



Research Article

Self-Reported Vaccine Hesitancy among Undergraduates in Two Universities in Nasarawa State, Nigeria

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ABSTRACT

Vaccine hesitancy undermines immunization coverage worldwide, yet data on Nigerian university students remain scarce. This study assessed the prevalence and correlates of vaccine hesitancy among undergraduates at the Federal University of Lafia (FULafia) and Nasarawa State University Keffi (NSUK), Nigeria. A cross-sectional survey was conducted; 400 questionnaires were administered and 385 were adequately completed and analyzed (96.3% response rate; 172 FULafia, 213 NSUK). The questionnaire covered vaccination history, self-rated and vaccine-specific hesitancy, reasons for hesitancy, and information sources. Associations were examined using Chi-square/Fisher's exact tests and multivariable logistic regression. Overall, 66.2% (255/385) self-identified as vaccine hesitant. Hesitancy was more prevalent among students in NSUK than in FULafia (75.1% vs 55.2%, $p < 0.001$), among Muslim than Christian respondents (88.4% vs 44.6%, $p < 0.001$), and among male than female students (83.1% vs 40.9%, $p < 0.001$). After adjustment, institution (adjusted odds ratio [aOR] = 2.90, 95% confidence interval [CI] 1.72–4.90), Muslim affiliation (aOR = 4.05, 95% CI 1.81–9.04), and peer/family encouragement to refuse (aOR = 3.68, 95% CI 1.93–7.03) remained independent correlates; the sex effect attenuated. Hesitancy was highest toward COVID-19 (47.0%) and Hepatitis B (39.2%) vaccines; fear of side effects was the leading reason (68.2%). Vaccine hesitancy is highly prevalent among undergraduates in the two Nasarawa State universities studied and is independently associated with institution, religion, and social encouragement to refuse vaccination. Interventions combining transparent safety communication with engagement of religious and peer networks are needed to strengthen vaccine confidence among this population.

Keywords: COVID-19 Vaccine; Immunization; Institutional Variation; Nigeria, Religion; Undergraduate Students; Vaccine Hesitancy

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INTRODUCTION

Vaccine hesitancy has been defined by the World Health Organization (WHO) Strategic Advisory Group of Experts (SAGE) as a delay in acceptance or refusal of vaccines despite the availability of vaccination services (MacDonald, 2015), and it is recognized as one of the ten most critical global health threats of the twenty-first century (WHO, 2019). Globally, vaccine hesitancy has been linked to resurgences of

vaccine-preventable diseases such as measles, poliomyelitis, and pertussis, with substantial preventable morbidity and mortality (Eskola et al., 2015). In sub-Saharan Africa, hesitancy is compounded by multifactorial determinants, including religious beliefs, cultural norms, misinformation circulated through social media, fear of adverse events following immunization (AEFIs), and historical distrust of pharmaceutical

interventions (Renne, 2006; Jegede, 2007; Yahya, 2007; Oloruntoba et al., 2019; Osei Bonsu et al., 2022). Religious framing of vaccination has been particularly consequential in northern Nigeria, where past boycotts of polio vaccination campaigns were driven substantially by religious leaders and rumours of harmful intent (Renne, 2006; Jegede, 2007; Yahya, 2007).

Nigeria, Africa's most populous nation (NBS, 2023), continues to record suboptimal immunization coverage across many states, with national coverage rates for several antigens remaining below the WHO-recommended 95% threshold for herd immunity despite existing government immunization programmes (NPHCDA, 2018; WHO, 2022); immunization indicators in Nasarawa State specifically have lagged behind national targets (NSMOH, 2023). Young adults, particularly undergraduate students, constitute a strategically important demographic for vaccine uptake, as dense social networks and close physical contact on university campuses facilitate rapid disease transmission, and students represent future healthcare workers, educators, and policymakers whose vaccination attitudes may shape public health outcomes (Gallagher et al., 2017). The COVID-19 pandemic considerably elevated global discourse on vaccine hesitancy, with studies across African nations reporting substantial proportions of young adults expressing unwillingness or uncertainty toward COVID-19 vaccines (Adeniyi et al., 2021; Sallam, 2021; Solís Arce et al., 2021).

In Nasarawa State, north-central Nigeria, published evidence on vaccine hesitancy among undergraduate students remains limited. Federal University of Lafia (FULafia) and Nasarawa State University Keffi (NSUK) are the two major public universities in the state, collectively enrolling students of diverse ethnic, religious, and socioeconomic backgrounds. An earlier preliminary assessment by our group, based on a small convenience sample of 50 students, suggested that hesitancy was common but was insufficiently powered to yield stable estimates of its correlates. Understanding the magnitude and correlates of vaccine hesitancy in this population is therefore essential for designing evidence-based interventions (Ibrahim et al., 2022; Adeyemi et al., 2023).

This study therefore determined the prevalence, pattern, and correlates of self-reported vaccine hesitancy among undergraduate students at FULafia and NSUK, examining socio-demographic and attitudinal predictors of hesitancy in this population.

MATERIALS AND METHODS

Study Area and Design

A cross-sectional survey was conducted at two public universities in Nasarawa State, north-central Nigeria. The Federal University of Lafia (FULafia) is located in Lafia, the state capital, while Nasarawa State University Keffi (NSUK) is located in Keffi. Both institutions offer undergraduate programmes across faculties including health sciences, natural sciences, social sciences, engineering, and management sciences.

Study Population, Sample Size, and Sampling Technique

The study population comprised full-time undergraduate students aged 18 years and above who provided written informed consent. The minimum sample size was calculated using the Cochran formula for an infinite population, assuming a hypothesized prevalence of 50%, a 95% confidence level, and a 5% margin of error, yielding a minimum requirement of 385 respondents ($n = Z^2p(1 - p)/d^2 = [1.96^2 \times 0.5 \times 0.5]/0.05^2 = 384.16$, rounded up to 385). To allow for incomplete or spoiled questionnaires, 400 questionnaires were administered, proportionately allocated between the two institutions by stratified random sampling. Of these, 385 were returned adequately completed and were retained for analysis (96.3% response rate; 172 from FULafia and 213 from NSUK), meeting the calculated minimum sample size.

Administration of Structured Questionnaire

A structured, self-administered questionnaire was used, adapted conceptually from the WHO SAGE Working Group framework for vaccine hesitancy (WHO, 2014; MacDonald, 2015), covering: (i) socio-demographic characteristics; (ii) vaccination history and practice (ever received, ever delayed, and ever refused a vaccine); (iii) a single-item self-rated hesitancy question ("yes/no"); (iv) a checklist of hesitancy toward nine named vaccines (Hepatitis B, tetanus-diphtheria [Td], meningococcal, human papillomavirus [HPV], COVID-19, varicella, yellow fever, influenza, and other); (v) a checklist of perceived reasons for hesitancy (fear of side effects, distrust, religious reasons, cultural reasons, lack of information, cost, family/peer influence, social media influence, other); (vi) whether the respondent had been encouraged by a peer or family member to refuse vaccination; (vii) a three-level perceived-importance-of-vaccination item (low, moderate, high); and (viii) sources of vaccine-related information. As only a single-item hesitancy measure

was administered, rather than the full 10-item Vaccine Hesitancy Scale, psychometric indices such as Cronbach's alpha could not be computed and are not reported.

Data Analysis

Data were cleaned and analyzed in Python 3 (pandas and SciPy libraries), with multivariable logistic regression fitted using the statsmodels package. Descriptive statistics (frequencies, percentages, means, and standard deviations) were computed for all variables. Associations between categorical variables and self-reported hesitancy were assessed using the Chi-square test, or Fisher's exact test for 2x2 tables. Crude odds ratios (OR) with 95% confidence intervals are reported for bivariate comparisons. A multivariable binary logistic regression was fitted with institution, sex, religion, marital status, being encouraged to refuse vaccination, and perceived importance of vaccination as covariates, and adjusted odds ratios (aOR) with 95% confidence intervals are reported. Statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Committee of the Nasarawa State Ministry of Health (NHREC Protocol No: 18/06/2017) and the Health Research Ethics Committee of Federal University of Lafia (Ref: FULafia/HREC/2024/018). Administrative permission was granted by the registrars of both institutions. Participation was voluntary and anonymous, and written informed consent was obtained from all participants. All procedures conformed to the Declaration of Helsinki.

RESULTS

Socio-demographic characteristics of respondents

Out of 400 questionnaires administered, 385 were returned adequately completed, giving a 96.3% response rate (172 from FULafia, 44.7%; 213 from NSUK, 55.3%). The mean age of participants was 21.0 ± 1.7 years (range 18–24). Males constituted 60.0% ($n = 231$) and females 40.0% ($n = 154$). Most respondents were single (89.6%). Religious affiliation was near-evenly split between Christianity (50.6%) and Islam (49.4%). Hausa was the most common ethnic group (43.1%), followed by Yoruba (26.2%). Socio-demographic characteristics are detailed in Table 1.

Vaccination history and self-rated hesitancy

All respondents (100%) reported having ever received at least one vaccine. However, 34.0% ($n = 131$) reported having ever delayed a vaccine dose and 45.5% ($n = 175$) reported having ever refused a vaccine outright. Half of the respondents (50.1%, $n =$

193) reported having been encouraged by a peer or family member to refuse a vaccine. On self-rating, 66.2% ($n = 255$) of respondents identified as vaccine hesitant. Hesitancy was significantly more prevalent at NSUK (75.1%) than FULafia (55.2%) ($\chi^2 = 15.95$, $df = 1$, $p < 0.001$; Table 2).

Hesitancy toward specific vaccines

Among all 385 respondents, vaccine-specific hesitancy was most frequent for the COVID-19 vaccine (47.0%), followed by Hepatitis B (39.2%), meningococcal (30.9%), Td (22.1%), HPV (19.5%), yellow fever (17.7%), varicella (14.8%), other vaccines (11.7%), and influenza (5.7%). Overall, 38.2% ($n = 147$) of respondents did not identify hesitancy toward any specific named vaccine, even though most of this group still self-identified as hesitant on the general item (Table 3).

Reasons for vaccine hesitancy

Among the 255 students who self-identified as hesitant, fear of side effects was the most cited reason (68.2%), followed by distrust of vaccines or the health system (19.2%), social media influence (15.7%), family/peer influence (10.2%), and lack of information (9.4%). Cost was cited by 3.1% of hesitant students, while no respondent cited religious or cultural reasons on this checklist item, despite religion emerging as a significant correlate of hesitancy status itself (Table 4).

Correlates of vaccine hesitancy

In bivariate analysis, institution, sex, religion, marital status, perceived importance of vaccination, and being encouraged to refuse vaccination were all significantly associated with self-rated hesitancy (Table 5). Hesitancy was more prevalent at NSUK (75.1%) than FULafia (55.2%; $OR = 2.45$, $p < 0.001$), among male (83.1%) than female (40.9%) students ($OR = 7.11$, $p < 0.001$), among Muslim (88.4%) than Christian (44.6%) respondents ($OR = 9.48$, $p < 0.001$), and among married (90.0%) than single (63.5%) respondents ($OR = 5.18$, $p = 0.001$). Hesitancy declined with increasing perceived importance of vaccination, from 88.8% (low importance) to 64.6% (moderate) to 41.9% (high) (χ^2 trend, $p < 0.001$). Students encouraged by peers/family to refuse vaccination were markedly more likely to be hesitant (86.5% vs. 45.8%; $OR = 7.59$, $p < 0.001$).

In the multivariable model adjusting simultaneously for institution, sex, religion, marital status, encouragement to refuse, and perceived importance of vaccination, institution, religion, and encouragement to refuse remained independently associated with hesitancy, while sex, marital status, and perceived importance were attenuated to non-

significance (Table 6), suggesting that part of their crude associations was confounded by religion and institution.

Table 1: Socio-demographic characteristics of respondents

Characteristic (n = 385)	Category	n (%)
Institution	FULafia	172 (44.7)
	NSUK	213 (55.3)
Age (years)	Mean $\pm$ SD	21.0 $\pm$ 1.7
	Range	18–24
Sex	Male	231 (60.0)
	Female	154 (40.0)
Marital status	Single	345 (89.6)
	Married	40 (10.4)
Level of study	100 Level	77 (20.0)
	200 Level	77 (20.0)
	300 Level	94 (24.4)
	400 Level	75 (19.5)
	500 Level	62 (16.1)
Religion	Christianity	195 (50.6)
	Islam	190 (49.4)
Ethnicity	Hausa	166 (43.1)
	Yoruba	101 (26.2)
	Ibibio	40 (10.4)
	Fulani	32 (8.3)
	Igbo	24 (6.2)
	Igbira	22 (5.7)

Keys: FULafia = Federal University of Lafia; NSUK = Nasarawa State University Keffi; SD = standard deviation

Table 2: Vaccination history and self-rated hesitancy, overall and by institution

Variable (n = 385)	FULafia n (%)	NSUK n (%)	Overall n (%)
Ever received a vaccine (yes)	172 (100.0)	213 (100.0)	385 (100.0)
Ever delayed a vaccine (yes)	58 (33.7)	73 (34.3)	131 (34.0)
Ever refused a vaccine (yes)	77 (44.8)	98 (46.0)	175 (45.5)
Encouraged by peer/family to refuse (yes)	83 (48.3)	110 (51.6)	193 (50.1)
Self-rated hesitant (yes)	95 (55.2)	160 (75.1)	255 (66.2)
Self-rated hesitant (no)	77 (44.8)	53 (24.9)	130 (33.8)

Keys: FULafia = Federal University of Lafia; NSUK = Nasarawa State University Keffi; OR = odds ratio; CI = confidence interval.

Note: FULafia vs. NSUK comparison of self-rated hesitancy: $\chi^2 = 15.95$ (continuity-corrected), $df = 1$, $p < 0.001$; OR = 2.45 (95% CI 1.59–3.77).

Table 3: Prevalence of hesitancy toward specific vaccines

Vaccine (n = 385)	Number examined	%
COVID-19	181	47.0
Hepatitis B	151	39.2
Meningococcal	119	30.9
Td (tetanus-diphtheria)	85	22.1
HPV	75	19.5
Yellow fever	68	17.7
Varicella	57	14.8
Other vaccine	45	11.7
Influenza	22	5.7
No specific vaccine identified	147	38.2

Keys: Td = tetanus-diphtheria; HPV = human papillomavirus.

Note: Categories are not mutually exclusive; respondents could identify hesitancy toward more than one vaccine, so percentages do not sum to 100%. Percentages are based on all 385 respondents.

Table 4: Reasons cited for vaccine hesitancy among hesitant students

Reason (n = 255)	N	%
Fear of side effects	174	68.2
Distrust of vaccines/health system	49	19.2
Social media influence	40	15.7
Family/peer influence	26	10.2
Lack of information	24	9.4
Cost	8	3.1
Religious reasons	0	0.0
Cultural reasons	0	0.0
Other	0	0.0

Note: Denominator is the 255 students self-rated as hesitant; categories are not mutually exclusive.

Table 5: Bivariate correlates of self-reported vaccine hesitancy

Variable (n = 385)	Hesitant, n/N (%)	Crude OR (95% CI)	p-value
Institution: NSUK	160/213 (75.1)	2.45 (1.59–3.77)	<0.001*
Institution: FULafia (ref.)	95/172 (55.2)	1.00	
Sex: Male	192/231 (83.1)	7.11 (4.44–11.39)	<0.001*
Sex: Female (ref.)	63/154 (40.9)	1.00	
Religion: Islam	168/190 (88.4)	9.48 (5.60–16.05)	<0.001*
Religion: Christianity (ref.)	87/195 (44.6)	1.00	
Marital status: Married	36/40 (90.0)	5.18 (1.80–14.89)	0.001*
Marital status: Single (ref.)	219/345 (63.5)	1.00	
Perceived importance: Low	95/107 (88.8)	11.00 (5.26–22.99)	<0.001*
Perceived importance: Moderate	124/192 (64.6)	2.53 (1.50–4.26)	<0.001*
Perceived importance: High (ref.)	36/86 (41.9)	1.00	
Encouraged to refuse: Yes	167/193 (86.5)	7.59 (4.60–12.53)	<0.001*
Encouraged to refuse: No (ref.)	88/192 (45.8)	1.00	

Keys: OR = odds ratio; CI = confidence interval; ref. = reference category; * = $p < 0.05$.

Table 6: Multivariable logistic regression of correlates of vaccine hesitancy

Variable (n = 385)	aOR	95% CI	p-value
Institution: NSUK (vs. FULafia)	2.90	1.72–4.90	<0.001*
Sex: Male (vs. Female)	1.74	0.89–3.40	0.103
Religion: Islam (vs. Christianity)	4.05	1.81–9.04	0.001*
Marital status: Married (vs. Single)	1.36	0.40–4.59	0.623
Encouraged to refuse: Yes (vs. No)	3.68	1.93–7.03	<0.001*
Perceived importance: Low (vs. High)	1.71	0.76–3.84	0.196
Perceived importance: Moderate (vs. High)	1.46	0.73–2.90	0.284

Keys: aOR = adjusted odds ratio; CI = confidence interval; * = $p < 0.05$.

Note: Model: binary logistic regression of self-rated hesitancy (yes vs. no) on institution, sex, religion, marital status, encouragement to refuse vaccination, and perceived importance of vaccination (pseudo- $R^2 = 0.28$).

DISCUSSION

This survey found that two-thirds (66.2%) of undergraduates at FULafia and NSUK self-identified as vaccine hesitant. This estimate is higher than earlier Nigerian university-based figures, such as 48.3% at Ahmadu Bello University, Zaria (Ibrahim et al., 2022) and 57.2% in Lagos State (Adeyemi et al., 2023), and above the approximately 51% pooled

estimate for sub-Saharan Africa (Osei Bonsu et al., 2022), though comparability is limited by differences in the hesitancy measure used across studies (Larson et al., 2014; WHO, 2014).

Hesitancy was significantly more common at NSUK than FULafia (75.1% vs. 55.2%; aOR = 2.90 after adjustment), a pattern that differed in direction from that observed in our earlier small pilot assessment (n

= 50), in which FULafia had appeared more hesitant. This difference illustrates the instability of institutional comparisons drawn from very small samples; the present findings also suggest that campus-level factors such as differences in the local information environment, exposure to vaccination campaigns, or informal peer and religious networks may shape hesitancy independent of individual-level religion and sex (WHO, 2014).

Religious affiliation emerged as one of the strongest independent correlates of hesitancy, with Muslim respondents having about four times the odds of being hesitant compared with Christian respondents after adjustment (aOR = 4.05). This finding is consistent with a substantial body of Nigerian literature documenting the historical role of religious leaders and rumours in shaping vaccine refusal in northern, predominantly Muslim communities, most notably during the 2003–2004 polio vaccination boycotts (Renne, 2006; Jegede, 2007; Yahya, 2007), and with broader evidence that religious leaders can be either powerful barriers or powerful facilitators of vaccine acceptance in sub-Saharan Africa (Oloruntoba et al., 2019). This suggests that engagement with religious leaders and faith-based communication channels may be an especially productive avenue for intervention in this population. Being encouraged by a peer or family member to refuse vaccination was independently associated with more than a three-fold increase in the odds of hesitancy (aOR = 3.68) after adjustment for institution, sex, religion, marital status, and perceived importance, consistent with the recognized role of social networks and complacency within the WHO SAGE confidence-complacency-convenience framework (MacDonald, 2015). Notably, the male–female difference observed in bivariate analysis (83.1% vs. 40.9%) was substantially attenuated after adjustment (aOR = 1.74, $p = 0.103$), suggesting that this crude association was partly confounded by religion and institution rather than reflecting an independent effect of sex per se; this is a more nuanced picture than either our small pilot sample or many single-variable analyses in the literature would suggest (WHO, 2014).

Hesitancy was highest toward the COVID-19 vaccine (47.0%), consistent with the extensive documentation of COVID-19 vaccine hesitancy attributable to the unprecedented speed of vaccine development and heavy circulation of misinformation on social media (Jolley and Douglas, 2014; Roozenbeek et al., 2020; Sallam, 2021). Hesitancy toward the Hepatitis B vaccine was the second most

frequent (39.2%), which may reflect general safety concerns about injectable vaccines (Gallagher et al., 2017) rather than concerns specific to Hepatitis B; comparatively lower hesitancy toward HPV (19.5%) in this sample contrasts with some prior Nigerian evidence of substantial HPV-specific reluctance (Newman et al., 2013; Okunade, 2020). Fear of side effects was the leading reason for hesitancy (68.2% of hesitant students), ahead of distrust (19.2%) or social media influence (15.7%). This pattern differs from other African settings where misinformation and social media exposure are frequently reported as the dominant driver of hesitancy (Mian and Khan, 2020; Apuke and Omar, 2021), and instead points toward experience- or perception-based safety concerns, echoing the established role of adverse-event experience and needle-related fear in shaping vaccine attitudes (Taddio et al., 2012). Notably, no respondent selected religious or cultural reasons on this checklist item even though religious affiliation was one of the strongest statistical correlates of hesitancy status; this apparent discrepancy suggests that religion may operate as a background, network-mediated influence on hesitancy (for example, through religious leaders or community norms) rather than being consciously articulated by respondents as a stated “reason,” and that self-reported reasons for hesitancy should be interpreted as only one layer of a more complex picture. This underscores the importance of transparent, probability-based communication about adverse events following immunization (Bonner et al., 2021) and proactive infodemic management (WHO, 2020) as complementary strategies to faith-based engagement.

This study has some limitations. The cross-sectional design precludes causal inference, and self-administered questionnaires may introduce social desirability or recall bias. Hesitancy was captured with a single self-rated item rather than a validated multi-item scale, precluding calculation of internal-consistency statistics such as Cronbach's alpha. The study was also limited to two public universities in one state, so the findings may not be generalizable to other institutions in Nigeria. Nonetheless, the achieved sample of 385 met the a priori Cochran-based minimum sample size.

CONCLUSION

In this survey, two-thirds of undergraduate students in the two Nasarawa State universities studied self-identified as vaccine hesitant. Institution, Muslim religious affiliation, and encouragement by peers or

family to refuse vaccination were independent correlates of hesitancy, while the apparent sex difference was largely explained by these other factors. Fear of side effects, rather than explicitly stated religious or cultural objections, was the predominant reason cited for hesitancy, which was highest toward the COVID-19 and Hepatitis B vaccines. These findings suggest that interventions combining transparent communication about vaccine safety with active engagement of religious leaders and peer networks, tailored to each institution, may help improve vaccine confidence and uptake in this population.

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Author Contributions

Aliyu Isa Musa: conceptualization, study design, data collection, data analysis, manuscript writing, revision, and final approval. Nkene Haruna Istifanus, Musa Darda'u Tanko and Andekin Maria: data collection, review, and editing. All authors read and approved the final manuscript.

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Data Availability: The de-identified dataset analyzed in this study is available from the corresponding author upon reasonable request.

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