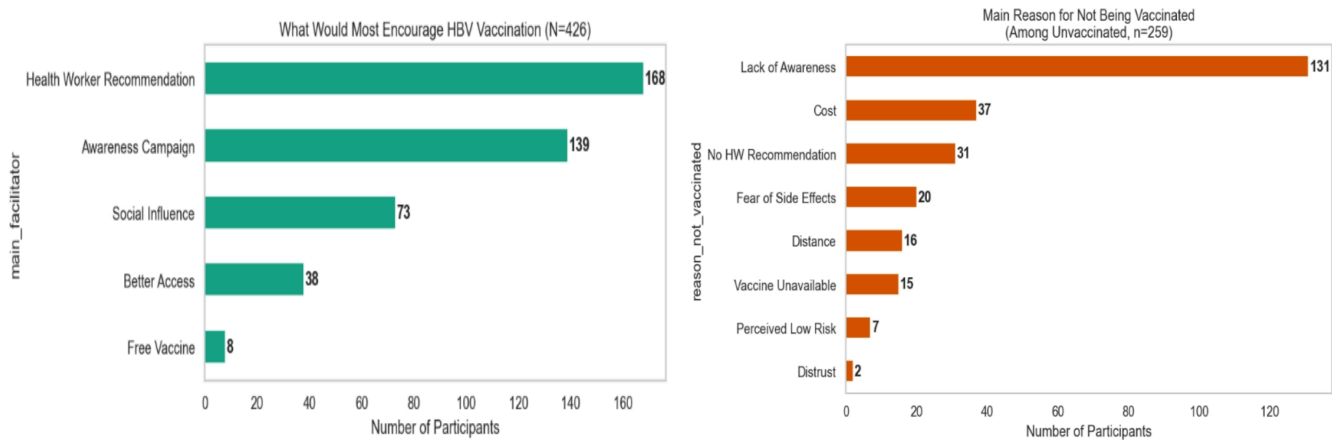


Figure 4

Shows the main facilitators of vaccination and main reason for non-vaccination