



Original

Exploring the Impact of COVID-19 Vaccine Experiences and Safety-Related Reports on Vaccine Confidence among Nursing Students in Delta State College of Nursing Science Agbor, Nigeria

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Abstract

Background: Vaccine confidence is crucial for public health but remains a challenge in developing nations like Nigeria. This study explores vaccination confidence among nursing students at Delta State College of Nursing Science, Agbor, focusing on trends experiences with vaccines and potential impacts on future vaccination decisions.

Methods: A cross-sectional survey of 279 nursing students at DSCNSA was conducted on vaccination experiences, exposure to and impact of safety-related information about COVID-19 vaccines.

Results: Only 37.3% had received at least one dose of the COVID-19 vaccine, primarily Moderna and Pfizer, although 47.1% could not remember the brand. A total of 52.8% reported experiencing mild side effects, and one student reported having a seizure. Although many students expressed concerns about safety and efficacy, 91.7% showed a positive perception towards vaccination. Also, 93.6% of the 84.2% who are aware of COVID-19 safety/risk reports trusted the sources, 95.3% say it impacted their overall confidence in vaccines, and 55.1% are truly sceptical about future vaccinations. Vaccine perception shared association with history of COVID-19 vaccination ($P = 0.0280$). Females were more influenced by safety concerns while males were more likely to consider future vaccinations. Vaccine confidence also varied by religious affiliation, student year, and side effects experienced after COVID-19 vaccination, with those experiencing mild side effects showing a higher inclination to receive future vaccinations.

Conclusion: This study indicates that Nigerian nursing students have mixed views on vaccines with concerns about safety and efficacy remaining prominent. Addressing these concerns through accurate information is essential to boosting vaccine confidence.

Keywords: COVID-19 vaccination, Nigerian nursing students, Seizures episode, Vaccine confidence, Vaccine side effects, Vaccination uptake



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Introduction

The Research Problem: The global COVID-19 epidemic has elevated vaccination confidence as a central issue in public health discussions. Comprehending the determinants of vaccination acceptance and hesitancy is essential for formulating efficient immunization regimens and attaining extensive protection against infectious illnesses. Numerous studies have underscored considerable geographical disparities in vaccine uptake rates. Research categorizing global COVID-19 vaccination acceptance rates by area revealed that in West and Central Africa, acceptance rates varied from 93% in Niger to a markedly low 15% in Cameroon.¹ This regional variation highlights the necessity of comprehending country-specific settings and factors influencing vaccination reluctance. This study seeks to examine the influence of COVID-19 experiences on vaccine confidence among Nursing Students at Delta State College of Nursing Science in Agbor, Delta State, Nigeria.

Existing Context: Research in Nigeria has indicated inadequate vaccine intention and uptake rates. A meta-analysis of 42 studies in Nigeria revealed low vaccine acceptance and significant vaccine hesitancy, influenced by factors such as safety concerns, scepticism regarding vaccine efficacy, distrust in governmental and manufacturing entities, and the impact of misinformation and conspiracy theories.² A further study revealed a COVID-19 immunization acceptance rate of 52.4% in Nigeria, insufficient to achieve herd immunity.³ Extensive studies have been conducted to comprehend the determinants affecting global COVID-19 vaccine acceptance and hesitation, uncovering a complex interaction of sociodemographic variables, views of vaccination safety and efficacy, institutional trust, and personal experiences.^{1,4-6} Research has continuously revealed prevalent factors contributing to vaccine hesitation, such as apprehension regarding side effects, doubts about vaccine safety, distrust in governmental institutions, and the impact of misinformation and conspiracy theories.^{7,8} Confidence in healthcare systems and information sources has been recognized as a crucial determinant of vaccine adoption.

Research has also underscored the impacts of trust in government,^{1,5,6,9} confidence in scientists and healthcare practitioners,^{4,6} and the impact of social media^{4,10} in shaping public opinions of COVID-19 vaccinations. Studies have shown the significance of

sociodemographic parameters in vaccine acceptability. Individuals' beliefs and attitudes toward vaccine acceptance are shaped by factors including age, ethnicity, socioeconomic status (including domicile and occupation), and educational attainment.^{7,11,12} The influence of individual encounters with COVID-19 on vaccination acceptability has been examined to a certain degree. Studies indicate that those with firsthand experience of the disease are more inclined to view the vaccine as advantageous and essential.⁷ Research that examined the impact of prior vaccination history on the acceptance of the COVID-19 vaccine, indicate that persons with a background of receiving other vaccines may exhibit a greater propensity to take the COVID-19 vaccine.¹⁰ Previous encounters with vaccinations, especially Adverse Events Following Immunization (AEFI), might profoundly influence vaccine trust.¹³

Research Gaps: Although comprehensive studies have been undertaken about global COVID-19 vaccine uptake and hesitancy, notable deficiencies persist in the current literature, especially concerning Nigeria and specifically Delta State, underscoring the necessity for targeted studies. Vaccine reluctance has been documented in the region. Asiwe et al.¹⁴ discovered in their study conducted in Agbor, Delta State, that although most respondents acknowledged the existence of COVID-19 and its vaccine, a considerable number were reluctant to receive vaccination. This study did not explore the reasons for elevated vaccine reluctance or its potential connection to prior experiences. Further exploration is necessary especially following these studies, and Josiah and Kantaris.¹⁵ emphasized that comprehending the determinants of vaccination adoption is essential for formulating effective methods to alleviate the effects of the COVID-19 pandemic and vaccine preventable diseases.

Purpose of Research: The objective of this research is to examine the correlation between COVID-19 vaccination experiences and general vaccine trust in Agbor, Delta State. This study concentrates on nursing students at Delta State College of Nursing Science Agbor to elucidate the local context and ascertain the sociodemographic determinants affecting vaccine confidence among Agbor people and healthcare professionals. This research will augment the current knowledge base by elucidating how individual experiences with COVID-19 vaccinations affect long-term beliefs in immunizations within this demography,

as previous studies suggest that tailored interventions addressing the specific concerns of diverse population groups will improve vaccination uptake.¹⁶⁻¹⁸

Methodology

Study Area

Delta State, located in Nigeria's South-South region, is home to an estimated population of over 5.6 million people, according to the 2006 census, with current projections suggesting a significant increase. Agbor, a prominent city within Delta State, has an estimated population of around 67,000 people, making it a key cultural and educational hub. The State School of Nursing Science, Agbor (DSCNSA), contributes to the region's development by training nursing professionals to serve the growing population.

Design

The study was a descriptive cross-sectional study.

Study Population

The study population was nursing students from the College of Nursing Science, Agbor. The target population for this study was 894 participants comprising the total nursing students in the College of Nursing Science, Agbor.

Inclusion and Exclusion Criteria

Only student nurses currently enrolled at the College of Nursing Science Agbor were included. Participants were 18 years and above and provided informed consent before participating. Students who were not physically present during data collection visit were excluded from the study.

Sample size Determination

The Taro Yamane formula for finite populations was used to calculate the sample size with a total population of 894 nursing students and a 5% (0.05) margin of error, and 95% confidence level (i.e. a set 0.05 level of significance in p-value analysis), the sample size is calculated to be 276, by using the formula.

$$n = \frac{N}{1 + N(e^2)}$$
$$n = \frac{894}{1 + 894(0.05^2)} = 276.35$$

An approximate sample size of 304 participants was targeted to account for an estimated non-responses rate of up to 10% calculated as follows.

$$n = 0.10 \times 276.35 = 27.635$$

$$n = 276.35 + 27.635$$
$$= 303.985 \text{ (Approximately 304)}$$

Data collection was stopped when 305 student nurses completed and submitted their surveys.

Data collection Tool

The author developed a questionnaire comprising sections on sociodemographic data, COVID-19 vaccine experiences, and overall vaccine confidence. The validity and reliability of the tool was done through a pretesting conducted among Nursing Students in Delta State University, Abraka with a reliability test result (Cronbach's alpha) of 0.67. The questionnaire was further reviewed for face validity, wording, ordering, and sequencing with a final reliability of 0.82. The research team supervised the print questionnaire completion, collation, and analysis.

Data Collection Procedure

The researchers visited selected sites to engage the college administration after the initial written application for clearance through the office of the provost. During this visit, the purpose of the study, eligibility criteria, and process for data collection was explained to the staff. The data collection lasted from 14/10/2024 to 30/10/2024. The participants were approached in their various classes. The researchers with the help of the lecturers explained the purpose and process of the research to each class. For each of the three classes students were randomly selected using a table of random numbers. Numbers were initially assigned to each student based on the conventional arrangements in the classroom across each row of seats. The total numbers of students were then typed into the Spin The Wheel App [19] from 1 – N (N being the highest number of consenting students in the class). The selected students were again given the informed consent document to review and sign, afterwards along with the print Printed questionnaires. Print questionnaires were used due to the challenges with power and internet. Responses were collated and uploaded by the team and reviewed for accuracy. A total of 305 questionnaires were received, with 279 accurately completed and included in the analysis.

Data Analysis

On completion of the data collection phase, data was analysed using IBM SPSS (version 29) statistical software. Descriptive statistics (means, medians,

standard deviations, frequencies, and percentages) was calculated to summarize the sociodemographic characteristics of the participants and their experiences with the COVID-19 vaccine. This analysis provided a baseline understanding of the distribution of key variables among the sample population. Chi-Square test (or Fisher's exact test) was used to test association between the sociodemographic factors and vaccine confidence.

Ethical Consideration

The research process was reviewed, approved and monitored by the Delta State Ministry of Health Research Ethics Committee under a broader proposal that captured Delta State College of Nursing Science and the General Hospital Agbor with approval number HM/596/T²/244 on 9th of October 2024. Informed consent was obtained from study participants. Participation was voluntary and in compliance with the ethical standards for consent procedures. Participants were contacted at school, and no contact was made outside the official premises. The administration such as the school provost, the lecturers, and the support team assisted during the school visits. Data anonymity and integrity was ensured throughout the survey process by avoiding collection of any student identifying details in the responses and maintaining records of information gathered through questionnaires until all uploads and validations were completed. All the important records are saved securely for the period required by regulatory authorities and will be securely disposed of after the study's dissemination.

Results

A total of 279 valid responses were retrieved from the nursing students at the Delta State College of Nursing Science, Agbor (DSCNSA) and analysed using Statistical Product and Service Solution (SPSS) version 29. Details of the results obtained are presented in tables and charts shown below and test of hypotheses generated

Sociodemographic Attributes of Respondents

Table 1: Sociodemographic Profile of Respondents (n= 279)

Characteristics	Response	Frequency	Percentage
Age	18-24 years	232	83.2
	25-34 years	46	16.5
	35 and above	1	0.4
Gender	Female	221	79.2
	Male	58	20.8
Religion	Christianity	261	93.5
	Islam	11	3.9
	Traditional	1	0.4
	None	6	2.2
Highest Level of education	Secondary School	217	77.8
	Diploma Certificate	57	20.4
	Bachelor's Degree	5	1.8
Class/Year of study	Year 1	9	3.2
	Year 2	82	29.4
	Year 3	188	67.4

Table 1 shows that 83.2% of the respondents were aged 18-24 years, 79.2% were females, 93.5% practiced Christianity, 77.8% had a secondary school certificate, 22.2% already had a diploma or bachelor's degree outside of the college, and 67.4% were in their third year in the school

COVID-19 Vaccine Uptake among Students of DSCNSA

Table 2: Rate of COVID-19 vaccine uptake among students at Delta State College of Nursing Science, Agbor.

Characteristics	Response	Frequency	Percentage
Received any COVID-19 vaccine? (n=279)	Yes	104	37.3
	No	175	62.7
COVID-19 Vaccine brand received (n=104)	Pfizer	23	22.1
	Moderna	23	22.1
	AstraZeneca	7	6.7
	Janssen	2	1.9
	I Cannot Remember	49	47.1
Experienced post-vaccination side effects (n=104)	Yes	55	52.8
	No	49	49.1
	Injection site pain	40	72.7
	Fever	28	51
	Headache	32	58
	Fatigue	12	21.8
	Cold feeling	5	9
	Body ache	18	32.7
	Injection site swelling	5	9
	Vertigo	0	0
Side effects experienced (n=55)	Drowsiness	10	18.1
	Vomiting	0	0.0
	Loss of appetite	6	11
	Injection site itching	8	14.5
	Seizure	1	1.8
	Minor discomforts	8	14.5
	Mild	30	54.6
	Moderate	17	30.9
	General Hospital, Agbor	4	7.2
	Health centre near me	34	61.8
Severity of the side effect (n=55)	Vaccination outreach program	17	30.9

Table 2 shows that 37.3% of the respondents had received COVID-19 vaccine. 22.1 % of them received the Moderna and Pfizer brand of the vaccine while 47.1% could not remember the type they received. 52.8% of them experienced side effect with most of them experiencing injection site pain, fever and headache. 54.6% experienced mild side effect while 30.4% experienced moderate side effect. Most of the respondents (61.8%) received the COVID-19 vaccine in a health centre near them, some of them (30.9%) received it at a vaccination outreach program and few of them (7.2%) received it at the General Hospital, Agbor.

Table 3: Respondents Confidence in Vaccines (n=279)

Items	SA (%)	A (%)	D (%)	SD (%)
I trust the safety of vaccines.	60(21.5)	170(60.9)	36(12.9)	13(4.7)
I believe vaccines are effective in preventing many diseases	62(22.2)	182(65.2)	28(10.0)	7(2.5)
My vaccination is important for the health of others in my community	79(28.3)	153(54.8)	39(14.0)	8(2.9)
I would recommend getting vaccinations to others	43(15.4)	174(62.4)	46(16.5)	16(5.7)
I would take vaccines knowing it is possible for adverse reactions may occur due to vaccination.	42(15.1)	148(53.0)	69(24.7)	20(7.2)
*I do not need vaccines since no diseases are occurring around me	24(8.6)	78(28.0)	132(47.3)	45(16.1)

*Negatively coined questions. SA = Strongly Agree, A = Agree, D= Disagree, SD = Strongly Disagree

Table 3 shows that most (81.5%) of the respondents trust the safety of vaccines, most (87.4%) of them believed in the efficacy of vaccines, most of them (83.1%) opined that their vaccination is important for the health of other community. Also, 63.4% of the respondents disagreed with the statement about not needing the vaccine in the absence of obvious diseases, and 77.8% said they would recommend vaccines to others, even though a good number of respondents agrees that vaccines have side effects (68.1%).

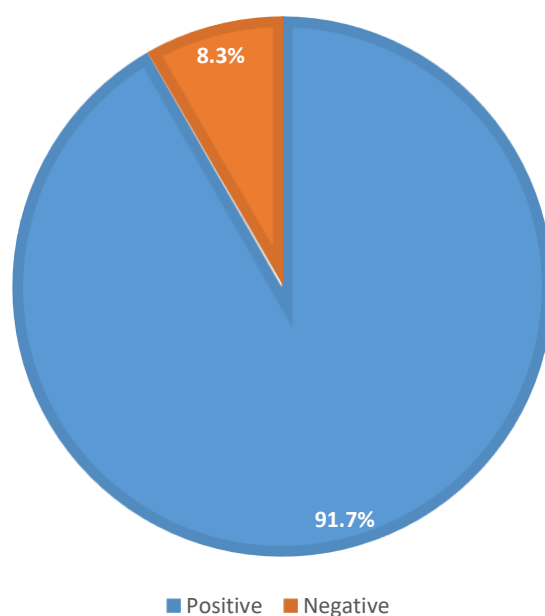


Figure 1: Summary of perception towards vaccines confidence among the respondents (n=279)

Using a six-question Likert scale inquiry, strongly agree was assigned 4, agree = 3, disagree = 2, and strongly disagree = 1. The reverse for the negatively worded row, the perceptions towards vaccines was collated on against a maximum score of 4 with 2.5 and above being the cut off positive or negative perceptions towards vaccines. The result shows that 91.7% had a positive perception towards vaccines while 8.3% did not.

Table 4: Respondents exposure to COVID-19 vaccine risks and safety reports (n=279)

Characteristics		Frequency	Percentage
Heard/read any reports about risks and safety concerns related to COVID-19 vaccines (n=279)	Yes	235	84.2
	No	44	15.8
Frequency of actively accessing COVID-19 vaccine safety-related information (n=235)	Never	2	0.8
	Rarely	82	34.8
	Sometimes	115	49.0
	Often	28	12.0
	Very often	8	3.4
Perception of the reliability of information and their sources (n=235)	Not reliable at all	15	6.4
	Somewhat reliable	94	40.0
	Moderately reliable	85	36.2
	Very reliable	41	17.4

Table 4 shows that most of the respondents (84.2%) have heard/read reports about safety concerns related to COVID-19 vaccine and 64.4% of this category actively follow these reports (sometimes, often, and very often), while 35.6% rarely or never did. A high proportion (53.6%) of respondents consider the report to be very (17.4%) or moderately (36.2%), the next 40.0% considers it somewhat reliable, while 6.4% completely objects to its reliability.

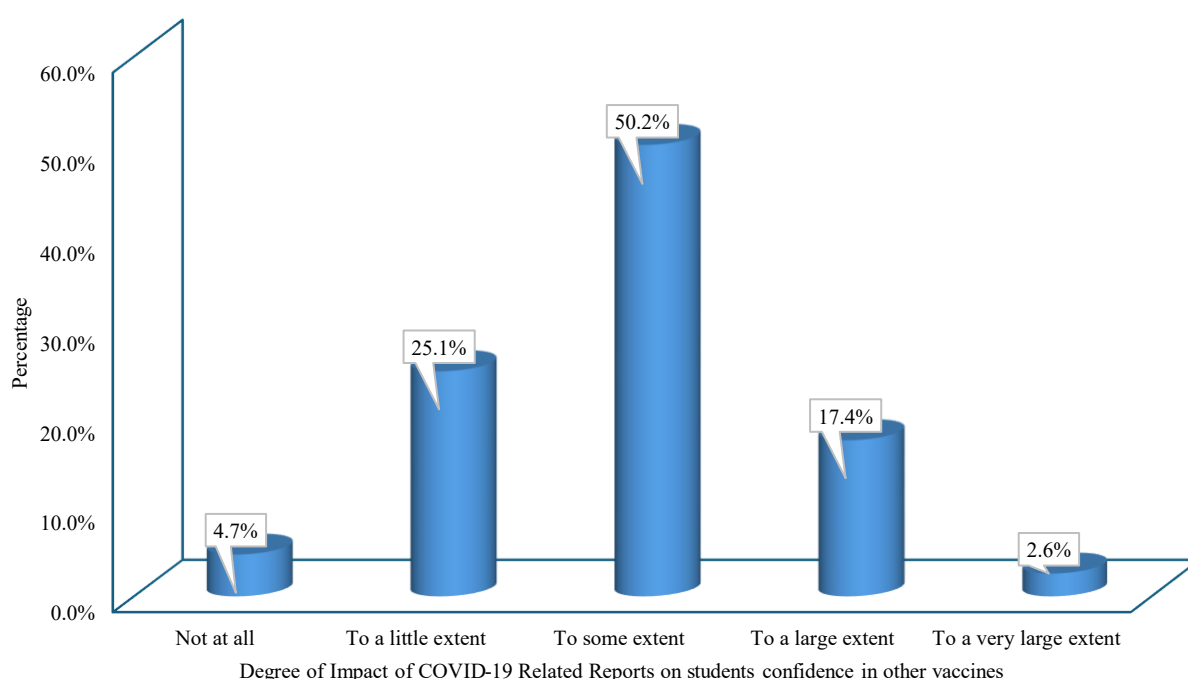


Figure 2: Degree of Impact of COVID-19 Related Reports on students' confidence in other vaccines (n=235).

Figure 2 shows that students gave varying reports that their confidence have been impacted by reports regarding the risks and safety events about the COVID-19 vaccines. Although 4.7% said it has no influence on them, all other students indicated their confidence would have been impacted to a very large extent (2.6%), large extent (17.4%), to some extent (50.2%), and to a little extent (25.1%) (Figure2)

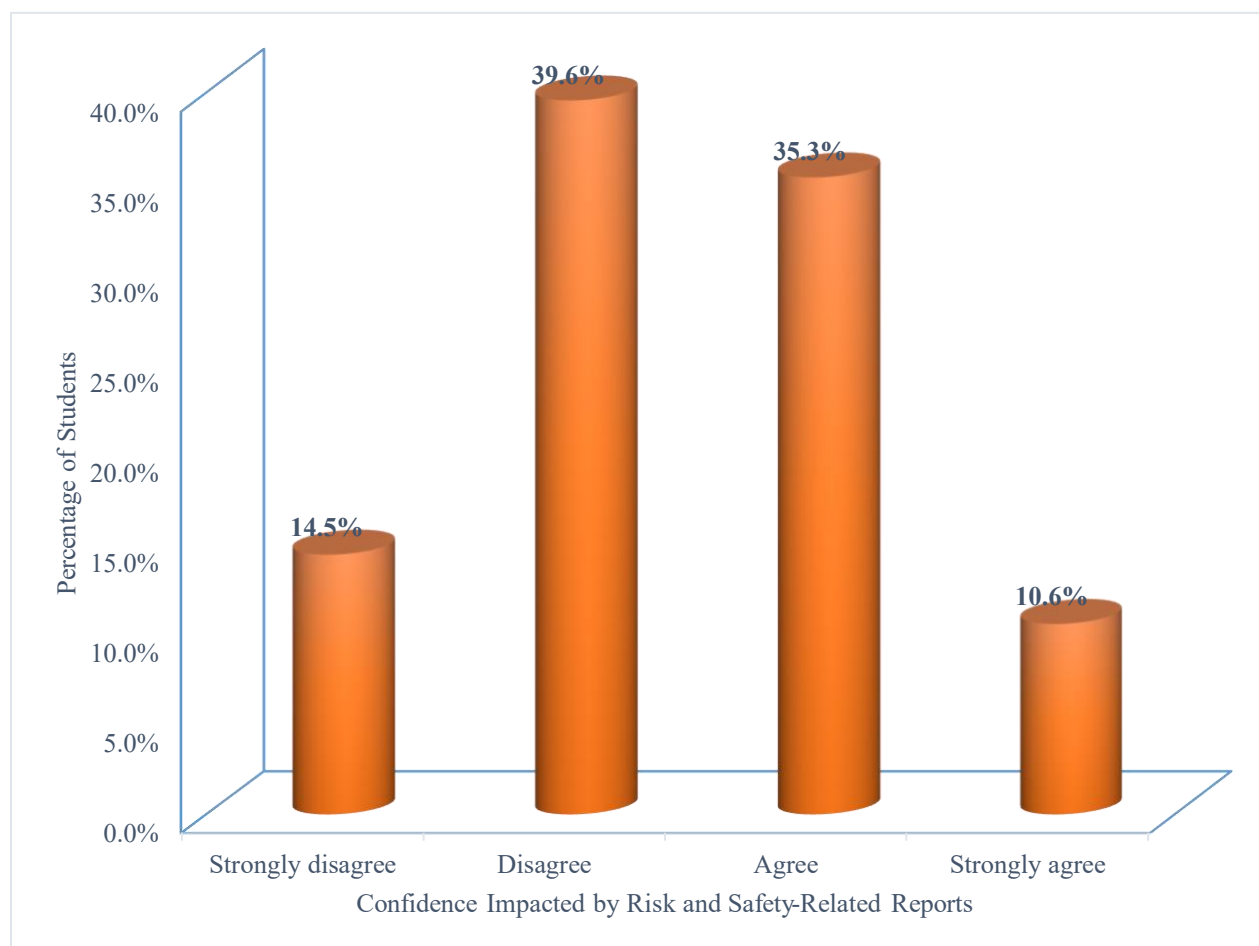


Figure 3: Impact of COVID-19 Vaccine Risks and Safety-Related Reports on Confidences in Other Vaccines (n=235). When asked if the news and events about COVID-19 safety would impact their future decisions to get vaccinated, a total of 45.9% (agree + strongly agree; Figure 3) states that the events surrounding COVID-19 vaccines has not influence on their subsequent decisions to get vaccinated with other vaccines, while 55.1% show scepticism based on the reports (disagree + strongly disagree; Figure 3).

Factors associated with vaccine confidence

Table 5: Fisher Exact contingency test of associations between sociodemographic characteristics and the vaccine perception among nursing students in DSCNSA (n = 279).

Independent Variable		Perception		Total	Fischer Exact P-Value
		Negative Perception (%)	Positive Perception (%)		
Age Group	18 – 24 years	18 (7.8)	214 (92.2)	232	0.156
	25 and above	7 (14.9)	40 (85.1)	47	
Gender	Female	20 (9.0)	20 (91.0)	219	1.000
	Male	5 (8.6)	53 (91.4)	56	
Religion	Christianity	22 (8.4)	239 (91.6)	257	0.211
	Non-Christianity	3 (16.7)	15 (83.3)	18	



Independent Variable		Perception		Total	Fischer Exact P-Value
		Negative Perception (%)	Positive Perception (%)		
Highest Level of Education	Prior Diploma or Bachelors	5 (8.1)	57 (91.9)	216	1.000
	Secondary	20 (9.2)	197 (90.8)	59	
Level of Study	Year 1 & 2	6 (6.6)	85 (93.4)	90	0.3795
	Year 3	19 (10.1)	169 (89.9)	185	
Did you receive any COVID-19 vaccine?	Yes	4 (3.8)	100 (94.7)	100	0.0280*
	No	21 (12.0)	154 (88.0)	175	
Did you experience any side effects after receiving the COVID-19 vaccine?	Yes	2 (3.6)	53 (96.4)	54	1.000
	No	2 (4.1)	47 (95.9)	46	
	Total**	4 (3.8)	100 (96.2)	100	
How severe were the side effects?	Mild to Moderate	2 (4.3)	45 (95.7)	24	1.000
	Minor discomforts	0 (0.0)	8 (7.7)	30	
	Total***	2 (3.6)	53 (96.4)	54	

*Significant at 95% (0.05 significance) level. Total based on those who received COVID-19 vaccines (**) and those who experienced side effects (***).

The Fisher's exact test was performed as illustrated in Tables 5, 6, and 7. Only prior COVID-19 vaccination shown a correlation with attitudes towards vaccines ($P = 0.0280$), indicating that those who had COVID-19 vaccines tend to hold a favourable impression of vaccination overall.

Table 6: Fisher Exact contingency test of associations between sociodemographic characteristics and the vaccine confidence among nursing students in DSCNSA ($n = 231$)

Independent Variable		Level of Impact on Confidence in Vaccines		Total	Fischer Exact P-Value
		Significant n(%)	None/Minimal n(%)		
Age Group	18 – 24 years	140 (72.2)	54 (27.8)	194	0.1880
	25 and above	25 (61.0)	16 (39.0)	41	
Gender	Female	133 (71.1)	54 (28.9)	187	0.5970
	Male	32 (66.7)	16 (33.3)	48	
Religion	Christianity	155 (69.8)	67 (30.2)	222	0.7591
	Non-Christianity	10 (76.9)	3 (23.1)	13	
Highest Level of Education	Prior Diploma or Bachelors	38 (71.7)	15 (28.3)	53	0.8650
	Secondary	127 (69.8)	55 (30.2)	182	
Level of Study	Year 1 & 2	52 (68.4)	24 (31.6)	76	0.7602
	Year 3	113 (71.1)	46 (28.9)	159	
Did you receive any COVID-19 vaccine?	Yes	63 (69.2)	28 (30.8)	91	0.884
	No	102 (70/8)	42 (29.2)	144	
Did you experience any side effects after receiving the COVID-19 vaccine?	Yes	35 (71.4)	14 (28.6)	49	0.6550
	No	28 (66.7)	14 (33.3)	42	
	Total**	63 (69.2)	28 (30.8)	91	
How severe were the side effects?	Mild to moderate	29 (70.7)	12 (29.3)	41	1.000
	Minor discomforts	6 (75.0)	2 (25.0)	8	
	Total***	35 (71.4)	14 (28.6)	49	

*Significant at 95% (0.05 significance) level. Total based on those who heard about safety issues & received COVID-19 vaccines (**) and had side effects (***).

Direct assessment of the percentages reveals considerable disparities: news regarding COVID-19 safety issues markedly influenced vaccine trust in a greater proportion of females (71.1%) compared to males (66.7%), but the impact on the propensity to receive vaccination in the future was higher among males (58.3%) than females (52.9%). Regarding religion, vaccine perception was marginally more favourable among Christians (91.6%) compared to other religious affiliations (83.3%); while vaccine confidence was more significantly affected among other religious affiliations (76.9%) than among Christians (69.7%); and the likelihood of receiving future vaccines was lower among other religious affiliations (61.5%) than among Christians (53.6%).

Table 7: Fisher Exact contingency test of associations between sociodemographic characteristics and the likelihood for future vaccination among nursing students in DSCNSA (n = 231)

Independent Variable		Likelihood for Future Vaccinations		Total	Fischer Exact P-Value
		Less/Not Likely n(%)	Likely n(%)		
Age Group	18 – 24 years	109 (56.2)	85 (43.8)	194	0.1700
	25 and above	18 (43.9)	23 (56.1)	41	
Gender	Female	99 (52.9)	88 (47.1)	187	0.5210
	Male	28 (58.3)	20 (41.7)	48	
Religion	Christianity	119 (53.6)	103 (46.4)	222	0.7759
	Non-Christianity	8 (61.5)	5 (38.5)	13	
Highest Level of Education	Prior Diploma or Bachelors	26 (49.1)	27 (50.9)	53	0.4356
	Secondary	101 (55.5)	81 (44.5)	182	
Level of Study	Year 1 & 2	44 (57.9)	32 (42.1)	76	0.4835
	Year 3	83 (52.2)	76 (47.8)	159	
Did you receive any COVID-19 vaccine?	Yes	48 (52.7)	43 (47.3)	91	0.7890
	No	79 (54.9)	65 (45.1)	144	
Did you experience any side effects after receiving the COVID-19 vaccine?	Yes	28 (57.1)	21 (42.9)	49	0.4050
	No	20 (47.6)	22 (52.4)	42	
	Total**	48 (52.7)	43 (47.3)	91	
How severe were the side effects?	Mild to Moderate	25 (61.0)	16 (39.0)	41	0.2630
	Minor discomforts	3 (37.5)	5 (62.5)	8	
	Total***	28 (57.1)	21 (42.9)	49	

*Significant at 95% (0.05 significance) level. Total based on those who heard about safety issues & received COVID-19 vaccines (**) and had side effects (***).

Additionally, perception was more favourable among first and second-year students (93.4% compared to 89.9% for third-year students), with vaccination confidence among third-year students being more adversely affected (76.9% versus 68.4%); yet, third-year students exhibited a greater likelihood of receiving other vaccines in the future. Concerning COVID-19 vaccination status, vaccine confidence was slightly more affected by safety-related news among unvaccinated individuals (70.8%) compared to vaccinated individuals (69.2%), although those who received the COVID-19 vaccine exhibited a little greater likelihood of future immunization than their unvaccinated counterparts.

Individuals who experienced side effects after COVID-19 vaccination exhibited marginally more favourable perceptions towards vaccines (96.4% vs 95.9%). However, those with more severe side effects demonstrated less positive perceptions compared to those with mild side effects (95.7% vs. 100%). Vaccine confidence was more significantly affected among individuals who experienced side effects (71.4%) compared to those who did not (66.7%). However, those who encountered mild to moderate side effects (70.7%) were more inclined to receive vaccination than those with minimal side effects (75.0%).

Discussion

This survey examines vaccination confidence among nursing students at Delta State College of Nursing Science, Agbor (DSCNSA), focusing on trends in COVID-19 vaccine uptake, experience with COVID-19 Vaccines, exposure to COVID-19 vaccine risk and safety reports, and its impact on vaccine confidence.

COVID-19 Vaccine Uptake and Experience among Students of DSCNSA

Vaccine Uptake: There was a poor vaccination uptake among the students. This research found that merely 37.3% of participants had received at least one dose of the COVID-19 vaccine, with Moderna and Pfizer being the predominant vaccines received: each accounting for 22.1%. This is in sharp contradiction to various predictive perceptual studies that found 56.7% intentions to vaccinate among Japanese students by Myachi et al [22], 72.4% willingness to vaccinate among Sokoto State Nigeria residents as seen by Oche et al [23], and a global vaccine uptake rate of 60.23% as seen in an umbrella review by Abate et al [24]. However, while the finding is also way lower than reports of Josiah and Kantaris who found 48.6% willingness to get vaccinated in Delta State in year 2021, it is significantly higher than the findings of Asiwe et al [14] who reported 14.2% acceptance rate in a 2022 study in same Agbor community within same state. This means that as the COVID-19 pandemic evolved, the population beliefs and behavioural dynamics continued to change, requiring a real-time or close monitoring of public health interventions.

Vaccine Access: Significantly, the majority had received vaccinations at nearby health institutions, indicating accessibility. Nearly 50% of vaccinated respondents were unable to recollect the brand of the vaccine received, highlighting a communication deficiency during vaccination, as emphasized by Lorenzetti et al. [25]. This may stem from the expedited vaccination initiatives during the peak of the epidemic, prioritizing coverage above participation.

Vaccination Awareness: Also, 47.1% of the vaccinated respondents were unable to identify the brand of vaccine they received, suggesting a lack of awareness or indifference towards this information, even though a previous study by Josiah and Kantaris [15] and Asiwe et al [14] who had shown a higher awareness about the vaccine in development at the earlier periods of the pandemic. It implies that these individuals either were not told by the healthcare providers what brand of vaccines they were given, or the students were not

curious enough to ask or review the vaccines cards to identify the vaccines them. Also, it could mean that they would have forgotten COVID-19 has less attention and has becoming perceived as less threat. These findings indicate the necessity of integrating a more intentional and comprehensive vaccination literacy programs into nursing curricula to help students get familiarized about the concepts, attributes, and significance of vaccines.

Side Effects: One student reported having a seizure following the receipt of COVID-19 vaccination while the others (52.8%), experienced moderate side effects primarily manifesting as fever, chills, localized discomfort, headache, fatigue, body ache, drowsiness, vomiting, and loss of appetite being the most prominent side effects as with many other vaccines [26]. This findings also resonates with post-immunization experiences were seen by Olaoye et al [27], and may contribute to ongoing peer reluctance [28], which therefore means that sufficient counselling before, during, after vaccination, is required to manage the deep-seated feelings of fear that may have developed in the population.

Respondents' Exposure to COVID-19 Vaccine Risks and Safety Reports

Approximately 84.2% of respondents indicated significant exposure to reports concerning the safety and risks of vaccines. Merely 17.4% of respondents deemed the material highly dependable, while over 49% indicated that they occasionally adhered to the report. The media served as the primary source of information that shaped the opinions of almost fifty percent of the surveyed participants. Widespread exposure demonstrates the prevalence of discussions over vaccines during and after the COVID-19 pandemic [29,30]. However, this favourable sign is undermined by a perception of unreliability, illustrating the challenges of navigating a media world rife with mosaic pool of right and wrong information [31]. Even among nursing students, safeguarding against the adverse impacts of sensationalized or biased reporting is insufficient. It is essential to improve media literacy among students to instruct them in critical source evaluation by distinguishing credible information from false information in line with the WHO recommendations [32] as a way to promote safety with use and provision of health services as professionals.

Respondents' Confidence in COVID-19 Vaccine

The responders exhibited moderate trust in COVID-19 immunization. In the study, roughly 64.5% of respondents expressed general confidence in the

vaccines, 60.9% deemed them safe, and 65.2% considered them effective. Simultaneously, significant apprehension persisted: 37.6% would not advocate for vaccination to others, and 53% expected severe adverse consequences. These figures highlight the ambivalence in vaccine confidence, even among individuals with less health information. A significant obstacle noted is the fear of negative reactions; hence transparent communication is essential, highlighting bigger societal challenges [27,28]. Students may comprehend vaccination science; nonetheless, they might exhibit scepticism due to societal misinformation or anecdotal accounts of adverse consequences, as shown by a moderate level of belief in vaccine efficacy.

It is particularly concerning since more than 40% of respondents were reluctant to endorse vaccination to others. This may affect patients when these upcoming students become practitioners in the future. Conversely, educational activities must dispel myths, enhance confidence among nursing students, and develop their roles as vaccine advocates within the community.

Factors associated with Vaccine Confidence

The findings from the Fisher's exact analyses reveal that although other sociodemographic factors such as age, gender, educational history, and level of study did not exhibit significant influence on perception sentiment, history of COVID-19 vaccination emerged as a significant factor affecting vaccine perception, with students were vaccinated demonstrating a more positive perception towards vaccines compared to those who were not ($P = 0.0280$). Interestingly, those who experienced side effects had better perceptions, suggesting that adverse effects may not deter positive attitudes towards vaccination among these students. It may imply that those who had COVID-19 vaccines has an existing higher trust in vaccines and public health systems. This findings slightly supports Ayikoru et al [33] who found that concerns after vaccinations were mostly rational inquiries rather than unsubstantiated fears or refusal of vaccination in Uganda. Furthermore, experiencing side effects from the vaccines generally did not deter positive perceptions, though severe side effects led to less favorable views compared to mild ones. This suggests that personal experiences and demographic attributes remains underlying factors that shape how individuals perceive vaccines [35].

Similarly, there was no significant association between vaccine confidence level and age, gender, religion, level of study, or the receipt of COVID-19 vaccines. However, students in the third year and students with

only prior secondary education were slightly less confidence towards vaccines. This is similar to Modal et al [34], found education and other sociodemographic factors as strong predictors of vaccine acceptance in a nation-wide US-based study, and similar to the findings of White et al. [35] who found that vaccine acceptance was higher among people with higher education and socioeconomic status. Although, this aligns with the Falcone et al [36], the direction of the impacts on perception is contradictory with regards to prior education since they found that the less educated were less confident contrary to our findings in which those with prior higher education are less confident just as reported by Bashar et al [37].

Furthermore, none of the examined factors significantly affected the likelihood for future vaccinations among nursing students (p-values ranging from 0.1700 to 0.7890), suggesting that that while perceptions and confidence levels regarding vaccination are shaped by specific sociodemographic characteristics, these factors do not directly translate into a significant likelihood of future vaccinations. However, close observation of percentages showed that males were more inclined to consider future vaccinations than females and there was a paradoxical relationship between religious affiliation and future vaccination intentions, with Christians showing less likelihood despite having more favorable perceptions. Third-year students, despite having lower confidence, demonstrated a greater willingness to receive future vaccines. Additionally, individuals who had received COVID-19 vaccines were more likely to consider future immunizations than those who had not. The experience of side effects also played a role, with those experiencing mild side effects being more inclined toward future vaccination than those with minimal side effects. This suggests that personal experiences and demographic factors interact in complex ways to influence future vaccination decisions just as seen in many studies such as Agustarika et al. [38] who found that education level and other socio demographic attributes influence vaccine acceptance; Supremo et al. [39] which indicates that employment status and other sociodemographic characteristics had significant negative relationships with vaccine acceptance; Pagador et al. [40] which reports that age, sex, profession, income, religion, etc. were significant determinants of vaccine acceptance. These findings also challenge the popular view that sociodemographic characteristics affect trust in the healthcare system, perceptions of vaccine quality and safety, and the willingness to receive vaccinations [41], belief in vaccines [42], and vaccine confidence [43].

As seen in this study, it is important to note that the relationship between sociodemographic factors and vaccine confidence can be complex and context dependent. Zhao et al. [44] suggests that vaccine hesitancy emerges as a product of interactions between individual cognitive styles and perceptions of public health institutions, rather than being solely determined by sociodemographic factors. Additionally, White et al. [35] found that trust in science was a strong predictor of vaccine acceptance, which remained relatively stable across different sociodemographic groups. Understanding these dynamics is essential for developing targeted public health strategies aimed at improving vaccine acceptance and uptake within this critical demographic group especially by using educational interventions.

Public Health Policy Implications

This study points out the urgent necessity for focused public health strategies to enhance vaccine confidence, especially among healthcare trainees. Due to significant vaccine hesitancy among nursing students, it is imperative to design a counter measure and enhance health education. The concerned policymakers must prioritise communications about vaccine safety and efficacy to promote conditions that facilitate open dialogue between healthcare practitioners, educators, and the student communities in line with the WHO recommendation for augmenting media literacy and safety.

Recommendations

Based on the findings of this research, it is recommended that the Delta State Ministry of Health, Ministry of Education, and the Nursing and Midwifery Council of Nigeria should take steps to address the identified challenges using the following steps.

1. Integrate comprehensive and strategic vaccination safety awareness programs into nursing curricula, to ensure students understand the benefits and risks associated with vaccines.
2. Develop clear, consistent messages that addresses public concerns and effectively address panics.
3. Implement training for nursing students on researching and critically evaluating information on public health issues.
4. Collaborate with school and community leaderships in vaccination campaigns to leverage their influence in promoting vaccine acceptance within the student communities.
5. Establish systems to effectively vaccine knowledge and perceptions among healthcare students and

healthcare professionals to inform ongoing public health interventions.

Strengths and Limitations of the Study

The study offers significant specific insights into nursing students' experiences and opinions of COVID-19 immunisations, enhancing the overall comprehension of vaccine confidence. It employs a thorough survey methodology and ethical practice. Meanwhile, the study recommends further evaluation of future impacts of educational interventions on vaccine confidence and solidly builds upon prior study completed in 2021 by the authors regarding the perception and acceptance of COVID-19 vaccines in the entire State [15]. While the sample size accurately represents the target study population, generalizability may still be limited to the institution and city while a larger study may be needed to capture larger population of nursing students in Delta State or Nigeria.

Conclusion

This study identifies substantial shortcomings in vaccine confidence among nursing students at Delta State College of Nursing Science, Agbor, Nigeria. Despite their health education background, numerous students demonstrate hesitance towards vaccination owing to apprehension regarding side effects. Steps geared toward enhancing vaccine knowledge and communication techniques is essential for cultivating a more positive attitude towards immunizations among prospective healthcare practitioners.

Declarations

Authors' Contribution: Josiah, B. O (Conceptualization, Data Curation, Formal Analysis, Funding, Investigation (Data Collection), Methodology, Project Administration, Resources, Supervision, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing); Shittu, M. B (Data Curation, Formal Analysis, Funding, Investigation (Data Collection), Methodology, Project Administration, Resources, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing); Enebeli, E. C., (Data Curation, Funding, Methodology, Resources, Supervision, Validation, Visualization, Writing – Review & Editing); Duncan, B. A., (Conceptualization, Funding Acquisition, Project Administration, Validation, Writing – Review & Editing); Josiah, C. C., (Funding, Investigation (Data Collection), Writing – Original Draft Preparation, Writing – Review & Editing); Martins-Ifeanyi, O. P., (Data collection, Supervision, Validation); Emmanuel, M., (Data collection, Supervision, Validation); Opeyemi,



F. I., (Conceptualization, Methodology, Validation, Writing – Review & Editing); Alimele, K. E., (Methodology, Validation, Writing – Review & Editing); Akingbade, O., (Methodology, Validation, Writing – Review & Editing); & Kantaris, M (Conceptualization, Methodology, Supervision, Validation, Visualization, Writing – Review & Editing).

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