



COVID-19 Vaccine Uptake and Hesitancy amongst University Students in a Tertiary Institution in Edo State, Nigeria

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ABSTRACT: Hesitancy among various population groups, including young university students, is a significant challenge to maximising vaccination benefits, including the promotion of educational activities. However, there is a paucity of epidemiological evidence on COVID-19 hesitancy among this young population. Therefore, the objective of this paper is to describe the COVID-19 vaccine uptake and hesitancy amongst University students in a Tertiary Institution in Edo State, Nigeria, using appropriate standard methods with 677 students participating in this study from December 2021 to January 2023. Students aged 18-22 accounted for the highest proportion of the study participants at 71.1%, and the proportion of male students was slightly higher than that of female students (52.4% vs 47.6%). Only 9.2% of the 677 students had ever taken the COVID-19 vaccine prior to the study. However, 615 responded to whether they would be willing to take the COVID-19 vaccine if made available, of which 68.3% (420/615) reported hesitancy. The common reasons cited by hesitant students (n=420) were the ineffectiveness of the vaccine against severe clinical outcomes (46.0%; 193/420), unavailability of the vaccine (29.5%; 124/420), and other reasons such as fear and rumoured side effects (14.5; 61/420). In conclusion, COVID-19 vaccine uptake and hesitancy among students in the study population were low and high, respectively, underlining the need for context-specific COVID-19 vaccination campaigns.

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Following the identification of SARS-CoV-2 as the causative agent of COVID-19 in December 2019, the virus rapidly spread throughout the globe leading to the World Health Organization (WHO) declaring a Pandemic in mid-March 2020 (World Health Organization, 2023). In Nigeria, the index case of the disease was recorded in February 2020. By ending of March of the same year, most countries, including Nigeria, had implemented diverse pandemic control measures, which included lockdowns (Haider *et al.*, 2020). This led to the closure of all institutions in Nigeria, with a view to protecting lives and university communities (students and staff) from the deadly virus. However, the closures had several effects on students and staff, not only directly but through many other sectors that are indirectly related to educational institutions. Further justifying the university closure is

the evidence that increased transmission of SARS-CoV-2 in crowded and confined indoor spaces is directly associated with higher infection rates (Perera *et al.*, 2020). Additionally, demographic shifts, high population densities, and population mobility impact the spread of infectious diseases (Bengtsson *et al.*, 2015; Chinazzi *et al.*, 2020). The return of university students to in-person and hybrid (in-person and online) learning in October 2020 during the COVID-19 pandemic represented a massive demographic shift in many communities in Nigeria. Specifically, the increased proportion of persons living in high-density living facilities resulted in a concomitant increase in person-to-person interactions (Leidner *et al.*, 2021). This shift had the potential to increase SARS-CoV-2 transmission in returning students and to surrounding communities, particularly for off-campus where

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COVID-19 incidence increased in larger population centres (Leidner *et al.*, 2021). Moreover, modelling analyses conducted prior to student return raised concerns that university re-opening would result in significant SARS-CoV-2 transmission in both the returning student and community resident population (Leidner *et al.*, 2021). To put this into context, Nigeria, with a population of over 200 million, recorded about 300,000 confirmed cases of COVID-19 and about 3,200 deaths as of September 2022. Despite the rapid scale-up of the molecular laboratory network across the country, Nigeria lagged behind other countries' COVID-19 testing rates. Difficulty in reagent procurement, insufficient reagents and equipment led to low testing rates. In addition, there were few molecular laboratories in the country and testing hesitancy due to the stigma around COVID-19. The initial low testing rate and targeted testing strategy likely contributed to the true rate of SARS-CoV-2 infection being under-reported in Nigeria (Elimian *et al.*, 2020). Given the close proximity of many university students living in high-density residential housing and their extensive connected social networks compared to the general population, the potential for the rapid spread of SARS-CoV-2 in university settings is of concern. In this context, understanding the uptake and hesitancy towards preventive measures, such as the COVID-19 vaccine, is of paramount public health importance. Vaccination hesitancy is a complex global public health problem that varies across cultures, times, places, and vaccine types (Galagali *et al.*, 2022). Consequently, the phenomenon has significantly delayed the vaccine coverage rate and the attendant attainment of herd immunity necessary to extinguish the COVID-19 pandemic. For example, the COVID-19 vaccine acceptance rate across the six geopolitical zones in Nigeria was estimated to range from 20.0% to 58.2% among adults, while only a few studies provide specific information about vaccine uptake, potential acceptance and hesitancy among students in the university in the country (Mustapha *et al.*, 2021; Njoga *et al.*, 2022; Olawade *et al.*, 2022; Olu-Abiodun *et al.*, 2022; Onwe *et al.*, 2022; Uzochukwu *et al.*, 2021). Therefore, the objective of this paper is to describe the COVID-19 vaccine uptake and hesitancy among University students in a Tertiary Institution in Edo State, Nigeria.

MATERIALS AND METHODS

Study setting: This study was conducted at the University of Benin, South-South Nigeria. The university is one of the largest in Nigeria, with an average student population of 77,000 across its two campuses (Ugbowo and Ekenwan). However, participants for this study were recruited at the main campus in Ugbowo.

Study design: A cross-sectional design and it was reported according to the STROBE checklist.

Sampling approach and sample size estimation: We adopted a systematic sampling approach to recruit the study participants. Based on pragmatic considerations, the sampling approach involved determining the sampling interval based on consensus rather than statistics, wherein the total population size is divided by the estimated sample size. We subsequently commenced sampling at a strategic starting point within the campus (e.g., entrance gates and hostel common areas), and approached every fifth student for study eligibility review. In the case of ineligibility, the sampling approach was repeated

This study was part of a larger study which aimed at understanding the epidemiology of COVID-19 among university students; thus, the larger study formed the basis for sample size estimation per the formula below:

$$n = \frac{3.84\pi(1 - \pi)}{W^2}$$

Where n=sample size; w=precision (confidence interval); and π =COVID-19 seroprevalence. We assumed the seroprevalence of COVID-19 among university students in the study to be 20% ($\pi=0.2$). We wanted to estimate the sample size to be within 2.5% ($w=0.025$) with 95% certainty, resulting in a sample size of 983. However, considering a 10% non-contingency to make up for non-response, the final estimated sample size was 1,091, approximated to 1,000 students, given financial and time constraints.

Study participants and data collection: Students who were willing to sign an informed consent and aged 18 years or older were eligible for this study. Previous COVID-19 infection status, presence of COVID-19 symptoms, or vaccination status were not considered. Students who were unwilling to consent to the study or reported the potential to experience difficulty in providing samples were ineligible for the study. Ethical approval was obtained from the University of Benin Ethics Research Committee (reference number: CMS/REC/01/VOL.2/247) before the study commenced. Additionally, we received formal approval from the Vice-Chancellor's office to conduct the study. We explained the study's purpose to all the study participants before seeking informed consent and ensured anonymity and confidentiality were maintained throughout. Prior to commencing data collection, research assistants were trained for three days. on the study protocol, data collection techniques, standard operating procedures for sample collection,

ethical considerations, and completion of the Nigeria CDC case report form (mandatory for all COVID-19-related research) using a combination of physical and online platforms. We piloted the study questionnaire with 20 students to assess its comprehensibility and timeliness of administration. All identified gaps (e.g., making some questions mandatory) were addressed before commencing data collection.

Each systematically selected student was approached and informed about the study objective, including ethics, the requirement for blood samples for serological tests, and information on socioeconomic data. Following screening for eligibility, those who met the study’s predefined inclusion criteria were recruited into the study. After completing the consent form, with the opportunity to ask questions as needed, data were collected at two points. Firstly, a questionnaire on socioeconomic, clinical data and willingness to receive the COVID-19 vaccine, if made available to them (i.e., vaccine hesitancy), was administered to the student by a trained data collector. Data collection was conducted in English language. We collected data in two phases due to the 8-month industrial strike by the Academic Staff Union of Universities (ASUU), which resulted in the closure of universities nationwide. First, we commenced data collection in December 2021, stopped in February 2022 due to the ASUU strike, and resumed data collection in October 2022 until the study ended in January 2023.

Data management and analyses: Data management and statistical analyses were performed using Stata version 16 (College Station, TX: StataCorp LLC). We used the 'missing indicator' approach to handle missing data, which is epidemiologically more robust than the complete case analysis. Descriptive statistics (frequencies and percentages for binary/categorical variables; and mean and standard deviation (SD) for normally distributed continuous variables) were used to summarise the students' baseline characteristics. The outcome variable was COVID-19 vaccine hesitancy, defined as the refusal or delay to take the COVID-19 vaccine if it were made available. It was coded as a binary variable (0 for 'No' and 1 for 'Yes'). We determined the prevalence of vaccine hesitancy using proportions with 95% Confidence Intervals (CIs). Another outcome variable explored was COVID-19 vaccine uptake, defined as a report of previous vaccination (yes/no).

RESULTS AND DISCUSSION

Baseline characteristics of the study participants: Six hundred and seventy-seven students were recruited into this study between December 2021 and January

2023 Table 1. Students aged 18-22 accounted for the highest proportion of the study participants at 71.1%. The proportion of male students was slightly higher than that of female students (52.4% vs 47.6%). The majority of the students had normal weight (67.4%), identified as Christians (97.8%), and received in a month an average stipend of over ₦10,000 (61.5%). Students from the Faculty of Life Sciences accounted for the highest proportion of the study participants at 22.3%, seconded by those from the Faculty of Engineering and Physical Sciences at 19.1%. Regarding residency while in school, about three-quarters (77.7%) of the student were residing off-campus, while over half of them (58.1%) described their accommodation as self-contained off-campus.

The most common mode of movement or transportation during studies was walking (36.3%), followed by bus or tricycle (colloquially referred to as 'keke'). Only about 22% of the students were very concerned about contracting COVID-19, while the majority of them (61.2%) reported being uncomfortable wearing a face mask as a preventive measure against COVID-19 infection. Only 10% (70/677) of the students reported having at least one comorbidity or medical condition. The most commonly reported clinical signs and symptoms in the past seven days prior to data collection were headache (26.0%), cough (11.8%), and runny nose (11.5%).

Table 1: Baseline characteristics of the study participants (N=677)

Characteristic	Frequency (%)
<i>Sociodemographic characteristics</i>	
Mean (SD) age, year	21.5 (2.7)
Age group, year	
18-22	481 (71.1)
23-27	184 (27.2)
≥28	12 (1.8)
Sex	
Female	322 (47.6)
Male	355 (52.4)
BMI	
Normal weight	456 (67.4)
Underweight	83 (12.3)
Overweight	91 (13.4)
Obese	47 (6.9)
Religion	
Christianity	662 (97.8)
Islam	10 (1.5)
Others	5 (0.7)
Setting of residence (during holidays)	
Urban	601 (88.8)
Rural	76 (11.2)
State of residence (during holidays)	
Edo	344 (50.8)
Other States by region	
South-South	104 (15.4)
South-East	22 (3.3)
South-West	187 (27.6)
North-Central	17 (2.5)
North-East	1 (0.2)
North-West	2 (0.3)

Average monthly stipend (pocket money)	
≤₦5,000	80 (11.8)
₦6,000-₦10,000	181 (26.7)
>₦10,000	416 (61.5)
Institutional characteristics	
Faculty	
Life Sciences	151 (22.3)
Education and Centre for Entrepreneurship Development	116 (17.1)
Engineering and Physical Sciences	129 (19.1)
Social Sciences, Arts and Law	83 (12.3)
Agriculture	87 (12.9)
Medicine, Basic Medical Sciences, and Pharmacy	52 (7.7)
Management and Environmental Sciences	59 (8.7)
Year of study	
Year 1	144 (21.3)
Year 2	167 (24.7)
Year 3	175 (25.9)
Year 4	166 (24.5)
Year 5 or higher	25 (3.7)
Accommodation type	
Self-contained (off-campus)	393 (58.1)
Shared apartment (off-campus)	133 (19.7)
School hostel (on-campus)	151 (22.3)
Share facility (bathroom and toilet) in accommodation	
No	253 (37.4)
Yes	424 (62.6)
Primary mode of transportation in school	
Walking	246 (36.3)
Bus/tricycle	178 (26.3)
Private taxi	108 (16.0)
Mixed	145 (21.4)
<i>COVID-19 preventive measures and lifestyle related to wellbeing</i>	
Relative or friend infected with COVID-19	
No	609 (90.0)
Yes	68 (10.0)
Able to maintain physical distance (at least 2m) from schoolmates	
No	497 (73.4)
Yes	180 (26.6)
Comfort in wearing a face mask at school	
No	414 (61.2)
Yes	263 (38.9)
Concern about contracting COVID-19	
Extremely or very concern	151 (22.3)
Moderately or somewhat concern	278 (41.1)
Not at all concerned	248 (36.6)
Frequency of religious gathering attendance in a week	
>Twice	198 (29.3)
Twice	174 (25.7)
Once	276 (40.8)
Never	29 (4.3)
Clinical characteristics	
Existing comorbidity or medical condition	
No	607 (89.7)
Yes	70 (10.3)
Signs and symptoms in the past 7 days before the study	

Sore throat	47/677 (6.9)
Cough	80/677 (11.8)
Shortness of breath	29/677 (4.3)
Chills	15/677 (2.2)
Runny nose	78/677 (11.5)
Vomiting	2/677 (0.3)
Nausea	21/677 (3.1)
Diarrhoea	14/677 (2.1)
Headache	176/677 (26.0)
Rash	7/677 (1.0)
Muscle aches	39/677 (5.8)
Joint aches	22/677 (3.3)
Loss of appetite	40/677 (5.9)
Fatigue	108/677 (16.0)

Table 2: Description of students' COVID-19 vaccination status

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Characteristic	Frequency (%)
Ever taken COVID-19 vaccine (n=677)	
No	615 (90.8)
Yes	62 (9.2)
Reason for taking COVID-19 vaccine (n=62)	
Travel purposes	15 (24.2)
Protection/immunity	24 (38.7)
Public health policy in the state of residence	9 (14.5)
Family/friend recommendation	12 (19.4)
Felt like taking it	2 (3.2)
COVID-19 vaccine dose (n=62)	
First	34 (54.8)
Second	28 (45.2)
Name of COVID-19 vaccine first dose (n=34)	
AstraZeneca	14 (41.2)
Johnson & Johnson	5 (14.7)
Moderna	8 (23.5)
Pfizer	2 (5.9)
I can't remember	5 (14.7)
Name of COVID-19 vaccine second dose (n=28)	
AstraZeneca	13 (46.4)
Johnson & Johnson	3 (10.7)
Moderna	7 (25.0)
Pfizer	2 (7.1)
I can't remember	3 (10.7)

Description of students' COVID-19 vaccination status: Of the 677 students asked if they had ever taken the COVID-19 vaccine, only 9.2% (62/677) responded in the affirmative. The most commonly cited reason for taking the COVID-19 vaccine among these 62 students were for immunity against SARS-CoV-2 infection (38.7% of 62), international travel purposes (24.2% of 62), and recommendation by family members or friends (19.4% of 62); the least reason for taking the vaccine reported as 'feeling like taking the vaccine' (3.2% of 62). Of the 62 students who had taken the vaccine, slightly above half had received the first dose (54.8% of 62), while 45.2% had taken the second dose. AstraZeneca vaccine was the most common vaccine product received by the study participants in both the reported first (41.2% of 34) and second (46.4% of 28) doses.

COVID-19 vaccine hesitancy and its reasons: Six hundred and fifteen students responded to whether they would be willing to take the COVID-19 vaccine if made available to them (Table 3). A substantial proportion of the students (68.3%; 420/615) reported that they would be hesitant to take the vaccine. Of these 420 hesitant students, the most commonly cited reason for hesitancy was the view that the vaccine is unnecessary to protect against severe clinical outcomes (hospitalisation and/or death) following SARS-CoV infection (46.0%; 193/420). The second most commonly cited reason for vaccine hesitancy was the unavailability of the vaccine (29.5%; 124/420), although there was no distinction with respect to the first vs second dose. Also commonly cited for COVID-19 vaccine hesitancy is ‘other reasons’, which comprised fear of side effects following vaccination and rumours that the vaccines could have deleterious effects on human health, among others (14.5; 61/420).

Table 3: Description of the reasons for COVID-19 vaccine hesitancy

Variable	Frequency (%)
COVID-19 vaccine hesitancy (n=615)	
No	195 (31.7)
Yes	420 (68.3)
Reason for COVID-19 vaccine hesitancy (n=420)	
Unavailability	124 (29.5)
Medical contraindication	8 (1.9)
Religious reason/belief	18 (4.3)
Vaccine is harmful	16 (3.8)
Vaccine is not necessary	193 (46.0)
Other reasons (e.g., fear, rumours)	61 (14.5)

This paper addresses a significant public health issue among a peculiar population group in Nigeria by describing COVID-19 vaccine hesitancy among university students in the country's southern region, including the common reasons for hesitancy. Of the 615 students who responded to whether they would be willing to take the COVID-19 vaccine if made available, 68% (420/615) reported hesitancy. The commonly cited reasons for COVID-19 vaccine hesitancy included the view that the vaccine was not necessary for protection against severe clinical outcomes following SARS-CoV infection (46.0%; 193/420); unavailability of the vaccine (29.5%; 124/420); and other reasons comprising fear of side effects and rumours of deleterious effects on human health (14.5; 61/420). Additionally, only 9.2% of the total study population (62/677) had ever taken the COVID-19 vaccine, mainly because of immunity against SARS-CoV-2 infection (38.7% of 62). We found the proportion of students previously vaccinated against COVID-19 to be low at 9.2% (62/677), equivalent to one out of 10 university students in the

study context. However, it is difficult to directly compare with existing studies in Nigeria (Ifechi *et al.*, 2022; Mustapha *et al.*, 2021; Njoga *et al.*, 2022; Ogunbosi *et al.*, 2022; Olawade *et al.*, 2022; Olu-Abiodun *et al.*, 2022; Onwe *et al.*, 2022; Orok *et al.*, 2022; Sato, 2022; Tobin *et al.*, 2021; Uzochukwu *et al.*, 2021; Wonodi *et al.*, 2022) given the primary focus on vaccine hesitancy and identifying the associated factors on a few occasions. Among the reasons for previous vaccination is the belief that the vaccine can confer immunity against SARS-CoV-2 infection, the mandatory requirement for COVID-19 vaccination proof for international travel and recommendation by family or friends. The requirement for vaccination proof before international travel is expected, given the ‘mandatory’ nature of vaccination, especially in European and North American countries. A reasonably high proportion of previous vaccination on account of recommendation by family members or friends (19.4% of 62) underlines the need to adopt a comprehensive or integrated risk communication approach encompassing and non-silo. Of the 62 students who reported having taken the COVID-19 vaccine, just over half of them had received only the first dose (54.8% of 62), suggestive of partial vaccination, while 45.2% had taken the second dose, suggestive of complete vaccination. However, we cannot make any conclusions based on these findings due to the small sample and inadequate vaccination data at the national level during the study. AstraZeneca vaccine was the most common vaccine product received by the study participants in both the reported first (41.2% of 34) and second (46.4% of 28) doses. This could be explained by the fact that it is the first COVID-19 vaccine (4 million doses of the Oxford-AstraZeneca vaccine) to have arrived in Nigeria, precisely on 2 March 2021, from the COVAX facility (WHO Regional Office for Africa, 2021). About 68% of the 615 students who responded to the question on willingness to take the COVID-19 vaccine if provided to them were found to be hesitant in the present study. This implies that almost seven out of 10 students in our study population would be reluctant to receive the COVID-19 vaccine if made available. Therefore, the vaccine hesitancy in this study is high and is similar to the 65.0% recorded among 349 university staff and students at Nnamdi Azikiwe University in Nigeria (Uzochukwu *et al.*, 2021), but relatively more pronounced than the 50% recorded by national online survey in Nigeria (Tobin *et al.*, 2021), the global prevalence of 47.2% (Marzo *et al.*, 2022), and significantly lower than the 13.9% recorded in Italy (Barello *et al.*, 2020) amidst the pandemic. A possible reason for the high prevalence of vaccine hesitancy in the present study could be the young population (the mean age of the study population was 21.5 years), a feature identified to be

significantly associated with vaccine hesitancy in Portugal (Soares *et al.*, 2021). Nonetheless, the high prevalence of COVID-19 vaccine hesitancy recorded in the present study has an important implication for Nigeria's public health risk communication strategy. It could be argued that the existing risk communication messages or framing strategy for the COVID-19 vaccine at the time of the study did not adequately appeal to the student population to make them more positively disposed to take the vaccine if provided. Beyond the student population, a similarly high COVID-19 vaccine hesitancy was recorded across Nigeria.

The most commonly cited reason for COVID-19 vaccine hesitancy in the present study is the view that the vaccine was unnecessary to confer immunity against severe clinical outcomes (hospitalisation and/or death) following SARS-CoV infection. This misconception negates the essence of introducing the COVID-19 vaccines—mitigating adverse clinical outcomes rather than preventing infection. The second most commonly cited reason for vaccine hesitancy was its unavailability. However, we did not probe further to decipher between the participants' stances on the availability of the first and second doses. Indeed, the COVID-19 vaccine in the early phase of its roll-out in Nigeria was not readily available, with some recipients of the first dose complaining of not being able to access the second dose. While the challenge was quickly addressed nationally, the early experience might have lingered to influence the observed finding. An alternative explanation for this finding could be using vaccine availability as an 'excuse' for justifying hesitancy. Similar to our findings on the reasons for vaccine hesitancy, immunity misconception, suspicions about novel vaccines, and the local availability predicted higher odds of vaccine hesitancy among Czech university students (Riad *et al.*, 2021). Also commonly cited for COVID-19 vaccine hesitancy is the fear of side effects and rumours of deleterious vaccine effects on health following vaccination. These are similar to safety, efficacy, and side effects concerns expressed in a similar study in Qatar (Al-Mulla *et al.*, 2021). However, unlike our study, which focused primarily on undergraduate students (99.3% of the 677 students initially recruited for the study), Qatar's study found significantly lower odds of vaccine hesitancy among postgraduate students compared to undergraduate students (Al-Mulla *et al.*, 2021), suggesting that our findings could have varied if more postgraduate students were engaged. The perceived fear of side effects is unsurprising, given the widespread conspiracy theories and misinformation about COVID-19 in Nigeria (Wonodi *et al.*, 2022).

To a large extent, the reasons above for vaccine hesitancy among the study participants could be explained by a behaviour change theory (Li *et al.*, 2022), a typical example being the Health Belief Model (HBM). Based on our contextualisation, the perceived susceptibility construct of the HBM posits that students will take action to be vaccinated to prevent COVID-19 if they regard themselves as susceptible to the disease. Therefore, in our other study, it was unsurprising that students who reported having a relative or friend tested positive for COVID-19 were more willing to receive the COVID-19 vaccine. With the majority of younger persons (usually less than 30 years) infected with SARS-CoV-2 remaining asymptomatic in Nigeria (Elimian *et al.*, 2020), it is not surprising that students in the present study might not consider themselves at significant risk of infection and consequently prone to developing severe clinical outcomes (hospitalisation and/or death), even if the vaccines were available. The perceived severity construct of the HBM also posits that students will take action to be vaccinated in order to prevent COVID-19 if they believe it would have potentially serious consequences. With the high level of COVID-19 vaccine hesitancy among the study participants, one could argue that students may not have perceived COVID-19 as a severe disease hence the lack of motivation to take the vaccine, which became readily available shortly after its introduction in Nigeria. Lastly, the construct of perceived benefits of the HBM posits that students will take action to prevent COVID-19 and its attendant effects if they believe that a particular course of action available to them, in this case, vaccination, would reduce the severity or lead to other positive outcomes. That this scenario was lacking suggests suboptimal risk communication from public health institutions and the educational sector at the state and national levels. In our other study, we found that compared to students who reported extreme concern about contracting COVID-19, those without any concern were more likely to be hesitant to receive the COVID-19 vaccine [In Press]. As recorded in Egypt (Saied *et al.*, 2021), students' concerns regarding the vaccine's adverse effects and ineffectiveness—which contribute to vaccine hesitancy—could be effectively addressed by investing in and disseminating locally-generated epidemiological data on the COVID-19 vaccine's effectiveness and safety, thereby allaying the concerns mentioned above. Furthermore, as postulated in a study conducted in Bangladesh (Rahman *et al.*, 2022), strategic investment in COVID-19 knowledge and awareness among university students can lower hesitancy. Exposure to misinformation and believing it is accurate could increase vaccine hesitancy and

decrease positive behavioural intention to get vaccinated if made available (Lee *et al.*, 2022).

This study has the advantage of providing early evidence on COVID-19 vaccine hesitancy among youthful university students in southern Nigeria, findings that would be crucial to both the educational and health sectors in preparedness and response to subsequent COVID-19 epidemic or similar infectious disease outbreaks. Additionally, the study has provided additional evidence available in Nigeria (Ifechi *et al.*, 2022; Mustapha *et al.*, 2021; Njoga *et al.*, 2022; Ogunbosi *et al.*, 2022; Olawade *et al.*, 2022; Olu-Abiodun *et al.*, 2022; Onwe *et al.*, 2022; Orok *et al.*, 2022; Sato, 2022; Tobin *et al.*, 2021; Uzochukwu *et al.*, 2021; Wonodi *et al.*, 2022) in evaluating the COVID-19 vaccine impact (e.g., via a systematic review and meta-analysis), vaccination campaigns and risk communication strategies. This study has some limitations that are worth noting. Understanding the vaccination status of the study participants is crucial for public health planning and evaluation of vaccination campaigns across Nigeria. However, this could not be assessed in the present study, given the limited information on the dates of vaccination variables, in order to ensure data completeness and quality.

Such information would have strengthened our assessment of students' vaccination status: fully vaccinated (completion of two-dose vaccine or single-dose vaccine); partially vaccinated (vaccinated if they have received one of two doses at least 14 days before symptom onset or SARS-CoV-2 detection and the second dose not yet or less than 14 days before symptom onset); and unvaccinated (if a student did not receive COVID-19 vaccine or was vaccinated after symptom onset or SARS-CoV-2 detection). Furthermore, we did not describe COVID-19 vaccine hesitancy by their faculties of studies; however, evidence from a comparative study indicates that vaccine hesitancy does not significantly differ among healthcare students compared to non-healthcare students (Barello *et al.*, 2020).

Lastly, we could not attain the estimated initial sample size for the study, primarily due to delays from the prolonged ASUU strike; however, our analysed data is still more robust regarding sample size than those reported in many studies in Nigeria that ranged from 233 to 349 (Ifechi *et al.*, 2022; Olawade *et al.*, 2022; Orok *et al.*, 2022; Uzochukwu *et al.*, 2021).

Conclusions: This study found COVID-19 vaccine uptake and hesitancy among students of a tertiary institution in southern Nigeria to be low and high, respectively. The findings further underline the need for more a context-specific intervention and risk communication strategy in promoting COVID-19 vaccination uptake among students.

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