

Pregnant women's hepatitis B vaccination coverage in Nigeria: a national pilot cross-sectional study

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Abstract

Objective: To determine the hepatitis B vaccination coverage, full-dose (≥ 3) coverage and the associated factors affecting uptake among pregnant women.

Methods: This was a cross-sectional study among pregnant women attending antenatal care in six tertiary hospitals across all the geopolitical zones of Nigeria. Pregnant women who consented to the study completed screening questions about their hepatitis B vaccination status and coverage. The main outcome measures were hepatitis B vaccination coverage rate, dose, and factors affecting uptake. Bivariate analysis was performed by the chi-square test and conditional logistic regression analysis was used to determine variables associated with uptake of the vaccination. Odds ratios (ORs) and adjusted odds ratios (aORs) were calculated and statistical significance was accepted when p -value was < 0.05 .

Results: Of 159 pregnant women who completed the interview questions, 21 [13.2%, 95% confidence interval (CI) 7.9–18.5%] were vaccinated for hepatitis B for one to three doses. The numbers of doses received were: three doses (8/159, 5.0%), two doses (5/159, 3.1%), and one dose (8/159, 5.0%). The reasons for non-uptake of vaccination included: lack of awareness of the vaccine 83/138 (60.1%), inadequate access to vaccine 11/138 (8.0%), and positivity to hepatitis B virus 10/138 (7.2%). The uptake of hepatitis B vaccination was significantly affected by the level of education (OR 0.284, 95% CI 0.08–1.01, $p=0.041$), but in multivariable logistic regression, adjusted for confounders, the association between hepatitis B vaccination and participants' level of education (aOR 3.09; 95% CI 0.95–10.16; $p=0.061$) did not remain significant.

Conclusions: In Nigeria, the national hepatitis B vaccination coverage among pregnant women appears poor, with the full-dose coverage even poorer. The level of education was not positively associated with uptake of hepatitis B vaccination, while lack of awareness of the vaccine was the commonest reason for non-uptake.

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Introduction

Despite the availability of hepatitis B vaccine, the coverage for hepatitis B immunization is still inadequate in Nigeria.¹ Hepatitis B vaccination is the most operational method of prevention for hepatitis B virus (HBV) infection,^{1,2} but in Nigeria, to our knowledge, there is no available data on hepatitis B virus vaccination in pregnant women.³ However, studies have shown that hepatitis B virus vaccine coverage among healthcare workers is about 14.2%, but there are no data for the general population.^{1,2} Hepatitis B infection is a major public health problem in Nigeria, and sexually active individuals such as pregnant women may be at increased risk. As a result of the poor screening and low vaccination rate, the vertical transmission of HBV has become a major route of transmission of the virus in Nigeria. This leaves the children born at risk of developing chronic liver disease later in life.^{3,4}

There is increased maternal and perinatal death associated with the HBV infection during pregnancy.^{3,4} Placenta abruption, gestational hypertension, gestational diabetes mellitus, fetal growth restriction, higher risk of intraventricular hemorrhage in the fetus and neonatal asphyxia have also been associated with chronic HBV during pregnancy.^{4–6} Whereas the consequences of an acute hepatitis B infection in pregnancy may include preterm labor leading to preterm birth, chronic HBV in pregnancy increases the risk of progression to cirrhosis.⁶ The pregnancy complications may interact with maternal HBV infection and hepatitis flares, leading to serious and lethal complications. Hepatitis flares and coagulation failure are common especially postpartum, and could be unpredictable and unpreventable with antiviral treatment.^{7,8}

As HBV infection has serious consequences, there is a need to understand its epidemiology, especially in low-income settings such as Nigeria. The World Health Organization (WHO) has branded the global ambition of eliminating viral hepatitis infection by setting targets for achieving substantial reductions in new infections and deaths due to viral hepatitis by 2030.⁹ There have been major gaps in this global hepatitis elimination effort that continuously threaten achievement of the WHO targets.⁹ Experts in viral hepatitis have identified these gaps and challenges and have pointed out that there should be priorities on vaccination

efforts.⁹ This is because hepatitis B vaccine is highly immunogenic, with 90–100% protection conferred following a completed hepatitis B vaccination schedule among infants, children, and adults.^{10,11}

Unfortunately, the HBV immunization coverage rate among pregnant women has not previously been determined in a Nigerian population. In addition, there is no policy or enactment of any policy in Nigeria that makes uptake of HBV vaccination unavoidable to all women prior to pregnancy. This is somewhat not ideal considering the high population of Nigeria. The aim of this study, therefore, is to determine the hepatitis B vaccination coverage, full-dose HBV vaccination (uptake of ≥ 3 doses of vaccine) coverage and the factors associated with the uptake among pregnant women in Nigeria.

Methods

Study design

This was a cross-sectional pilot baseline finding from a Nigerian longitudinal cohort study, designed to explore the vaccination coverage rate and factors affecting such interventions among pregnant women. Pregnant women 18 years or over and registered for their antenatal care (ANC) were eligible to participate in the study. The questions (screening survey) asked their hepatitis B vaccination status, and those who were previously or recently vaccinated. Consent was obtained from all participants before recruitment into the study.

Study population

The study was conducted among pregnant women attending ANC in the six geopolitical zones of Nigeria.

Study sites

The study was conducted in Nigeria, a country made up of the federal capital territory and 36 states which are partitioned into contiguous six geopolitical zones. Participants were recruited from one randomly selected tertiary level facility in each of the five geopolitical zones in Nigeria apart from the south-east zone where the lead institution for the TETFund National Research Fund 2019 was selected. The sites randomly

selected are: University of Maiduguri Teaching Hospital, Maiduguri (north-east zone); University of Abuja Teaching Hospital, Gwagwalada (north-central zone); Aminu Kano Teaching Hospital, Kano (north-west zone); Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife (south-west zone); and University of Port Harcourt Teaching Hospital, Port Harcourt (south-south zone) in addition to the lead Institution, Nnamdi Azikiwe University Teaching Hospital, Nnewi (south-east zone).

Recruitment of participants

We employed purposive non-probability sampling by selecting six tertiary hospitals across the six geopolitical zones in Nigeria. The research assistants were adequately trained in recruiting and screening pregnant women in the survey. We recruited pregnant women from various antenatal clinics at each hospital between June and July 2020. Trained research assistants systematically handed out a screening survey to all pregnant women attending antenatal clinics in those sites. The screening survey contained questions asking women whether they had received hepatitis B vaccination before, among others, and if they had not received hepatitis B vaccination before, they were then excluded from answering any further full survey questions. Each hospital was asked to recruit approximately 25 pregnant women into the pilot phase.

Pregnant women who completed the full survey were asked for their contact details and given a unique identifier; a member of the research team cross-checked these details to ensure each woman completed the full survey questions.

Sample size determination

No formal sample size calculations were made because of the pilot nature of the study.

Ethical consideration

Ethical clearance for this study was obtained from the National Health Research Ethics Committee, with registration number: NHREC/01/01/2007–23/01/2020 (approval date: 23 January 2020). Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidance was used for reporting. Full details of the study are in the protocol.¹²

Survey content and measurements

The survey was divided into two parts: the screening survey and the full survey.

Screening survey

The women were asked their gestational age (in weeks), age, marital status, level of education, occupation, income available to the woman for ANC, ownership of housing and type of accommodation and whether they had completed the survey previously. They were then asked whether they have heard of hepatitis B infection, hepatitis B vaccination as well as their current and past hepatitis B vaccination status.

Full survey

For those who had received HBV vaccination, they were asked their age when they received the vaccination, and the number of doses they received: (one dose, two doses, three doses or more than three doses), and when they received the last dose prior to pregnancy (less than one month, between one month and 3 months, between 4 months and 6 months or more than 6 months). We defined HBV vaccination status as: (i) no vaccination when no dose was received; (ii) partial vaccination when one or two doses were received; and (iii) full vaccination when three or four doses were received.¹³

Measurements

The main outcome measure was hepatitis B vaccination and hepatitis B vaccine knowledge status collected from the screening and full survey.

Data analysis

The Statistical Package for the Social Sciences (SPSS) version 22.0 (IBM Corp., Armonk, NY, USA) was used to perform the statistical analyses in this study. Screening survey responses were used to estimate the prevalence of hepatitis B vaccination and knowledge of hepatitis B vaccine for all pregnant women with 95% confidence intervals (CIs). The estimates of the proportions, in the following categories: dose of hepatitis B vaccine, and reasons for non-uptake of the hepatitis B vaccine were evaluated and the prevalence of hepatitis B vaccination by level of education, maternal age, religion, marital status, occupation,

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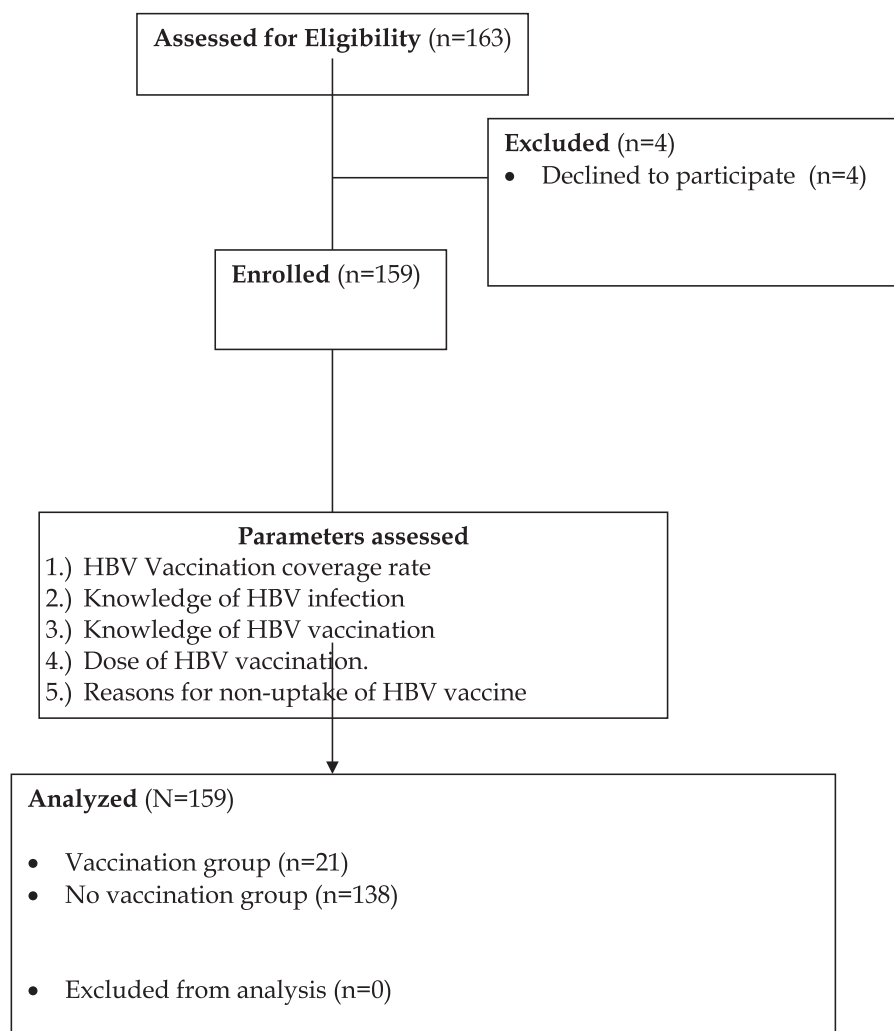


Figure 1. Flow pattern of participants in the study.

income availability for ANC, ownership of living apartment/house and type of accommodation were compared using chi-square statistics. For those who were eligible and completed the full survey, maternal characteristics, hepatitis B vaccination coverage and other factors among all participants were described. These latter independent variables were then used to conduct chi-square tests, to determine differences between women who received hepatitis B vaccination and those who did not receive hepatitis B vaccination and the differences between them. Conditional logistic regression was employed in the multiple regression analysis to determine variables associated with the uptake of hepatitis B vaccination, while controlling for other confounding variables (such as: age, religion, marital status, occupation

status, income availability and ownership of housing). In this analysis, the odds ratios (ORs), adjusted odds ratios (aORs) and CI was set at 95% and $p < 0.05$ was considered significant.

Results

Data for 159 pregnant women were evaluated. The flow pattern is shown in Figure 1. The mean age was 32.7 ± 5.8 years. A total of 21 out of 159 women (13.2%, 95% CI 7.9–18.5%) who completed the screening survey were vaccinated for hepatitis B.

Of the 159 women, 24 (15.1%, 95% CI 10.4–21.5%) had not heard of hepatitis B infection and 83 (52.2%, 95% CI 44.5–59.8%) had not

Table 1. Socio-demographic characteristics of the respondents.

Variables	Frequency	Percentage
Age (years)	(<i>n</i> = 159)	
21–30	65	40.9
31–40	70	44.0
41–50	24	15.1
Religion	(<i>n</i> = 159)	
Christianity	80	50.3
Islam	79	49.7
Marital status	(<i>n</i> = 152)	
Married	130	85.5
Not married	22	14.5
Educational level	(<i>n</i> = 159)	
Primary	4	2.5
Secondary	50	31.5
Tertiary	105	66.0
Participant's occupation	(<i>n</i> = 159)	
Unemployed	58	36.5
Formally employed	50	31.4
Farming, trading, artisan (others)	51	32.1
Income available for ANC	(<i>n</i> = 133)	
≤2500USD	83	62.4
>2500USD	50	37.6
Ownership of housing	(<i>n</i> = 158)	
Own house	54	34.2
Rented apartment	104	65.8
Type of accommodation	(<i>n</i> = 152)	
One room self-contained	47	30.9
2–3 Bedroom flat	83	54.6
Bungalow or duplex	22	14.5

Exchange rate: NGR1 = USD0.0025 (as at 20 December, 2020). ANC, antenatal care.

heard of hepatitis B vaccination. The numbers of doses received were: three doses (8/159, 5.0%), two doses (5/159, 3.1%), and one dose (8/159, 5.0%). Of all the 21 participants that received hepatitis B vaccination, all (100.0%) of them received it more than 6 months prior to pregnancy.

The result of the socio-demographic characteristics of the respondents is shown in Table 1. The association between hepatitis B vaccination and respondents' characteristics based on the bivariate test is shown in Table 2. The HBV vaccination was found to be associated with participants' educational level ($p=0.041$), but not by maternal age ($p=0.272$), religion ($p=0.791$), marital status ($p=0.192$), occupation ($p=0.470$), income availability for ANC ($p=0.342$), ownership of house ($p=0.112$) and type of accommodation ($p=0.348$).

Table 3 shows the association between hepatitis B vaccination and respondents' characteristics based on bivariate test and multiple logistic regression. In multivariable logistic regression, adjusted for confounders, the association between hepatitis B vaccination and respondents' educational level (aOR 3.09; 95% CI 0.95–10.16; $p=0.061$) did not remain significant.

The reasons for not receiving hepatitis B vaccine are shown in Table 4. As shown in Table 4, the reasons for non-uptake of vaccination included: lack of awareness of the HBV vaccine 83/138 (60.1%), lack of access to HBV vaccine 11/138 (8.0%), and hepatitis B virus positivity 10/138 (7.2%).

Discussion

To the best of our knowledge, this is the first Nigerian study to report hepatitis B vaccination coverage and awareness rates among pregnant women. Only 13.2% of all pregnant women reported having received hepatitis B vaccine prior to pregnancy, and over 50% of the study participants had not heard of hepatitis B vaccination. The hepatitis B vaccination coverage among pregnant women in Nigeria was poor, with the full-dose coverage even poorer. The level of education was not significantly associated with the uptake of hepatitis B vaccination, and lack of awareness of the vaccine was the commonest reason for poor uptake.

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Table 2. Association between hepatitis B vaccination and respondents' characteristics based on bivariate test.

Variables/subgroup	Vaccination group (%)	No vaccination group (%)	OR (95% CI)	p-Value
Age (years)	(n=21)	(n=138)		
21–30	10 (47.6)	55 (39.9)	0.786 (0.97–3.14)	0.272
31–40	8 (38.1)	62 (44.9)		
41–50	3 (14.3)	21 (15.2)		
Religion	(n=21)	(n=138)		
Christianity	10 (47.6)	70 (50.7)	1.132(0.45–2.84)	0.791
Islam	11 (52.4)	68 (49.3)		
Marital status	(n=21)	(n=138)		
Married	18 (85.7)	108 (78.3)	0.600 (0.17–2.17)	0.192
Not married	3 (14.3)	19 (13.7)		
Educational level	(n=21)	(n=138)		
Post-secondary	18 (85.7)	87 (63.0)	0.284 (0.08–1.01)	0.041*
Pre post-secondary	3 (14.3)	51 (37.0)		
Participant's occupation	(n=21)	(n=138)		
Unemployed	6 (28.6)	52 (37.7)	1.156 (0.35–3.84)	0.470
Formally employed	9 (42.9)	41 (29.7)		
Farming, trading, artisan (others)	6 (28.6)	45 (32.6)		
Income available for ANC	(n=19)	(n=114)		
≤2500USD	10 (52.6)	73 (64.0)	1.602 (0.60–4.27)	0.342
>2500USD	9 (47.4)	41 (36.0)		
Ownership of housing	(n=20)	(n=138)		
Own house	7 (35.0)	47 (34.1)	0.959 (0.36–2.57)	0.112
Rented apartment	13 (65.0)	91 (65.9)		
Type of accommodation	(n=20)	(n=132)		
One room self-contained	5 (25.0)	42 (31.8)	2.47 (0.63–9.64)	0.348
2–3 bedroom flat	10 (50.0)	73 (55.3)		
Bungalow or duplex	5 (25.0)	17 (12.9)		

Exchange rate: NGR1 = USD0.0025 (as at 20th December, 2020).
Pre post-secondary (secondary, primary, quoranic and no education).
95% CI, 95% confidence interval; OR, odds ratio.

Table 3. Association between hepatitis B vaccination and respondents' characteristics based on bivariate test and multiple logistic regression.

Variables/subgroup	Vaccination group (%)	No vaccination group (%)	Unadjusted OR (95% CI)	p-Value	Adjusted OR (95% CI)	p-Value
Educational level	(n = 21)	(n = 138)				
Post-secondary	18 (85.7)	87 (63.0)	Reference		Reference	
Pre post-secondary	3 (14.3)	51 (37.0)	0.284 (0.08–1.01)	0.041*	3.09 (0.95–10.16)	0.061

Pre post-secondary (secondary, primary, quoranic and no education).
Conditional logistic regression was employed ($p < 0.1$) in the multiple regression analysis to control confounding variables: age, religion, marital status, occupation status, income availability ownership of housing and type of accommodation.
95% CI, 95% confidence interval; OR, odds ratio.

Table 4. Reasons for not receiving hepatitis B vaccination.

Variables	Frequency (N = 138)	Percentage
Unaware of vaccine	83	60.1
No access to vaccine	11	8.0
Hepatitis B positive	10	7.2
Do not have the virus	9	6.5
Reluctance	7	5.1
No opportunity	4	2.9
Pregnancy	4	2.9
Thought it is unimportant	4	2.9
Others	6	4.4

Others: Lack of decision to do the test (n=2), cost of vaccine (n=2), lack of time (n=2).

The overall uptake of hepatitis B vaccination coverage among pregnant women in Nigeria was 13.2%. This is similar to 14.2% observed in a previous study in Enugu, Nigeria,¹ but lower than 46.7% and 64.5% reported in previous studies in Nguru, Nigeria¹⁴ and Jos, Nigeria,¹⁵ respectively, although these previous studies were among healthcare workers. It is also lower than 57.8% among healthcare workers reported by Ssekamate *et al.*¹⁶ in Uganda, and 26.05% among medical students in Cameroon.¹⁷ These differences might be due to differences in the population studied or

due to differences in the socioeconomic status and standards of healthcare services as the present study was among pregnant women. Among healthcare workers, obligatory hepatitis vaccination may be a prerequisite for employment in some cases and the cost may also be covered by the employing hospital hence the very high uptake found in studies involving health workers.

The full-dose hepatitis B vaccination coverage in our present study was 5.0%. This was lower than in previous Nigerian studies among healthcare workers and medical students.^{1,14,18} In addition, our finding was lower than the national prevalence of full-dose hepatitis B vaccination coverage among healthcare workers in Ethiopia which was 20.04% (95% CI 13.83, 26.26).¹⁹ It was also lower than findings from a similar systematic review and meta-analysis conducted in America and China, where the prevalence of vaccination coverage was 63.4% and 60.0%, respectively.^{20,21} Hepatitis B vaccination is the pillar of HBV prevention. In preparation for the elimination of HBV, pregnant women should receive a full dose (three-dose vaccine series) to achieve >90% protection against hepatitis B virus. A previous study by Omotowo *et al.*¹ in Enugu, Nigeria among healthcare workers documented the prevalence of the dose received for hepatitis B to be as follows: three doses (48.9%), two doses (16.0%), and one dose (35.1%), while in our findings, the numbers of doses received were: three doses (5.0%), two doses (3.1%), and one dose (5.0%).¹ The variations in findings are probably due to different data collection methods and population of study and nature of recalls in the population periods. It could also be due to differences in knowledge

between healthcare workers and non-healthcare workers.

Our findings revealed that women with a low educational level did not have significantly increased or decreased odds of receiving hepatitis B vaccine prior to pregnancy. This finding is very interesting for a Nigerian population because, in a previous study, positive hepatitis B surface antigen (HBsAg) status was associated with the increased risk of obstetric complications (preterm labor) in women having low educational level, with an odds ratio of 2.59 (95% CI 1.41–4.76) even after adjusting for other co-variables.²² It is also particularly interesting because more educated or informed individuals expectedly should be more accepting of vaccines.

In a previous Nigerian study by Omotowo *et al.*,¹ the common reasons for non-uptake of hepatitis B vaccination included: long vaccination schedule and lack of time (35.1%), cost of the vaccine (10.8%), and lack of belief that they could be infected (6.6%).¹ However, in a previous Kenyan study, the major reason for not receiving the recommended doses was the non-availability of the vaccine.¹³ In our findings, the reasons were different as the majority revealed that lack of awareness of the HBV vaccine was the greatest reason for their non-uptake of the vaccine. This finding is understandable because our present study was performed on a general antenatal (pregnant) women population while the previous Nigerian study¹ and Kenyan study¹³ were on health workers.

This study has become necessary because vertical transmission of hepatitis B virus from infected mothers to their fetuses or newborns results in a 90% positive likelihood if the pregnant woman has chronic hepatitis B and is positive for hepatitis B virus e antigen (HBeAg).⁶ Universal screening for hepatitis B virus infection during pregnancy at the first prenatal visit has been recommended by the United State Preventive Services and Task Force and the American Congress of Obstetricians and Gynecologists. Such a measure should be adopted in Nigeria in line with Sustainable Development Goal (SDG) 3. A recent meta-analysis has revealed the safety and efficacy of antenatal HBV vaccination in combination with antenatal HBV immunoglobulin for preventing mother-to-child transmission of HBV as there

was a significant decrease in the number of newborns who were HBsAg positive following its administration.²³

To take action on SDG 3, target 3.3, indicator 3.3.4 on combating hepatitis, the World Health Assembly ratified the global health sector strategy for the elimination of viral hepatitis as a public health threat by 2030, with a target of new infection reduction by 90% and mortality by 65%.²⁴ Thus, there may be a need for hepatitis B vaccination prior to pregnancy and every pregnant woman should be screened for HBsAg at the initial visit. This is to decrease the mother-to-child transmission of the hepatitis B virus.

In addition, pregnant women should not only be screened for HBsAg at the initial visit, but those who had prior history of HBV vaccination should also be tested for anti-hepatitis B surface immunoglobulin G (IgG), so as to evaluate the long-time immunogenicity of anti-hepatitis B vaccination, as supported by the study of Bianchi *et al.*²⁵ The rationale for this is in accordance with international guidelines, which recommended that healthcare workers and others at high risk of exposure, and immunized against HBV, should be periodically tested for anti-hepatitis B surface IgG. As a result, individuals who show an anti-hepatitis B surface titre <10 mUI/mL are required to receive additional vaccine doses to induce a measurable antibody response.^{25,26}

Strengths and limitations

The strengths of this study include the prospective design of data collection during pregnancy, rather than retrospective data collection which increases recall error and bias. Apart from the lead institution with the grant for this research, the selection of other hospital recruitment sites was random and covered the geopolitical zones in Nigeria. The acceptability rate to participate freely in the study was also a huge strength. Only women who attended antenatal clinics were involved in this study, yet most women in Nigeria do not attend antenatal clinics in specialist or tertiary healthcare centers. Therefore, findings may not be representative of all pregnant women in Nigeria. Reliance on self-reported vaccination history and some missing data may have led to underreporting. We could not evaluate for the long-time immunogenicity of anti-hepatitis B

vaccination among the women who had prior uptake of HBV vaccination.²⁵ This should be a subject for future study.

Conclusions

In Nigeria, the national hepatitis B vaccination coverage among pregnant women appears poor, with the full-dose coverage even poorer. The level of education was not significantly associated with the uptake of hepatitis B vaccination, and lack of awareness of the HBV vaccine was the commonest reason for non-uptake. The increased awareness campaign for HBV vaccination should be intensified and there is a need to streamline vaccination programmes in women of reproductive age to guarantee accessibility and availability. More information about this subject could be obtained from studies with larger populations of women.

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Authors' contributions

GU Eleje, II Mbachu, A Rabi, GO Akaba, PO Fiebai, O Loto, HA Usman, CU Onubogu, UC Ogwaluonye, SO Kalu, RO Egeonu, CE Uzochukwu, CH Nwankwo, SI Nweje, SN Chukwurah, OS Umeononihu, RC Chukwu-anukwu, EO Umeh, EA Emeka, CN Ogbuagu, NN Joe-Ikechebelu, C Jibuaku, P Aja, CP Chidozie, HS Ibrahim, FE Aliyu, EO Igue, B Adosoji, AI Numan, OD Okoro, SA Omoruyi, IC Oppah, UI Anyang, SO Inuyomi, A Ahmed, AA Onwuegbuna, EP Igbodike, IC Ajuba, IA Yakasai, O Ezechi, and JI Ikechebelu made substantial contributions to the concept and design of the article, the acquisition, analysis, and interpretation of data for the article. All the authors drafted the manuscript and revised it critically for important intellectual content. All the authors read and approved the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of interest statement

The authors declare that there is no conflict of interest.

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Ethics approval and consent to participate

Ethical approval was obtained from the National Health Research Ethics Committee, Abuja and Health Research Ethics Committees of the six tertiary hospitals. Informed written consent was obtained from the participants.

Consent for publication

Not applicable

Data availability

The data used to support the findings of this study are available from the site publicly.

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