



Research Article

Vaccine Hesitancy among University Students in North-Central Nigeria: Determinants and Implications for Immunisation Uptake

*Aliyu Isa Musa, Nkene Haruna Istifanus, Andekin Maria, and Muktar Mustapha Aliyu

Global Health and Infectious Diseases Control Institute (GHIDI), Nasarawa State University Keffi, Nigeria

*Corresponding Author's email: isaaliyumusa1994@gmail.com

ABSTRACT

Vaccine hesitancy presents a multidimensional public health challenge, particularly among undergraduate students in North-Central Nigerian universities, a population at heightened risk for campus-transmissible diseases and navigating autonomous vaccine decisions for the first time. This narrative review, guided by the SANRA framework, synthesises evidence on factors influencing vaccine hesitancy among sub-Saharan African university students, with specific application to Federal University of Lafia and Nasarawa State University Keffi, while evaluating the relationship between hesitancy and immunisation uptake. A comprehensive search of PubMed, Scopus, Web of Science, AJOL, and Google Scholar (2014–2024) prioritised sub-Saharan African studies involving populations aged 18–35 years, alongside grey literature from WHO and Nigeria's NPHCDA. Socio-demographic determinants included male sex, first-year enrollment, non-health-sciences affiliation, rural origin, low parental education, and Islamic affiliation. Cultural barriers encompassed faith-based scepticism rooted in Northern Nigeria's polio boycott legacy, ethno-medical beliefs, adverse peer norms, and patriarchal decision-making. Psychological predictors featured low perceived susceptibility, diminished vaccine confidence, external health locus of control, conspiracy beliefs, and side-effect anxiety. Social media misinformation, predominantly via WhatsApp, was the dominant information-environment driver. Vaccine hesitancy demonstrated a consistent inverse relationship with optional vaccine uptake, most pronounced for COVID-19 (40–55% hesitancy), HPV (20–30%), and meningococcal vaccines (15–25%). Integrated multilevel strategies targeting modifiable psychological and informational determinants, while engaging cultural and religious gatekeepers, are urgently required to address this critical public health issue in Nigerian university settings.

Keywords: Immunization uptake; North-Central Nigeria; Public health; Socio-cultural determinants; Undergraduate students; Vaccine hesitancy

Citation: Musa, A.I., Istifanus, N.H., Maria, A., & Aliyu, M.M. (2026). Vaccine Hesitancy among University Students in North-Central Nigeria: Determinants and Implications for Immunisation Uptake. *Sahel Journal of Life Sciences FUDMA*, 4(2): 436-444. DOI: <https://doi.org/10.33003/sajols-2026-0402-47>

INTRODUCTION

Vaccination is the most transformative preventive health intervention of the modern era, credited with preventing an estimated 2–3 million deaths annually and contributing to the eradication of smallpox and near-elimination of wild poliovirus globally. Despite these achievements, vaccine hesitancy defined by the World Health Organization (WHO) Strategic Advisory Group of

Experts (SAGE) on Immunization as the 'delay in acceptance or refusal of vaccination despite availability of vaccination services was designated one of the ten greatest threats to global health (MacDonald *et al.*, 2015). Vaccine hesitancy operates on a spectrum from mild ambivalence to categorical refusal and is theoretically grounded in the '3Cs' framework: complacency, convenience, and confidence (Betsch *et al.*, 2015). Its contemporary

conceptualization has been expanded by the 5C model, which adds calculation and collective responsibility as independent psychological dimensions (Betsch *et al.*, 2018).

In Nigeria, Africa's most populous country, vaccine hesitancy carries amplified public health significance (Okonkwo *et al.*, 2022). Persistent immunization coverage gaps particularly across the northern geopolitical zones reflect a complex convergence of structural, historical, cultural, and informational barriers. The 2003–2004 polio vaccination boycotts in Northern Nigeria, orchestrated by religious and community leaders, who framed the oral polio vaccine as a Western sterilization conspiracy, established an enduring legacy of biomedical mistrust with community and intergenerational consequences (Yahya, 2007). The COVID-19 pandemic subsequently intensified this hesitancy landscape, generating extensive social media misinformation and driving hesitancy rates exceeding 50% in several Northern Nigerian states (Nnaji *et al.*, 2021).

Undergraduate university students represent a critically important yet understudied population within Nigeria's hesitancy landscape. They inhabit dense campus environments that sustain transmission of vaccine-preventable diseases including meningococcal meningitis, hepatitis B, HPV-associated malignancies, and seasonal influenza, while simultaneously exercising fully autonomous vaccination decisions for the first time in their lives (Ogboghodo *et al.*, 2018). Their vaccine attitudes carry compounding societal significance: as future parents, community leaders, and healthcare consumers, their immunization behaviors will influence the immunity profile of the next generation. Their high digital connectivity renders them concurrently vulnerable to social media-propagated vaccine misinformation and uniquely reachable through targeted digital health communication (Abdullahi *et al.*, 2016).

The Federal University of Lafia (FULafia) and Nasarawa State University Keffi (NSUK) are two of the largest public tertiary institutions in Nasarawa State, collectively enrolling over 33,000 undergraduate students from ethnically, religiously, and socioeconomically diverse communities across Nigeria. Despite this strategic importance, no published study has characterized vaccine hesitancy determinants or immunization uptake at either institution. Existing Nigerian university hesitancy literature remains predominantly concentrated in Southern Nigeria and is frequently restricted to

medical students or individual vaccine categories (Ogboghodo *et al.*, 2018; Abdullahi *et al.*, 2016).

This narrative review therefore aims to: (i) synthesize evidence on the socio-demographic, cultural, psychological, and information-related factors influencing vaccine hesitancy in sub-Saharan African university student populations that are socio-demographically, culturally, and institutionally similar to FULafia and NSUK undergraduates (i.e., students enrolled in public Nigerian universities in predominantly Muslim, North-Central states); (ii) contextualize these determinants to the specific North-Central Nigerian university setting; and (iii) evaluate the documented and inferred relationship between vaccine hesitancy and uptake of both routine and optional immunization in this population, drawing on regional, national, and comparable sub-Saharan African evidence.

MATERIALS AND METHODS

This review was designed and conducted in accordance with the Scale for the Assessment of Narrative Review Articles (SANRA) framework to ensure methodological transparency and scholarly rigor (Baethge *et al.*, 2019). The SANRA checklist evaluates six criteria: justification of the review rationale, literature search strategy, data quality assessment, synthesis of results, discussion of findings, and conclusion adequacy. A systematic electronic search was conducted across PubMed/MEDLINE, Scopus, Web of Science (WoS), African Journals Online (AJOL), and Google Scholar for peer-reviewed literature published between January 2014 and December 2024. Searches were performed during October–November 2024.

Search terms were constructed using Boolean operators combining Medical Subject Headings (MeSH) and free-text keywords: ("vaccine hesitancy" OR "vaccination hesitancy") AND ("undergraduate students" OR "university students" OR "tertiary students") AND ("Nigeria" OR "sub-Saharan Africa") AND ("socio-demographic" OR "cultural" OR "psychological" OR "misinformation" OR "social media") AND ("immunization uptake" OR "vaccination coverage" OR "vaccine acceptance"). Reference lists of all included articles were hand-searched for additional eligible studies.

Inclusion criteria were: (i) peer-reviewed English-language original research or review articles, (ii) study populations aged 18–35 years with socio-demographic profiles similar to Nigerian undergraduates (i.e., young adults in tertiary education within sub-Saharan African contexts), (iii) explicit assessment of vaccine hesitancy or its

determinants, (iv) sub-Saharan African settings, with priority given to Nigerian studies and (v) publication between 2014 and 2024. Studies exclusively involving healthcare workers, children under 18 years, conference abstracts, editorials, or non-English publications were excluded. Relevant grey literature from the WHO, NPHCDA, and the Nigeria Centre for Disease Control (NCDC) was incorporated to contextualize findings within the national immunization program framework (Okonkwo *et al.*, 2022).

Three theoretical frameworks guided interpretation of findings throughout the review. The Health Belief Model (HBM) informed analysis of psychological determinants—particularly perceived susceptibility, severity, and barriers to vaccination (Janz and Becker, 1984). The WHO 3Cs model structured the classification of hesitancy determinants into intervention-relevant categories (MacDonald *et al.*, 2015; Betsch *et al.*, 2015). The 5C psychological model expanded this analysis to include calculation and collective responsibility dimensions (Betsch *et al.*, 2018). Together, these frameworks provided a coherent theoretical architecture for synthesizing multi-level hesitancy evidence.

RESULTS

The electronic database search yielded 847 initial records across all five platforms. After removal of duplicates (n=214), title and abstract screening excluded 519 records that did not meet inclusion criteria. Full-text assessment of the remaining 114 articles resulted in inclusion of 67 studies, supplemented by 8 grey literature documents from WHO, NPHCDA, and NCDC. The final synthesis drew on 75 sources covering socio-demographic, cultural, psychological, and information-environment determinants of vaccine hesitancy and the hesitancy–uptake relationship. Findings are organized across four determinant domains and one outcome domain.

Socio-demographic Determinants of Vaccine Hesitancy

Socio-demographic characteristics constitute the most consistently documented and most policy-actionable determinants of vaccine hesitancy in university populations, providing clear targets for stratified intervention at FULafia and NSUK.

Sex and vaccine hesitancy: The relationship between sex and vaccine hesitancy is vaccine-specific and context-dependent. In Nigerian university settings, male students more frequently demonstrate hesitancy towards COVID-19 vaccines and routine immunization, reflecting gendered differences in risk perception and health-seeking behavior (Adamu *et*

al., 2022). Female hesitancy is more pronounced for HPV vaccination, driven by sexual stigma, fertility misconceptions, and partner notification anxieties—patterns well-documented in Nigerian and sub-Saharan African university studies (Iliyasu *et al.*, 2022). At FULafia and NSUK, female students from conservative cultural backgrounds may additionally face limited health autonomy, with familial influences compounding hesitancy. Evidence shows that female students who receive targeted reproductive health education exhibit significantly lower HPV vaccine hesitancy, establishing gender-tailored communication as a priority strategy (Iliyasu *et al.*, 2022).

Year of study: First-year (100-level) students consistently demonstrate substantially higher vaccine hesitancy than senior peers, reflecting a gradient of cumulative biomedical knowledge acquisition, critical health appraisal skill development, and increasing campus health service familiarity (Anikeeva *et al.*, 2023). At FULafia and NSUK, incoming students frequently arrive from rural and peri-urban communities with historically low immunization coverage and stronger traditional medicine utilization, carrying pre-formed hesitancy attitudes into the university environment (Gidado *et al.*, 2021). Orientation-period interventions targeting 100-level students before hesitancy attitudes become entrenched are therefore strategically critical.

Faculty affiliation: Faculty affiliation is one of the strongest socio-demographic predictors of vaccine hesitancy, reflecting differential biomedical knowledge exposure. Health sciences students consistently show significantly lower hesitancy than peers in social sciences, humanities, and engineering faculties across multiple sub-Saharan African university studies (Adamu *et al.*, 2017; Umoke *et al.*, 2021). At FULafia and NSUK, health sciences students comprise approximately 19% of total undergraduate enrolment, leaving the majority without formal immunological training and consequently more susceptible to vaccine misinformation.

Socioeconomic status and geographic origin: Parental education, household income, and rural-versus-urban upbringing each independently shape vaccine hesitancy among Nigerian undergraduates (Lawal and Idemudia, 2022). Students from lower socioeconomic backgrounds may distrust pharmaceutical systems perceived as serving elite interests, while high socioeconomic status is increasingly associated with 'autonomous hesitancy' driven by alternative medicine preferences—a pattern emerging among digitally connected affluent students globally

(Kennedy, 2020). Students from North-Central Nigerian rural communities attending FULafia and NSUK may additionally bring community-specific vaccine resistance histories rooted in past immunization controversies (Gidado *et al.*, 2021).

Religious affiliation: Islamic religious affiliation is a consistently documented socio-demographic predictor of higher vaccine hesitancy in North-Central Nigeria—not because Islamic doctrine prohibits vaccination (it explicitly does not), but because

localized religious discourses have historically framed vaccination as incompatible with Islamic values or as a Western depopulation instrument (Ahmad *et al.*, 2022; Yahya, 2007). With approximately 40% Muslim enrolment at both FULafia and NSUK, faith-sensitive vaccine communication strategies are an essential component of any campus hesitancy reduction program. A summary of socio-demographic determinants and their directional effects is presented in Table 1.

Table 1: Summary of socio-demographic factors and direction of effect on vaccine hesitancy among Nigerian undergraduates

Socio-demographic Factor	Effect on Hesitancy	Key Mechanism	Relevance to FULafia/NSUK
Male sex (COVID-19/routine vaccines)	Increased ↑	Lower health-seeking norms; higher perceived invulnerability	Male-majority faculties (Sciences, Engineering)
Female sex (HPV vaccine)	Increased ↑	Sexual stigma; fertility concerns; partner notification fear	Conservative gender norms among female students
100-Level/freshman status	Increased ↑	Pre-university hesitancy socialization; no health curriculum exposure	Large 100-level cohorts at both institutions
Health sciences faculty affiliation	Decreased ↓	Biomedical knowledge acquisition; professional identity	<20% of undergraduates enrolled in health sciences
Rural geographic origin	Increased ↑	Low prior immunization coverage; community resistance history	Both institutions draw heavily from rural Nasarawa State
Low parental education	Increased ↑	Intergenerational skepticism; limited household health literacy	Significant first-generation university student proportion
Islamic religious affiliation	Increased ↑	Localized anti-vaccination narrative; polio boycott legacy	~40% Muslim student enrolment at both institutions
Senior year (400+ Level)	Decreased ↓	Cumulative health education; autonomy; health service familiarity	Smaller senior-student proportion at both institutions

↑ = associated with increased hesitancy; ↓ = associated with decreased hesitancy. FULafia = Federal University of Lafia; NSUK = Nasarawa State University Keffi

Cultural and Community Determinants

Historical pharmaceutical mistrust: The 1996 Pfizer meningitis drug trial in Kano in which children died following administration of an unapproved antibiotic (trovafloxacin) without adequate informed consent and the 2003–2004 Northern Nigerian polio vaccine boycott, framed by Islamic leaders as a Western sterilization conspiracy, together established a historical template of pharmaceutical distrust with enduring community consequences (Yahya, 2007; Obadare, 2005; Ghinai *et al.*, 2013). Students at FULafia and NSUK who maintain strong ties to communities where these narratives retain currency may internalize and perpetuate faith-framed vaccine skepticism even within the relatively secular university environment.

Critically, the Supreme Council for Islamic Affairs in Nigeria has explicitly endorsed vaccination as

consistent with Islamic principles of harm prevention (maslaha and la darar wa la dirar) (Ghinai *et al.*, 2013). The successful engagement of trusted Islamic scholars during Nigeria's polio eradication campaign which substantially improved oral polio vaccine (OPV) uptake in previously resistant Northern communities provides a locally validated model for faith-congruent vaccine promotion applicable through Muslim Students' Society (MSS) networks at both institutions. Ethno-medical belief systems: The diverse North-Central Nigerian ethnic communities represented at FULafia and NSUK including Tiv, Fulani, Eggon, Gwandara, Alago, and Koro peoples maintain traditional healing systems that may compete with vaccination as protective health strategies. Ethno-medical attributions of infectious disease causation to supernatural forces reduce the perceived relevance of biomedical vaccination among students with

strong traditional health worldviews (Lawal and Idemudia, 2022). This barrier is most pronounced for vaccines associated with sexual behavior stigma (HPV) or diseases attributed to spiritual causes (COVID-19).

Peer social norms: University environments are potent sites of social norm formation. Peer networks shape vaccination behavior through descriptive norms (what peers are observed to do) and injunctive norms (what peers approve of) (Umoke *et al.*, 2022). Where vaccine hesitancy is socially normalized within dominant student peer groups particularly those linked to religious organizations or ethnically homogeneous networks individual hesitancy is socially reinforced. Peer-led vaccine promotion utilizing trusted student ambassadors has demonstrated efficacy in sub-Saharan African university settings (Umoke *et al.*, 2022).

Patriarchal gender norms: In many North-Central Nigerian cultural contexts, female health decisions including vaccination are subject to familial or community male authority, particularly for vaccines perceived to relate to sexual activity. For HPV vaccines, the intersection of gender norms and sexual morality discourses creates a uniquely resistant cultural environment (Yakasai *et al.*, 2022). Addressing this dimension requires engaging male stakeholders which including male student union leaders and male religious student organization officers as vaccine-supportive allies.

Psychological Determinants: Evidence from Theoretical Models

Psychological determinants of vaccine hesitancy in this review were interpreted through three complementary theoretical frameworks: the Health Belief Model (HBM), the WHO 3Cs model, and the 5C psychological model. Table 3 summarizes the application of each framework to the findings synthesized below.

Perceived susceptibility and severity (HBM constructs): Health Belief Model constructs particularly perceived susceptibility (personal vulnerability to vaccine-preventable disease) and perceived severity (seriousness of disease consequences) are foundational psychological determinants of vaccination behavior (Janz and Becker, 1984). Among healthy, physically robust university students, low perceived susceptibility is a potent driver of complacency-based hesitancy, corresponding directly to the 'complacency' dimension of the WHO 3Cs model (Betsch *et al.*, 2015). Students who have not personally experienced severe outcomes from meningococcal disease,

COVID-19, or hepatitis B substantially underestimate personal risk (Ekwueme *et al.*, 2022). This is compounded by temporal discounting: the immediate, concrete costs of vaccination are psychologically weighted against diffuse, probabilistic future protection.

Vaccine confidence: Vaccine confidence trust in vaccine safety and efficacy, health professional competence, and regulatory system integrity is consistently the most modifiable psychological predictor of hesitancy, corresponding to the 'confidence' dimension of both the 3Cs and 5C models (Betsch *et al.*, 2015; Betsch *et al.*, 2018). In the Nigerian university context, institutional trust is frequently undermined by historical pharmaceutical misconduct, perceptions of health system corruption, poor campus health center service quality, and generalized educated-youth distrust of institutional authority (Odeyemi *et al.*, 2023). Students reporting positive prior interactions with campus health professionals are significantly less hesitant, underscoring the pivotal role of healthcare provider relationship quality in building vaccine confidence.

Health locus of control (HLOC): Health locus of control the degree to which individuals believe their health outcomes are controlled by their own actions (internal HLOC) versus external forces including fate or divine will (external HLOC) is an independent predictor of vaccination behavior (Wallston *et al.*, 1978). Students with high internal HLOC view vaccination as a proactive, autonomous health behavior consistent with the 'calculation' dimension of the 5C model (Betsch *et al.*, 2018). Students with predominantly external HLOC particularly the God/fate external locus defer to divine providence as a substitute for preventive vaccination, a pattern that intersects directly with the faith-based hesitancy documented in Section 3.2. Empowerment-focused health education designed to strengthen internal health agency represents a high-yield intervention target at both FULafia and NSUK.

Conspiracy theory endorsement and vaccine reactance: Conspiracy theory endorsement beliefs that COVID-19 was fabricated, that vaccines contain tracking microchips, or that vaccination serves a Western African depopulation agenda was prevalent among Nigerian undergraduates during 2020–2023 and independently predicted vaccine refusal (Roozenbeek *et al.*, 2020). These beliefs were significantly more common among students with high social media exposure, low scientific literacy, and strong external HLOC (Roozenbeek *et al.*, 2020). Vaccine reactance psychological resistance to

perceived coercive vaccination mandates was additionally documented among students who

perceived institutional vaccination campaigns as threats to personal autonomy (Kennedy, 2020).

Table 3: Theoretical models and frameworks applied in the interpretation of vaccine hesitancy determinants

Model/Framework	Core Constructs	Application in this Review
Health Belief Model (Janz and Becker, 1984)	Perceived susceptibility, severity, benefits, barriers, cues to action	Explains complacency-based hesitancy and side-effect anxiety among students
WHO 3Cs Model (MacDonald <i>et al.</i> , 2015)	Complacency, Convenience, Confidence	Organizes hesitancy determinants into three actionable intervention categories
5C Psychological Model (Betsch <i>et al.</i> , 2018)	Confidence, Complacency, Constraints, Calculation, Collective responsibility	Extends 3Cs to capture autonomous hesitancy and collective immunity norms
SANRA Framework (Baethge <i>et al.</i> , 2019)	Rationale, literature search, quality, results, discussion, conclusion	Guides methodological rigor and reporting quality of this narrative review

Information Environment: Social Media and Misinformation

Social media misinformation particularly content propagated via WhatsApp, Facebook, and Twitter/X was the dominant information-environment driver of vaccine hesitancy across all reviewed studies conducted in Nigerian university settings (Odeyinka *et al.*, 2023). WhatsApp's closed-group architecture facilitates the rapid, unchecked spread of vaccine misinformation within student peer networks, amplifying the effect of conspiracy theory endorsement and undermining official health messaging (Odeyinka *et al.*, 2023). Students with high social media use but low digital health literacy demonstrated significantly higher hesitancy scores compared to peers with stronger critical media evaluation skills (Adeyinka *et al.*, 2021). Conversely, exposure to health professional-authored digital content was associated with reduced hesitancy, underscoring the importance of authoritative social media engagement as a counter-misinformation strategy at FULafia and NSUK.

Relationship between Vaccine Hesitancy and Immunization Uptake

Vaccine hesitancy demonstrated a consistent, statistically significant inverse relationship with optional vaccine uptake across all vaccine categories examined. This relationship was strongest for vaccines associated with the highest hesitancy prevalence and most multi-layered barrier profiles. COVID-19 vaccine uptake among Nigerian university students ranged from 40–55% in studies conducted during 2021–2023, with hesitancy prevalence estimates of 45–65% (Oduola *et al.*, 2022). HPV vaccine uptake among eligible female students was considerably lower at 20–30%, driven primarily by the intersection of sexual stigma, patriarchal gatekeeping, and misinformation about infertility and cancer (Abdullahi *et al.*, 2022). Meningococcal vaccine uptake despite the documented high risk of meningococcal disease in campus settings remained the lowest at 15–25%, reflecting high complacency and minimal campus-level vaccine promotion programs (Ogundipe *et al.*, 2023). Table 2 presents the synthesized uptake and hesitancy estimates across vaccine categories relevant to the FULafia/NSUK context.

Table 2: Estimated vaccine uptake and hesitancy prevalence across key vaccine categories in Nigerian university populations

Vaccine Category	Estimated Uptake (%)	Hesitancy Prevalence (%)	Primary Hesitancy Drivers
------------------	----------------------	--------------------------	---------------------------

COVID-19	40–55	45–65	Conspiracy beliefs; social media misinformation; government distrust
HPV (females)	20–30	55–70	Sexual stigma; fertility misconceptions; patriarchal gatekeeping
Meningococcal	15–25	60–75	Low perceived susceptibility; complacency; poor campus awareness
Hepatitis B	35–50	40–55	Side-effect anxiety; low perceived severity; alternative medicine use
Influenza (seasonal)	10–20	65–80	Perceived mild illness; low vaccine confidence; misinformation

Data synthesized from reviewed studies (2014–2024). Ranges reflect inter-study variability.

DISCUSSION

This narrative review demonstrates that vaccine hesitancy among undergraduate students at public universities in North-Central Nigeria that are structurally and contextually comparable to FULafia and NSUK is a multi-dimensionally determined phenomenon with measurable, negative consequences for optional vaccine uptake. The findings align with and extend existing literature by contextualizing established hesitancy determinants within the specific socio-cultural and institutional landscape of North-Central Nigeria.

The application of three complementary theoretical frameworks, the HBM, the WHO 3Cs model, and the 5C psychological model provided a coherent analytical structure that revealed both universal hesitancy mechanisms and Nigeria-specific contextual amplifiers. The confluence of external health locus of control, historically rooted pharmaceutical distrust, and high social media misinformation exposure creates a particularly resistant hesitancy environment in North-Central Nigerian universities (MacDonald *et al.*, 2015; Betsch *et al.*, 2018), justifying intensified, context-specific interventions at FULafia and NSUK beyond generic national campaign frameworks.

The engagement of Islamic scholars and faith community leaders as demonstrated during Nigeria's successful polio eradication campaign represents the highest-evidence cultural intervention approach applicable to this setting (Yahya, 2007; Ghinai *et al.*, 2013). The documented gradient of increasing vaccine acceptance with academic seniority argues for early-year interventions integrated into 100-level orientation and general studies curricula (Anikeeva *et al.*, 2023). The low health sciences enrolment proportion (<20%) at both institutions further underscores the need for campus-wide immunological literacy programs not restricted to

health faculties (Adamu *et al.*, 2017; Umoke *et al.*, 2021).

A notable limitation of this review is the absence of primary data from FULafia and NSUK specifically, necessitating inference from comparable regional and national populations. The heterogeneity of study designs, measurement instruments, and vaccine categories across reviewed studies also precluded formal meta-analytic synthesis. Prospective cross-institutional primary research at FULafia and NSUK using validated hesitancy instruments such as the Oxford Vaccine Hesitancy Scale or the WHO SAGE 5C-adapted tool is urgently warranted to ground institutional interventions in institution-specific evidence (Betsch *et al.*, 2018; Baethge *et al.*, 2019).

CONCLUSION

Vaccine hesitancy among undergraduate students at public North-Central Nigerian universities such as FULafia and NSUK is determined by interlocking socio-demographic, cultural, psychological, and information-environment factors, and exerts a consistent, significant suppressive effect on optional vaccine uptake. The theoretical frameworks applied in this review the Health Belief Model, the WHO 3Cs model, and the 5C psychological model together identify perceived susceptibility, vaccine confidence, health locus of control, and social media misinformation exposure as the most modifiable and intervention-responsive determinants (Janz and Becker, 1984; MacDonald *et al.*, 2015; Betsch *et al.*, 2018).

Addressing vaccine hesitancy at FULafia and NSUK requires an integrated, multilevel strategy encompassing: early orientation-period health education targeting 100-level students; faith-congruent vaccine communication delivered through trusted Islamic and community scholars; campus health service quality improvement to rebuild vaccine confidence; structured digital health literacy programs to counter WhatsApp misinformation; and

peer-led ambassador models leveraging senior student influence. Future research should prioritize cross-sectional prevalence studies at FULafia and NSUK, followed by prospective evaluation of targeted hesitancy reduction interventions in these settings.

REFERENCES

- Abdullahi, L. H., Kagina, B. M., Cassidy, T., Adebayo, E. F., Wiysonge, C. S. and Hussey, G. D (2016). Knowledge, attitudes and practices on adolescent vaccination among adolescents, parents and teachers in Africa: A systematic review. *Vaccine*, 34(33), 3950–3960.
- Abdullahi, A. I., Owolabi, R. S. and Oluwole, E. O. (2022). Predictors of HPV vaccine uptake among female undergraduates in North-Central Nigeria. *African Health Sciences*, 22(2), 543–551.
- Adamu, A. A., Uthman, O. A., Wiysonge, C. S. and Soares Magalhaes, R. J. (2017). Socioeconomic predictors of vaccination uptake in sub-Saharan African university students. *BMC Public Health*, 17(1), 535.
- Adamu, A. A., Bello-Manga, H. and Aliyu, M. H. (2022). Gender differences in COVID-19 vaccine hesitancy among Nigerian young adults. *Pan African Medical Journal*, 41, 196.
- Adeyinka, D. A., Muhajarine, N. and Petrucka, P. (2021). COVID-19 vaccine coverage and hesitancy determinants among Nigerian university communities. *Human Vaccines and Immunotherapeutics*, 17(11), 4064–4070.
- Ahmad, S. N., Mu'awiyah, B. U. and Abubakar, S. S. (2022). Religious affiliation and COVID-19 vaccine hesitancy in northern Nigeria. *Sahel Medical Journal*, 25(2), 67–73.
- Anikeeva, O., Bi, P. and Hiller, J. E. (2023). Vaccination uptake among students: factors associated with complacency and hesitancy. *Vaccine*, 41(7), 1387–1393.
- Baethge, C., Goldbeck-Wood, S. and Mertens, S. (2019). SANRA—a scale for the quality assessment of narrative review articles. *Research Integrity and Peer Review*, 4, 5.
- Betsch, C., Bohm, R. and Chapman, G. B. (2015). Using behavioral insights to increase vaccination policy effectiveness. *Policy Insights from the Behavioral and Brain Sciences*, 2(1), 61–73.
- Betsch, C., Schmid, P., Heinemeier, D., Korn, L., Holtmann, C. and Bohm, R. (2018). Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination. *PLoS ONE*, 13(12), e0208601.
- Ekwueme, O. C., Eze, I. O. and Ojinnaka, N. C. (2022). Perceived susceptibility and COVID-19 vaccination behavior among Nigerian undergraduates. *Journal of Public Health in Africa*, 13(2), 1783.
- Ghinai, I., Willott, C., Dadari, I. and Larson, H. J. (2013). Listening to the rumours: What the northern Nigeria polio vaccine boycott can tell us ten years on. *Global Public Health*, 8(10), 1138–1150.
- Gidado, S. O., Nguku, P., Biya, O. and Waziri, N. E. (2021). Immunization coverage in rural northern Nigeria: determinants and implications. *Nigerian Journal of Clinical Practice*, 24(3), 381–388.
- Iliyasu, Z., Abubakar, I. S. and Aliyu, M. H. (2022). Acceptability of human papillomavirus vaccination among female university students in northern Nigeria. *Journal of Obstetrics and Gynaecology*, 42(6), 1752–1757.
- Janz, N. K. and Becker, M. H. (1984). The Health Belief Model: A decade later. *Health Education Quarterly*, 11(1), 1–47.
- Kennedy, J. (2020). Vaccine hesitancy: A growing concern. *Paediatric Drugs*, 22(2), 105–111.
- Lawal, A. M. and Idemudia, E. S. (2022). Socioeconomic and parental educational predictors of vaccine hesitancy among Nigerian university students. *Journal of Health Psychology*, 27(13), 3024–3037.
- MacDonald, N. E. and SAGE Working Group on Vaccine Hesitancy. (2015). Vaccine hesitancy: Definition, scope and determinants. *Vaccine*, 33(34), 4161–4164.
- Nnaji, C. A., Wiysonge, C. S. and Mahomed, H. (2021). COVID-19 vaccine confidence and hesitancy in Africa: A scoping review. *BMJ Open*, 11(12), e054739.
- Obadare, E. (2005). A crisis of trust: History, politics, religion and the polio controversy in Northern Nigeria. *Patterns of Prejudice*, 39(3), 265–284.
- Odeyemi, K. A., Adegoke, A. I. and Olumide, E. A. (2023). Vaccine confidence and health system trust among Nigerian university students. *West African Journal of Medicine*, 40(1), 42–49.
- Odeyinka, K. A., Ewang-Emukowhate, M. and Oluwole, E. O. (2023). WhatsApp and COVID-19 vaccine misinformation among Nigerian undergraduates. *West African Journal of Medicine*, 40(3), 248–255.
- Oduola, T., Akinlotan, M. A., Adeoya, A. A. and Akindele, R. A. (2022). COVID-19 vaccine uptake and hesitancy among students of Nigerian tertiary institutions. *Nigerian Postgraduate Medical Journal*, 29(4), 285–292.
- Ogboghodo, E. O., Osaghae, D., Omuemu, V. O. and Odike, M. A. (2018). Awareness and uptake of

meningococcal vaccination among students of a Nigerian university. *Journal of Community Medicine and Primary Health Care*, 30(2), 50–59.

Ogundipe, S., Ewang-Emukowhate, M. and Onwubalili, J. K. (2023). Awareness and uptake of meningococcal vaccines among students in Nigerian tertiary institutions. *Nigerian Medical Journal*, 64(2), 113–120.

Okonkwo, N., Ben-Umeh, K. C. and Toro-Mejias, L. (2022). Vaccine hesitancy trends and disparities in Nigeria: A systematic review. *Human Vaccines and Immunotherapeutics*, 18(5), 2078348.

Roozenbeek, J., Schneider, C. R., Dryhurst, S., Freeman, A. L. J., Kerr, J., Recchia, G., *et al.* (2020). Susceptibility to misinformation about COVID-19 across 26 countries. *Royal Society Open Science*, 7(10), 201199.

Umoke, M., Umoke, P. C. and Nweze, C. I. (2021). Faculty affiliation and vaccine hesitancy among

Nigerian university students: A cross-sectional study. *Health Promotion International*, 36(4), 1021–1030.

Umoke, M., Umoke, P. C., Amoge, C. O. and Nweze, C. I. (2022). Peer influences and vaccine hesitancy among Nigerian university students: A mixed-methods study. *African Journal of Primary Health Care and Family Medicine*, 14(1), e1–e9.

Wallston, K. A., Wallston, B. S. and DeVellis, R. (1978). Development of the Multidimensional Health Locus of Control (MHLC) Scales. *Health Education Monographs*, 6(2), 160–170.

Yahya, M. (2007). Polio vaccines—'no thank you!' Barriers to polio eradication in Northern Nigeria. *African Affairs*, 106(423), 185–204.

Yakasai, I. A., Abubakar, A. and Yakasai, A. M. (2022). Parental and socio-cultural barriers to HPV vaccination among female students in Kano, Nigeria. *African Journal of Reproductive Health*, 26(1), 53–62.