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## Assessment of Knowledge of Covid-19 and Vaccine Hesitancy among Undergraduate Students of University of Jos, Plateau State, Nigeria

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### Abstract

**Background:** Severe Acute Respiratory Syndrome Corona Virus 2 causes the highly infectious coronavirus disease. Currently, the pandemic is causing numerous morbidities around the world. In developing countries, where

vaccine hesitancy is reported to be high, the knowledge of this virus is relatively low, likely due to illiteracy and/or misinformation. The objective of this study was to assess the knowledge of COVID-19 and vaccine hesitancy among undergraduate students of the University of Jos, Plateau State.

**Methodology:** Using a multi-stage sampling technique, students from various faculties and departments of the University participated in this cross-sectional study. The researcher collected data quantitatively using a semi-structured self-administered questionnaire and analysed it using EPI-INFO statistical software.

**Results:** 553 students participated in the study, with a mean age of  $23.16 \pm 4.83$  years. The respondents exhibited a knowledge score of 50.8% and a vaccine hesitancy of 65%, with only 35% expressing a willingness to receive the COVID-19 vaccine. The study found that 71% of the participants expressed vaccine hesitancy due to concerns about the safety profile and side effects of the vaccine.

**Conclusion:** This study revealed that the students had poor knowledge of COVID-19 and a high level of vaccine hesitancy. Concerns about the safety profile and potential side effects of the vaccine are the major contributing factors to vaccine hesitancy. We encourage research on vaccine safety and potential side effects to provide students and the community at large with adequate information.

## Introduction

Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2) causes the extremely infectious Coronavirus Disease (COVID-19). It is currently a pandemic that has resulted in the loss of lives worldwide. The disease typically incubates for 2-14 days, exhibiting simple respiratory symptoms such as fever, cough, and fatigue. Some patients may also experience runny nose, headaches, and other symptoms <sup>(1)</sup> with the devastating effect of the disease worldwide, several vaccines have emerged and been approved for emergency use. These include Pfizer/BioNTech (BNT162b2), Moderna (mRNA-1273), and Janssen COVID-19 vaccine, among others<sup>(2)</sup>.

The development of the COVID-19 vaccine is a breakthrough in the scientific community and the world at large. However, inadequate knowledge of COVID-19 and hesitancy about its use may hinder these efforts in searching for a COVID-19 vaccine. The World Health Organization (WHO) has named vaccine hesitancy as one of the top

threats to global health in 2019<sup>(3)</sup> while a vaccine for COVID-19 has been found, it is also expected that adequate knowledge will spur individuals to make the right decisions to prevent and curtail the epidemic.

A study to assess the knowledge of COVID-19 among university students in the United States (US) concluded that university students have a poor health literacy level, and their knowledge of COVID-19 was also poor<sup>(4)</sup>. This sharply contrasts with the knowledge of COVID-19 among undergraduate students in China, where knowledge of COVID-19 was found to be adequate, as over 82% of the respondents in a cross-sectional study had appropriate knowledge scores<sup>(2)</sup>. In a study conducted in Nigeria among undergraduate dental students, it was observed that half of the respondents had adequate knowledge of COVID-19, with the final-year students having higher knowledge scores when compared to those in lower classes.<sup>(5)</sup>

This contrasts sharply with another study carried out in Nigeria, which indicated that 78.7% of respondents had good knowledge.<sup>(6)</sup> In a Jordanian study, 63.2% of participants showed vaccine hesitancy<sup>(7)</sup>. These results further emphasize that vaccine hesitancy is a threat to global health<sup>(8)</sup>. Some studies have revealed concerns about the use of vaccines and a lack of trust in vaccination<sup>(7)</sup>. The prevalence of COVID-19 vaccine hesitancy among university students in Jordan was found to be 65.1%. Researchers have correlated this high prevalence with conspiracy beliefs among several studies<sup>(9)</sup>. A comparative cross-sectional study done in Jos- Nigeria among undergraduate medical and nursing students of the University of Jos, revealed that only 28.9% of the respondents expressed willingness to take a COVID-19 vaccine; medical students 37.1% compared to nursing students 17.1%<sup>(10)</sup>.

A US-based study observed a significant association between vaccine hesitancy and sociodemographic variables such as race, age, educational status, and socioeconomic status, among others<sup>(11)</sup>. Other studies have also provided supportive evidence, highlighting factors such as literacy level, income, level of education, vaccine efficacy, and trust in government that influence vaccine hesitancy<sup>(12-14)(12)</sup>. In Nigeria, factors such as age, marital status, male gender, willingness to travel for a vaccine, payment for the vaccine, trust in government, and risk perception were significantly associated with willingness to be vaccinated<sup>(15-18)</sup>. It is not clear if these factors will influence the level of vaccine hesitancy amongst the educated<sup>(15-18)</sup>.

Previous studies have shown that knowledge about a disease affects the behaviour of an individual toward it<sup>(19)</sup>. The availability of a vaccine

does not guarantee the sufficiency of population vaccinations. Studies have also demonstrated that achieving herd immunity in a population requires vaccination of a significant portion of the population. Therefore, public health officials need to understand whether people are willing to receive vaccinations. The focus of this study is to assess the knowledge of COVID-19 and vaccine hesitancy in the educational setting of the University of Jos, Jos. This study aims to gather data on undergraduate students' understanding of COVID-19 and their acceptance of the COVID-19 vaccine. We can then use this information to tailor educational programs aimed at educating students and reducing vaccine hesitancy among them. The study-specific objectives are as follows:

- The goal is to assess the knowledge of COVID-19 among undergraduate students at the University of Jos.
- The goal is to determine the level of vaccine hesitancy among undergraduate students at the University of Jos.
- The aim is to determine the factors responsible for vaccine hesitancy among undergraduate students of the University of Jos.

## **Methodology**

### ***Study Site***

The University of Jos, located in Plateau State, conducted the study. The state has a population of about 3.5 million, with Jos as its capital <sup>(21)</sup>. The university, which now offers diverse undergraduate and postgraduate courses, currently has about 15 faculties with over 85 different departments and about 41,000 students.

### ***Study Design:***

A cross-sectional study design was conducted from April to June 2022, and included a total number of 553 students to evaluate undergraduate students' knowledge of COVID-19 and vaccine hesitancy.

### ***Study Population***

The study population comprised full-time undergraduate students of the University of Jos, cutting across all the faculties, which include health sciences, natural sciences, law, education, arts, management sciences, etc.

### ***Inclusion Criteria***

- A student who is currently enrolled has a student identity card from the school.
- You must be in school at the time of data collection.

### ***Exclusion Criteria***

- People without student identity cards
- People who were ill and not in school at the time of data collection

### ***Sampling Technique***

We selected the study subjects using a multistage sampling technique.

*Stage I:* We made a list of all the faculties and selected eight out of the 16 based on the stratified sampling technique. The proportion of students sampled from each faculty will reflect the faculty's share of the total student population.

*Stage II:* To ensure the inclusion of students from various academic disciplines within the faculty, we used simple random sampling to select departments within each faculty.

*Stage III:* In each of the selected departments, all the students who met the inclusion criteria and gave their consent for the research participated in the study.

### **Sample Size**

Taro Yamane Sample size determination formula was adopted in the determination of the sample size

$$Nf = \frac{N}{1 + N(e)^2}$$

From the previous estimations, due to disturbances and environmental errors, about 95% of their samples were accurate, which means the researcher will want to calculate the sample size with the precision/absolute error of 5% and at type 1 error of 5% (Yamane, 1973)

Nf = expected Sample size

N = Total population

E = level of precision

Total number of students in university of Jos is 41,100 students

$$Nf = \frac{41,100}{1 + 41,100 (0.05)^2}$$

Nf = 396

For non-response, inappropriate responses, and incomplete responses 40% was added to the sample size giving a sample size of 553.

## Data Collection

Data collection for the study was done using a semi-structured self-administered questionnaire. It focused on demographic characteristics, knowledge of COVID-19, and attitude toward receiving the COVID-19 vaccine. A total of 10 stem questions were used to assess the knowledge level of COVID-19 among respondents with a maximum score of 1 for each correct answer and zero for incorrect or I don't know responses with the maximum attainable score being 36. These scores were converted to percentages. A percentage score of greater than 60% was rated as adequate while those with a percentage score of 60% and below were rated as inadequate knowledge. A total of 14 reasons were available for why respondents were hesitant in receiving the COVID-19 vaccine and the percentage for each of the reasons was calculated and reported accordingly. After calculating the scores, the values obtained were interpreted according to the decoding.

The Cronbach's Alpha internal consistency indicator was used to verify the reliability of the construct measures. The T-test was used for two means and ANOVA for three or more means to verify the difference between the mean scores of the knowledge and the factors impeding the acceptance of Covid 19 vaccine acceptance and the sociodemographic characteristics of the students. Finally, a correlation analysis was performed between the level of knowledge on covid 19 vaccine and the reasons for not accepting covid 19 vaccine, using the Pearson correlation test ( $r$ ) and considering weak correlation for " $r$ " values up to 0.30, moderate for values between 0.40 and 0.60, and strong for values higher than 0.70. A 95% ( $p \leq 0.05$ ) significance level was adopted for all calculations.

## **Data Analysis**

Data collected were processed and analysed using EPI-INFO statistical software and the results were summarized using tables and figures. Quantitative variables were expressed as mean  $\pm$  standard deviations and qualitative variables as frequencies, charts, and percentages. A 95% confidence level was used for the study and a p-value of less than 0.05 ( $p < 0.05$ ) was considered statistically significant.

## **Ethical Considerations**

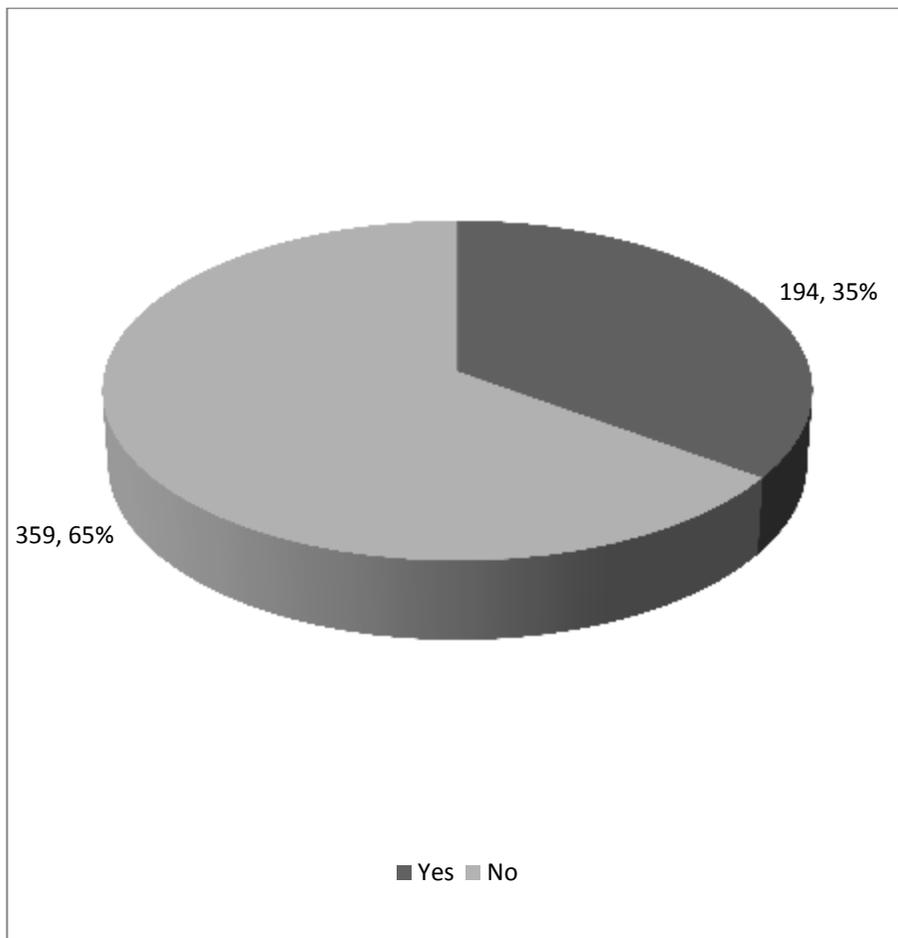
Ethical clearance was sought and obtained from Jos University Teaching Hospital (JUTH) Health Research Ethics Committee with the reference number JUTH/DCS/IREC/127/XXXI/2472. Confidentiality and anonymity of information were maintained and assured.

## **Results**

A total of 553 students were administered questionnaires and all the questionnaires were returned and analysed giving a response rate of 100%. From Table 1, the majority; 469 (84.8%) of the participants were between 15 to 25 years of age, with a mean age of  $23.16 \pm 4.83$  years. Over half; 51.4% of the participants were females. Four hundred and ninety-one (88.8%) of the participants were single, 9.6% were married, 1.1% were separated and only 0.5% were divorced. The three largest Departments were Geology (19.9%), Pharmacy (16.8%), and Nursing (16.6%). From Table 2, there is a statistically significant relationship between participants' department and their knowledge scores ( $P = < 0.0001$ ). There is also a statistically significant relationship between the level of study of participants and their knowledge of COVID-19 ( $P = 0.0266$ ).

The mean knowledge score of all participants in the study was  $18.3 \pm 5.5$  the highest possible score being 36 and the lowest being 0 (Table 3). Figure 1 demonstrates that 65% of the respondents were not willing to accept the COVID-19 vaccines when made available to them. From Table 4, while 71% of participants not willing to take the vaccine were concerned about the safety profile and side effects of the vaccine, 68.5% are concerned about its efficacy and effectiveness, 64.1% did not trust the information provided by the government and public health institutions on COVID-19 and the vaccine, and 51% were worried about how quickly the vaccine was developed and approved.

From Table 5, there was no statistically significant relationship between participants' age, sex and knowledge, and vaccine hesitancy. However, there is a statistically significant relationship between the department of participants and vaccine hesitancy ( $p=0.0328$ ). Also, there is a significant relationship between the level of the students and vaccine hesitancy ( $p = 0.0272$ , Odds Ratio = 1.5311). Hence, the odds that a student will refuse the vaccine are 1.5 times higher among junior students than among senior students.



**Figure 1.** Willingness to Accept Covid-19 Vaccine

**Table 1.** Socio-Demographic Profile and Information on COVID-19

Variable		Frequency n = 553	Percentage
<b>Age group (years)</b>	15 – 25	469	84.8
	26 – 35	69	12.5
	36 – 45	14	2.5
	46 – 55	1	0.2
<b>Sex</b>	Females	284	51.4
	Males	269	48.6
<b>Marital status</b>	Divorced	3	0.5
	Married	53	9.6
	Separated	6	1.1
	Single	491	88.8
<b>Department</b>	Dentistry	37	6.7
	Engineering	53	9.6
	Geology	109	19.7
	Law	80	14.5
	Nursing	92	16.6
	Pharmacy	93	16.8
	Religion and philosophy	34	6.1
	Veterinary medicine	55	9.9
<b>Religion</b>	Christianity	489	88.6
	Islam	60	10.9
	Others	3	0.5

**Table 2.** Knowledge Score with Mean

Characteristics	Adequate knowledge	Inadequate knowledge	Total	X <sup>2</sup>	Odds Ratio	Ci	Df	P-Value
<b>DEPARTMENT</b>								
Dentistry	14 (37.8)	23 (62.2)	37	44.0239			7	<0.0001
Engineering	11 (20.8)	42 (79.2)	53					
Geology	14 (12.8)	95 (87.2)	109					
Law	17 (21.2)	63 (78.8)	80					
Nursing	40 (43.5)	52 (56.5)	92					
Pharmacy	35 (37.6)	58 (62.4)	93					
Religion and philosophy	1 (2.9)	33 (97.1)	34					
Veterinary medicine	16 (29.1)	39 (70.9)	55					
<b>LEVEL</b>								
Junior students (200-300 Level)	95 (24.1)	299 (75.9)	394	4.9150	0.6355	0.4249 0.9504	1	0.0266
Senior students (400-600 Level)	53 (33.3)	106 (66.7)	159					
<b>Total</b>	<b>148 (26.8)</b>	<b>405 (73.2)</b>	<b>553</b>					

**Table 3.** Mean Knowledge Score

Characteristics	Mean	Std dev	T Statistic	P-value
All Participants	18.3	5.5	-	-
<b>Age group</b>				
Young (<25 years)	18.4	5.4	1.0101	0.3129
Older (≥25 years)	17.8	6.1		

**Table 4.** Reasons for not Accepting COVID-19 Vaccine

Reasons	Frequency	Percentage
I am concerned about the efficacy of the vaccine and am not convinced it will be effective	246	68.5
The vaccine will not protect me against the disease	95	26.5
COVID-19 was invented by man	149	41.5
COVID-19 was introduced to enforce vaccination	105	29.2
COVID-19 vaccination was planned to control people by implanting microchips into them.	94	26.1
Infertility will result from COVID-19 vaccination	56	15.6
I am concerned about the safety profile and side effects of the vaccine	255	71.0
The vaccine might transmit the virus to me	116	32.3
I am concerned about how quickly the vaccine was developed and approved	183	51.0
My immune system is weak/ I have an allergy to many substances and may have an allergy to the vaccine	61	17.0
The magnitude of the COVID-19 epidemic in Nigeria is not serious enough to warrant the use of a vaccine	121	33.7
I don't feel I'm at risk of getting COVID-19	157	43.7
I do not trust any vaccine made for COVID-19	202	56.3
I do not trust the information coming from the government and public health institutions on COVID-19 and its vaccines	230	64.1

**Table 5.** Relationship Between Students' Characteristics and COVID-19 Vaccine Hesitancy

Characteristics	Refuse vaccine	Accept vaccine	Total	X <sup>2</sup>	Odds ratio	Ci	Df	P-value
<b>Age</b>								
Young (<25 years)	283 (66.6)	142 (33.4)	425	2.2474	1.3636	0.9083 2.0470	1	0.1338
Older (>25 years)	76 (59.4)	52 (40.6)	128					
<b>Total</b>	<b>359 (64.9)</b>	<b>194 (35.1)</b>	<b>553</b>					
<b>Gender</b>								
Male	175 (65.1)	94 (34.9)	269	0.0043	0.9883	0.6969 1.4018	1	0.9476
Female	184 (64.8)	100 (35.2)	284					
<b>Total</b>	<b>359 (64.9)</b>	<b>194 (35.1)</b>	<b>553</b>					
<b>Department</b>								
Dentistry	16 (43.2)	21 (56.8)	37	15.2590	-	-	7	<b>0.0328</b>
Engineering	33 (62.3)	20 (37.7)	53					
Geology	79 (71.8)	31 (28.2)	110					
Law	47 (58.8)	33 (41.3)	80					
Nursing	56 (60.9)	36 (39.1)	92					
Pharmacy	68 (73.1)	25 (26.9)	93					
Religion & philosophy	23 (67.6)	11 (32.4)	34					
Veterinary medicine	37 (68.5)	17 (31.5)	54					
<b>Total</b>	<b>359 (64.9)</b>	<b>194 (35.1)</b>	<b>553</b>					
<b>Level</b>								
Junior students (200-300 level)	267 (67.8)	127 (32.2)	394	4.8800	1.5311	1.0480 2.2369	1	<b>0.0272</b>
Senior students (400-600 level)	92 (57.9)	67 (42.1)	159					
<b>Total</b>	<b>359 (64.9)</b>	<b>194 (35.1)</b>	<b>553</b>					
<b>Knowledge</b>								
Adequate	90 (61.2)	57 (38.8)	147	1.1998	1.2436	0.8416 1.8374	1	0.2733
Inadequate	269 (66.3)	137 (33.7)	406					
<b>Total</b>	<b>359 (64.9)</b>	<b>194 (35.1)</b>	<b>553</b>					

## **Discussion**

Only about one-fourth of the students in this study had adequate knowledge of COVID-19, indicating a low level of knowledge among the participants. This is unanticipated, as one would expect university students to have adequate knowledge of a disease of public health significance. This could be attributed to their reliance on social media platforms, which are notorious for spreading disinformation<sup>(8,13,14,22)</sup>. In contrast, a previous study among Nigerians concluded that most Nigerians had adequate knowledge of the COVID-19 vaccine and engaged in precautionary behavior by accepting it.

The methodology may have influenced the results due to the use of a multi-stage sampling technique for participant recruitment, which involved several stages of selection<sup>(23)</sup>. Furthermore, researchers observed a statistically significant relationship between the course of study and knowledge of COVID-19. In a similar study in China, more than 4/5ths of the undergraduate students had appropriate knowledge, which was significantly higher among medical students, providing evidence that course of study has an important effect on knowledge of COVID-19<sup>(2)</sup>.

A similar study among undergraduate dental students revealed that half of the respondents possessed adequate knowledge of COVID-19, in contrast to the findings that only 2/5ths had adequate knowledge<sup>(5)</sup>. The observation of high knowledge scores among medical students in Jordan aligns with the study, which found that students in the Department of Nursing had the highest knowledge score among all departments surveyed, followed by Pharmacy, Dentistry, and Veterinary Medicine in decreasing order; thus, all health-related departments outscored the others in knowledge scores.<sup>(24)</sup>

From the study, more than 3/5ths of the undergraduate students were not willing to accept a COVID-19 vaccine. This indicates that about 7 out of every 10 students were hesitant to accept the vaccine. We did not expect this finding among university students, who are supposedly more enlightened and should be more willing to accept the vaccine. Two different studies conducted among Nigerians observed similar findings, with about half of the participants hesitant to accept the vaccine.<sup>(17)</sup>

A web-based study also supports the finding, reporting that approximately 3/5ths of participants expressed a lack of willingness to receive vaccination. All these studies confirm the high level of vaccine

hesitancy in Nigeria, indicating the need for Studies conducted globally among university students and other populations have also yielded similar results. er populations. In Italy, 1 out of 10 among university students expressed a reluctance to receive vaccinations <sup>(25)</sup>, while vaccine hesitancy was nearly half in Malta and the US <sup>(26)</sup>. The picture is quite different. Studies conducted in Europe and Oxford have reported vaccine hesitancy rates as low as 3 out of 10, which is a significant difference. A global survey spanning 19 countries also reported a vaccine hesitancy level of 29.5%. <sup>(26)</sup>

Hence, the vaccine hesitancy level in Nigeria is significantly higher than what is obtainable in other nations of the world. However, a similar study in Jordan among university students revealed a vaccine hesitancy level exceeding 6 in 10, which is consistent with the current study <sup>(7)</sup>. Jos conducted a study among undergraduate medical and nursing students, and found that those at higher study levels (400-600) were more willing to take the COVID-19 vaccine than those at lower study levels (200-300) <sup>(10)</sup>. This finding aligns with the results of the study.

The study found no association between age groups and vaccine hesitancy. This contradicts previous studies in Nigeria that showed that age, male gender, trust in government, and risk perception were significantly associated with willingness to be vaccinated. The study found a strong correlation between the participants' department and vaccine hesitancy <sup>(15-18)</sup>. Students in the health-related departments showed lower levels of vaccine hesitancy compared to students from other departments. In contrast, there was no significant difference in the responses among healthcare university students and non-healthcare university students in an Italian study <sup>(25)</sup>.

The study revealed no significant correlation between the level of COVID-19 knowledge and vaccine hesitancy, unlike a Greek study that linked a higher knowledge score to a comparatively higher willingness to vaccinate<sup>13</sup>. Of the large number of participants who were unwilling to receive a COVID-19 vaccine, the majority were concerned about its effectiveness, safety profile, and side effects. Residents in the UK, indigenous people in Canada, and residents in Malta raised similar concerns. <sup>(26-28)</sup> The study revealed that some participants expressed concerns about the rapid development and approval of the vaccine. This is similar to the earlier findings on factors that influence vaccine hesitancy <sup>(29)</sup>.

Several studies have contributed to the level of vaccine hesitancy, as evidenced by the reasons given by those who declined vaccination. Approximately 2/5ths hold the belief that COVID-19 originated in a

laboratory, 3 out of 10 hold the belief that the introduction of COVID-19 aimed to enforce vaccination and control individuals through microchip implantation, and nearly 2/5ths hold the belief that vaccination will lead to infertility. A study among university students in Jordan found a correlation between vaccine hesitancy and some of the observed conspiracy theories<sup>(9)</sup>.

## **Conclusion**

Previous studies have shown that knowledge about a disease affects the behavior of an individual toward it. Indeed, the availability of a vaccine does not ensure a sufficient population vaccination rate, which is why this study was necessary. The study assessed the knowledge of COVID-19 vaccines and vaccine hesitancy in the educational setting of the University of Jos, Jos, Plateau State undergraduate community. This study revealed a knowledge score of 50.8% among 553 participants. 65% of the participants exhibit high vaccine hesitancy, with only 35% expressing willingness to receive the COVID-19 vaccine when it becomes available. The study also revealed that 71% of the participants attributed their vaccine hesitancy to concerns about the safety profile and side effects of the vaccine. The university community and the nation at large need to increase their awareness of the COVID-19 vaccine. The government should discourage the use of social media to spread false information about COVID-19 and its vaccine. There is a need for the Nigerian Centre for Disease Control to carry out further studies on the safety profile and side effects of the available vaccine and to determine interventions that would be suitable for addressing the high level of vaccine hesitancy in Nigeria.

## **Limitations**

1. One of the primary limitations is the self-report bias. Self-reported data may introduce bias, as students might misreport their knowledge or hesitancy.
2. Furthermore, social desirability bias could lead participants to align responses with socially accepted views on vaccination, potentially skewing results.
3. Meanwhile, exposure to misinformation on social media may also affect perceptions, further complicating the assessment of genuine knowledge gaps.

4. Additional limitations of the study include its cross-sectional nature, which hinders its ability to capture changes in knowledge and attitudes over time, and the potential restriction of data depth due to limited resources, which could impact comprehensive exploration.

## References

1. Huang X, Wei F, Hu L, Wen L, Chen K. IRANIAN Epidemiology and Clinical Characteristics of COVID-19. *Academy of Medical Sciences of the IR Iran*. 2020;23(4):268–71.
2. Peng Y, Pei C, Zheng Y, Wang J, Zhang K, Zheng Z, et al. Knowledge, Attitude and Practice Associated with COVID-19 among University Students: a Cross-Sectional Survey in China. 2020;
3. Kourlaba G, Kourkouni E, Maistreli S, Tsopela C grammatiki, Molocha N maria, Triantafyllou C, et al. Willingness of Greek general population to get a COVID-19 vaccine. *Global Health Research and Policy*. 2021;6(3):1–10.
4. Chesser A, Drassen Ham A, Keene Woods N. Assessment of COVID-19 Knowledge Among University Students: Implications for Future Risk Communication Strategies. *Health Education and Behavior*. 2020;47(4):540–3.
5. Adesola K, Bds U, Gerald I, Bds I, Oyeyemi B, Bds A. Nigerian undergraduate dental students' knowledge, perception, and attitude to COVID-19 and infection control practices. *J Dent Educ*. 2020;(July):1–10.
6. Adesegun OA, Binuyo T, Adeyemi O, Ehioghae O, Rabor DF, Amusan O, et al. The COVID-19 Crisis in Sub-Saharan Africa: Knowledge, Attitudes, and Practices of the Nigerian Public. *The American Society of Tropical Medicine and Hygiene*. 2020;103(5):1997–2004.
7. Al-Qerem WA, Jarab AS. COVID-19 Vaccination Acceptance and Its Associated Factors Among a Middle Eastern Population. *Frontiers in Public Health*. 2021;9(February):1–11.
8. Wilson SL, Wiysonge C. Social media and vaccine hesitancy. 2020;1–7.
9. Sallam M, Dababseh D, Eid H, Hasan H, Taim D, Al-Mahzoum K, et al. Low covid-19 vaccine acceptance is correlated with conspiracy beliefs among university students in Jordan. *International Journal of Environmental Research and Public Health*. 2021;18(5):1–14.

10. Agbo H, Noel N, Nkala C, Mamza J, Balogun R. Knowledge and Risk Perception of COVID-19 and the Willingness to Take COVID-19 Vaccine among Tertiary Institution Students in Jos, Plateau State: a Comparative Assessment of Medical and Nursing Students. *Journal of Epidemiological Society of Nigeria*. 2021;4(1):75–88.
11. Id CAL, Dayton L, Yi G, Colon B, Kong X. Mask usage, social distancing, racial, and gender correlates of COVID-19 vaccine intentions among adults in the US. 2021;2:1–11.
12. Murphy J, Vallières F, Bentall RP, Shevlin M, McBride O, Hartman TK, et al. Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. *Nature Communications*. 2021;12(1).
13. Ullah I, Khan KS, Tahir MJ, Ahmed A, Harapan H. Myths and conspiracy theories on vaccines and COVID-19: Potential effect on global vaccine refusals. Vol. 22, *Vacunas*. 2021. p. 93–7.
14. Ruiz JB, Bell RA. Predictors of intention to vaccinate against COVID-19: Results of a nationwide survey. *Vaccine*. 2020;39(2021):1080–6.
15. Adebisi YA, Alaran AJ, Bolarinwa OA, Akande-Sholabi W, Lucero-Prisno DE. When it is available, will we take it? Social media users' perception of hypothetical covid-19 vaccine in nigeria. *Pan African Medical Journal*. 2021;38.
16. Chiedozi AP, Chukwuebuka OJ, Chidimma CF, Gabriel OC, Chioma UB. Willingness to Accept a Potential COVID-19 Vaccine in Nigeria. *American Journal of Medical Sciences and Medicine*. 2021;9(1):1–5.
17. Alice Tobin E, Okonofua M, Adeke A, Obi A. Willingness to Accept a COVID-19 Vaccine in Nigeria: A Population-based Cross-sectional Study. *Central African Journal of Public Health*. 2021;7(2):53.
18. Eniade OD, Olarinmoye A, Otovwe A, Akintunde FE, Okedare OO, Aniyeloye AO. Willingness to Accept COVID-19 Vaccine and Its Determinants among Nigeria Citizens: A Web-based Cross-sectional Study. *Journal of Advances in Medicine and Medical Research*. 2021;33(0):13–22.
19. Iorfa SK, Ottu IFA, Oguntayo R, Ayandele O. COVID-19 Knowledge , Risk Perception , and Precautionary Behavior Among Nigerians : A Moderated Mediation Approach. 2020;11(November):1–10.

20. Dror AA, Eisenbach N, Taiber S, Morozov NG, Mizrachi M, Zigran A. Vaccine hesitancy : the next challenge in the fight against COVID - 19. *European Journal of Epidemiology*. 2020;35(8):775–9.
21. Welcome! At a Glance| Plateau State Government Website [Internet]. [cited 2021 Apr 18]. Available from: <https://www.plateaustate.gov.ng/plateau/at-a-glance>
22. Oyeyemi OT, Oladoyin VO, Okunlola OA, Mosobalaje A. COVID-19 pandemic : an online-based survey of knowledge , perception , and adherence to preventive measures among educated Nigerian adults. *J Public Health (Berl): From Theory to Practice*. 2021;(August):1–10.
23. Olapegba PO, Iorfa SK, Kolawole SO, Oguntayo R, Gandi JC, Otu IFA, et al. Survey data of COVID-19-related Knowledge , Risk Perceptions and Precautionary Behavior among Nigerians. *Data in Brief*. 2020;30:105685.
24. Oluseun O, Id A, Adenubi OT, Adesokan K, Oloye AA, Bankole NO, et al. SARS-CoV-2 ( COVID-19 pandemic ) in Nigeria : Multi-institutional survey of knowledge , practices and perception amongst undergraduate veterinary medical students. *PLoS ONE*. 2021;16(3):e0248189.
25. Barello S, Nania T, Dellafiore F, Graffigna G, Caruso R. ‘ Vaccine hesitancy ’ among university students in Italy during the COVID-19 pandemic. *European Journal of Epidemiology*. 2020;(0123456789):1–3.
26. Cordina M, Lauri MA, Lauri J. Attitudes towards covid-19 vaccination, vaccine hesitancy and intention to take the vaccine. *Pharmacy Practice*. 2021;19(1):1–9.
27. Ian M, Swidrovich J. Medical experimentation and the roots of COVID-19 vaccine hesitancy among Indigenous Peoples in Canada. *CMAJ*. 2021;193(11):381–3.
28. Razai MS, Osama T, Mckechnie DGJ, Majeed A. Covid-19 vaccine hesitancy among ethnic minority groups Tackling the reasons for hesitancy requires engagement , understanding , and trust. *BMJ*. 2021;372:n513.
29. Rutten LJF, Zhu X, Leppin AL, Ridgeway JL, Swift MD, Grif JM, et al. Evidence-Based Strategies for Clinical Organizations to Address COVID-19 Vaccine Hesitancy. 2021;96(March):699–707.