COVID-19 Guidelines Adherence and Vaccine Acceptability Among Pregnant Women in Niger Foundation Hospital Enugu, South-Eastern Nigeria: A Mixed Method Study

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Abstract

Objectives: This study aimed to determine the acceptability of coronavirus disease 2019 (COVID-19) vaccines and adherence to the preventive protocol among pregnant antenatal attendees in Niger Foundations Hospital Enugu, South-Eastern Nigeria.

Materials and Methods: Using a cross-sectional descriptive survey and in-depth interviews, we conducted a mixed method study from June to December 2021. We administered a structured questionnaire to 210 pregnant women to assess their knowledge and adherence to COVID-19 guidelines and interviewed 25 individuals. Quantitative and qualitative data were analyzed using SPSS v.28 and thematic analysis, respectively.

Results: The participants' age range was 20-43 years, with a mean of 29.9 (4.8) years. Most individuals (81.9%) had a university degree, 40.5% were skilled workers, and 73.3% had parity 0-1. They identified close contact (87.1%), respiratory distress (96.2%), and handwashing with soap (96.2%) as the commonest mode of transmission, symptom, and preventive strategy of COVID-19, respectively. Older women and individuals with higher parity had lower knowledge and adherence to COVID-19 precautions. Most participants rejected the vaccines due to fear of the side effects on themselves and the fetus.

Conclusions: Although there was good adherence to COVID-19 protocols among the pregnant women in this study, vaccine acceptance/uptake rate was low. Education on vaccine advantages and correction of conspiracy theories are recommended.

Keywords: COVID-19, Pregnancy, Vaccine uptake, Protocol, Precautionary measures

Introduction

The COVID-19 pandemic has affected the world in a way unseen in recent times. Globally, almost 518 million confirmed cases of COVID-19 with about 6.3 million deaths have been recorded (1), with a total of 255 859 cases and 3143 deaths in Nigeria as of May 16, 2022 (2). While 60.2% of the world population has been fully vaccinated, this rate is 7.7% for Nigerian population (3).

The pandemic has not only caused tremendous disruption to public health but also affected physician service delivery to patients. Though Lagos and Abuja were initially the most affected regions in the country, all states have recorded death cases. Physical distancing, quarantine of international travelers and their contacts, isolation of people with infection, hand hygiene measures, cough etiquette and wearing of face masks have all been promoted aggressively by the World Health Organization (WHO) and at regional and national levels. At the onset of the pandemic, despite aggressive measures of lockdown in most countries across the world, there was a continuous upward surge of new infections, showing the vulnerability of health systems worldwide. The lockdown has since been lifted in most countries, including Nigeria, due to huge socioeconomic losses and suffering, especially among the poor and underserved. However, all countries are enjoined to continue to practice precautions of physical distancing and other hygienic measures.

Pregnancy is a physiological state that predisposes women to viral infection (4). A pro-inflammatory stage is more evident during the first trimester where embryonic and placental implantation occurs, as well as within the third trimester for adaptation towards delivery, with an anti-inflammatory stage in-between that allows for fetal growth (5). In particular, cytokine outbursts production is linked to acute COVID-19. This pro-inflammatory stage of gestation throughout the first and third trimesters has been shown to render pregnant women more susceptible for more severe presentations of COVID-19 infection (6). While some studies reported no difference in risk of COVID 19 among pregnant women and the general

population (7), others showed an increased risk of infection due to the weakened immune system associated with pregnancy (8). In addition, due to the characteristic immune responses during pregnancy and potential risks from the cytokine-storm by COVID-19 infection, pregnant women with COVID-19 may face severe morbidity and even mortality (9).

Studies have shown that clinical signs, laboratory results, and radiographic criteria in pregnant women with COVID-19 are similar to other affected adults, but the risk of developing COVID-19 disease in pregnant women is high and there is the possibility of complications in pregnancy and newborn infection (10). Pneumonia, an important non-obstetric infectious condition, is an important cause of morbidity and mortality among pregnant women. Wang et al. (11) noted that pregnant women with severe acute respiratory syndrome (SARS) had higher rate of maternal mortality, intubation, and ICU admission than non-pregnant women with SARS, though there was no transmission of the virus to the infant, according to the study by Lam et al (12). COVID-19 pandemic has been shown to cause increased levels of stress, anxiety, and depression in pregnant women leading to decreased self-care scores and severe decline in their quality of life (13). In addition, in a systematic review, Razmjouei et al (14) noted that factors such as younger age, BMI <18.5, lower sleep quality, poor physical health, husband and pregnant wife's fear of COVID 19, poor marital life satisfaction, perceived poor support from the family, and presence of pregnancy complications contributed to increased mental health problems in pregnancy during the COVID-19 pandemic.

With the rapid spread of the disease in different countries, including Nigeria, taking special precautions like physical distancing and quarantining are recommended to protect and prevent the disease (15). One of the most effective public health measures to counter the spread of communicable diseases is through vaccination. The main goal of nationwide vaccination programs is to accomplish the desired herd immunity, but only if high vaccination rate is achieved (16). Huge efforts by the scientific community and pharmaceutical industry backed by governmental support were directed towards developing efficacious and safe vaccines for SARS-CoV-2. These efforts were manifested by the approval of several vaccines for emergency use.

On March 2, 2021, the National Primary Health Care Development Agency announced the arrival of the expected COVAX Astra Zeneca/Oxford COVID-19 vaccines. Only 13.3% of the Nigerian population has received at least a single dose of COVID-19 vaccine as of 16 May, 2022 (17).

Despite the huge efforts to achieve successful COVID-19 vaccines, a major hindrance can be related to vaccine hesitancy towards the approved and prospective COVID-19 vaccination (18). Understanding the influence of personal beliefs and experiences on maternal vaccination uptake is key to designing, testing, and deploying interventions that are tailored to improve vaccine acceptance and coverage in routine and outbreak settings (19).

Early detection and treatment of COVID-19 may reduce the potential obstetric complications such as miscarriage, intrauterine growth restriction, and preterm delivery, and may be beneficial for improving pregnancy outcomes. This is possible only if the pregnant women are aware of the symptoms of COVID-19, its impact on their pregnancies, the importance of early presentation, and readiness to accept available treatment including vaccination. In our environment, with minimal to absent social and medical infrastructures needed to properly manage COVID-19 infections, the importance of adherence to the preventive strategies cannot be overemphasized (20).

The aim of this study was to determine the knowledge and adherence to COVID-19 preventive precautions, as well as acceptance of (Astra Zeneca/Oxford) COVID-19 vaccines among pregnant women in Niger Foundations Hospital, Enugu, Southeast Nigeria.

Materials and Methods

The study was conducted in Niger Foundation Hospital and Diagnostic Centre, Independence Layout in Enugu Metropolis from June to December 2021. Though the area is designated as a high brow area, people of lower socioeconomic and educational level reside all around. The hospital is a specialist health facility which has a busy 20-bedded Obstetric Unit, with a dedicated obstetric theatre. The routine antenatal clinics run from Mondays to Fridays with an active emergency ward 24 hours a day. It caters for pregnant women living both in rural and urban areas of Enugu, the four surrounding Eastern States of Ebonyi, Anambra, Imo, and Abia, as well as the South-Southern states. The pregnant women were from all socioeconomic and educational levels, and paid the services fee either out of pocket, or in most cases through their health maintenance organizations.

We included all pregnant women within the

reproductive age (15-49 years), with a positive pregnancy test and ultrasound confirmation of viable fetus, and at least 6 weeks of gestational age.

Study Design
The study had a mixed-method design consisting of a cross-sectional descriptive quantitative aspect, and a qualitative part involving in-depth interviews with pregnant antenatal patients. The population consisted of all pregnant women who attended antenatal care in the facility and consented to participate in the study.

Sample Size
For the quantitative part of the study, the minimum sample size was determined using the formula for cross-sectional studies for an infinite population as follows:

$N = Z^2 PQ/D2 = Z^2 P (1-P)/D2$

which N = Minimum sample size at 95% confidence interval; Z = Standard normal deviation usually set at 1.96; P = 85.6% (proportion of nurses in Edo State, Nigeria during COVID 19 pandemic with good transmission-based precaution practices) (21); Q = 1-P; D = Precision (the difference between the true population rate and the sample rate set at 0.05; margin of error tolerable = 5% at 95% CI)

$1.96 \times 1.96 \times 0.856 \times 0.144 /0.05 \times 0.05 = 189.41$

Considering 10% (18.941) attrition rate, the sample size was calculated as 208.35 pregnant women. So, 210 women was deemed adequate for the descriptive cross-sectional quantitative part of the study.

For the qualitative part of the study, 25 in-depth interviews were conducted to explore the attitudes of the antenatal attendees towards COVID-19 pandemic and their views on the federal government vaccination strategy to limit the spread of the disease. Data was collected according to the data saturation principles (22).

Sampling Method
We used non-probability convenience sampling method and included all consecutive antenatal clients who booked for antenatal care in the facility and met the inclusion criteria.

Instruments
A structured researcher-made questionnaire was used to collect the demographic data, knowledge about COVID-19, and adherence to guidelines. The item used to measure these precautions was consistent with the guidelines issued by the WHO and NCDC. The demographic data consisted of age, marital status, parity, occupation, and level of education. The knowledge of COVID-19 assessed the awareness, pattern of transmission, symptoms, and preventive strategies. The adherence to guidelines was assessed based on a 5-point Likert scale (strongly adherent, adherent, somewhat adherent, non-adherent, and strongly non-adherent), which was divided into two groups for ease of analysis (adherent=strongly adherent and adherent, nonadherent = somewhat adherent, non-adherent, strongly non-adherent). Content validity of the instrument was done by two senior professors of the department of Obstetrics and Gynaecology of the University of Nigeria Teaching Hospital, Enugu. The questionnaire was pretested by administering it to 15 antenatal attendees who were excluded from the study. Content validity and reliability were also confirmed (Cronbach's alpha 0.86)

An interview guide was used for the in-depth interviews by the lead investigator, to assess the participants' attitudes towards COVID-19 vaccination. The questions asked included:

- Do you think COVID-19 vaccine is safe? Why?
- Are you willing to receive the vaccine? Why?
- If the vaccines were said to be 90% effective, would you be willing to receive the vaccine? Why?
- Do you agree to have your spouse, children, and relatives vaccinated? Why?
- How do you rate the government and health authorities' efforts in fighting the COVID-19?

The patients were allowed to answer the above questions with occasional probing to help explore in-depth the reasons behind their responses.

Data Collection Procedure
Eligible women were approached by trained medical interns and the objectives of the study were explained to them. We also provided the following information to the participants: the study type, importance of their participation in the study, and the effect of obtained results on improving the strategies for adequate service delivery and health outcomes of both mother and baby. We also guaranteed that their information would be used only for research purposes and treated with utmost confidentiality. We also informed that they were free to participate in the study, with no effect on their antenatal care in the facility whatsoever.

Quantitative Part
An informed oral consent was obtained was obtained from all participants. The 27-item questionnaires were either self-administered by the clients or interviewer-administered for those who were not educated enough to fully understand the questions on their own.

Qualitative Part
The participants in the in-depth interviews were recruited purposively from among the women who consented to participate in the quantitative part of the study, ensuring that social attributes of age, socioeconomic class, and educational status, as well as diversity in location or area of residence were represented. The clients of different ages and backgrounds were approached to participate in the in-depth interviews. The lead investigator also

notified that the interview would be tape-recorded and notes taken by a research assistant. The interview was in English for educated research participants and in Igbo language for those that were not literate. The interview lasted for about 30 minutes and was held in a private room in the hospital. Participants were assured that the interview could be stopped at any time of their choice and they could avoid answering any questions they wished. All tapes were reviewed at the end of each session to confirm adequacy. The notes taken were also reviewed after every interview to confirm that correct responses were recorded. The recordings were transcribed verbatim. In addition to the interview recordings, transcribing of digital files, and taking detailed field notes, reliability was further enhanced by having five percent of the tapes re-transcribed by another person to ensure correctness of the obtained information.

Data Analysis

In the quantitative part of the study, data analysis was done in the SPSS software version 28 (SPSS Inc., Chicago, Illinois) using descriptive statistics of frequency and percentage. Pearson chi-square was used to test association between demographic characteristics with knowledge on the mode of transmission, symptoms, preventive precautions, and adherence to the precautions. A *P* value <0.05 was considered statistically significant.

Analysis of the qualitative part of the study was done using the framework method, by arranging the responses in themes to answer the study objectives. After familiarization with the data, recurring similar phrases and ideas were coded and grouped together into broader patterns as themes. The identified themes were reviewed and confirmed to be accurate representations of the obtained data. The themes were finally defined and named to answer the open-ended survey questions. After the initial 20 interviews were analyzed and grouped into themes, the analysis of additional five interviews revealed no new themes, and saturation point was reached.

Ethical Considerations

Ethical clearance for the study was obtained from the Niger Foundations Hospital Ethics Committee (NFH-IRB 2023/0005). An oral informed consent was obtained from all participants, and the study was conducted in accordance with the Declaration of Helsinki. We also provided the following information to the participants: the study type, importance of their participation in the study, and the effect of obtained results on improving the strategies for adequate service delivery and health outcomes of both mother and baby. We also guaranteed that their information would be used only for research purposes and treated with utmost confidentiality. The option of refusal, with no negative consequence in antenatal care management was emphasized. Confidentiality and anonymity were ensured by storing up filled questionnaires in locked up cabinets, use of password protected files, and removing patient identification information from research records. In-depth interviews were held in a private room in the hospital, away from the clinic area. The questionnaires were administered by trained medical interns and not the research investigators to avoid any potential conflict of interest or therapeutic misconception, while the in-depth interviews were conducted by the lead investigator.

Results

Quantitative Analysis

Demographic and Obstetric Characteristics

The study sample consisted of 210 pregnant women. The age range of participants was 20-43 years with a mean (SD) of 29.9 (4.8) years. More than half of the respondents (54.3%) were aged 20-29 years. All respondents had at least secondary education, and the majority of them (81.9%) had a university degree. They were mostly primigravida/primipara (73.3%), with 26.2% being unemployed. The majority of participants booked for antenatal care in their first trimester (74.3%), while more than half (56.7%) of the respondents were in their third trimester during data collection (Table 1).

Knowledge About the Mode of COVID-19 Transmission, Symptoms, And Precautionary Measures With Adherence to Preventive Strategies

As indicated in Table 2, only three (1.4%) respondents were unaware of the COVID-19 pandemic. Also, 183 (87.1%), 140 (66.7%), and 141 (67.1%) respondents knew

Table 1. Demographic and Obstetric Characteristics

Variable	Number (n=210)	%	Mean (SD)
Age (y)			
20-29	114	54.3	Range: 20-43 29.9 (4.8)
30-39	91	43.3	
40-49	5	2.4	
Education			
Secondary	10	4.8	
Polytechnic	28	13.3	
University	172	81.9	
Occupation			
Unemployed	55	26.2	
Unskilled	70	33.3	
Skilled	85	40.5	
Parity			
0-1	154	73.3	
2-3	51	24.3	1.0 (1.1)
4 or more	5	2.4	
Booking gestational age wk)			
0-13	156	74.3	
14-26	51	24.3	11.5 (5.0)
27-40	3	1.4	
Gestational age at data collection			
0-13	12	5.7	
14-26	79	37.6	25.6 (7.1)
27-40	119	56.7	

Table 2. Knowledge on the Route of Transmission, Symptomatology, and Preventive Strategies of COVID-19 With Adherence to Preventive Precautions Among Pregnant Nigerian Women

Variable	Yes n (%)	No n (%)
Awareness of COVID-19 pandemic	207 (98.6)	3 (1.4)
Transmission by close contact	183 (87.1)	27 (12.9)
Transmission by air droplets	140 (66.7)	70 (33.3)
Transmission by handshake	141 (67.1)	69 (32.9)
Symptom of fever	175 (83.3)	35 (16.7)
Symptom of cough	170 (81.0)	40 (19.0)
Symptom of respiratory distress	202 (96.2)	8 (3.8)
Symptom of Diarrhea	50 (23.8)	160 (76.2)
Symptom of inability to smell	125 (59.5)	85 (40.5)
Washing hands with soap	202 (96.2)	8 (3.8)
Alcohol hand sanitizer	190 (90.5)	20 (9.5)
Facemask covering nose and mouth	190 (90.5)	20 (9.5)
Avoid touching the face	191 (91)	19 (9)
Two-meter physical distancing	195 (92.9)	15 (7.1)
Avoid crowded places	183 (87.1)	27 (12.9)
Adherence to handwashing with soap	190 (90.5)	20 (9.5)
Adherence to alcohol hand sanitizer	166 (79.0)	44 (21.0)
Adherence to proper face-masking	177 (84.3)	33 (15.7)
Adherence to 2-meter physical distancing	140 (66.7)	70 (33.3)
Adherence to avoidance of face touching	140 (66.7)	70 (33.3)
Adherence to avoidance of crowded places	138 (65.7)	72 (34.3)

that the modes of transmission included close contact with the infected people, air droplets, and handshake with the infected people.

Fever, cough, and respiratory distress were identified as symptoms of COVID-19 infection by 83.3%, 81%, and 96.2% of participants, respectively. Only 59.5% and 23.8% of respondents knew that inability to smell and diarrhea were the symptoms of COVID-19 infection.

The two commonest preventive precautionary measures noted by the participants were handwashing with soap (96.2%) and two-meter physical distancing (92.9%). Other preventive strategies were alcohol hand sanitization (90.5%), facemask covering nose and mouth (90.5%), avoidance of touching the face (91%), and avoidance of crowded places (87.1%).

Our participants were mostly adherent with hand washing with soap (90.5%) followed by proper face-masking (84.3%). Only 65.7% of the respondents adhered to avoidance of crowded places.

Association Between Demographic/Obstetric Variables and Knowledge About the Modes of Transmission of COVID-19

As shown in Table 3, there was no significant association between the respondents' age and level of education with knowledge of close contact with the infected people as a mode of COVID-19 transmission, but people with parity 4 or more ($P<0.001$) and a higher proportion of unemployed people ($P=0.014$) had no knowledge that close contact was a mode of transmission. While there was no significant association between participants' occupation and knowledge of air droplets as a mode of transmission, none of those aged 40-49 years ($P=0.006$), a lower proportion of those with parity 2-3 ($P=0.002$), and those with polytechnic level of education ($P<0.001$) had knowledge that air droplets was a mode of transmission. In addition, a lower proportion of those with parity 4 or more ($P=0.005$) knew that handshake was a mode of transmission, with no association between age, occupation and education.

Association Between Demographic/Obstetric Variables and Knowledge About COVID-19 Symptoms

There was no association between age, occupation, and education with knowledge of fever as a symptom. However, those with parity 4 or more had no knowledge

Table 3. Association Between Demographic Variables With Knowledge About the Modes of Transmission of COVID-19 Among Pregnant Nigerian Women

Variable	Close Contact		P Value	Air Droplets		P Value	Handshakes		P Value
	Yes	No		Yes	No		Yes	No	
Age (y)									
20-29	102	12	0.135	78	36	0.006*	82	32	0.158
30-39	78	13		62	29		57	34	
40-49	3	2		0	5		2	3	
Occupation									
Unemployed	54	1		34	21		36	19	
Unskilled	57	13	0.014*	43	27	0.168	44	26	0.478
Skilled	72	13		63	22		61	24	
Parity									
0-1	139	15		113	41		113	41	
2-3	44	7	<0.001*	24	27	0.002*	26	25	0.005*
4 or more	0	5		3	2		2	3	
Education									
Secondary	7	3		5	5		7	3	
Polytechnic	26	2	0.179	9	19	<0.001*	15	13	0.259
University	150	22		126	96		119	53	

Note: *Statistically significant P value <0.05.

(P=0.001) that fever was a symptom of COVID-19. None of those aged 40-49 years (P<0.001), people with parity 4 or more (P<0.001), with lower proportion of those working in unskilled labor (P=0.001), and secondary level of education (P=0.001) had knowledge about cough as a symptom. However, there was no association between the demographic variables with knowledge of diarrhea (Table 4).

Association Between Demographic/Obstetric Variables and Knowledge of Precautionary Measures

As Table 5 shows, the demographic variables were not significantly associated with knowledge of handwashing with soap. However, a lower proportion of those employed in unskilled labor had knowledge of precautionary measures of alcohol-based hand sanitization (P=0.001), avoidance of touching the face (P=0.031), proper face masking (P=0.003), two-meter physical distancing (p=0.016), and avoidance of crowded places (P<0.001). Similarly, a lower proportion of those with parity 4 or more had knowledge of alcohol-based hand sanitization (P<0.001), avoidance of touching the face (P<0.001), proper face masking (P=0.010), two-meter physical distancing (P<0.001), and avoidance of crowded places (P<0.001). There was no significant association between the level of education with knowledge of the preventive measures, except that a lower proportion of those with secondary education had knowledge about two-meter physical distancing (P=0.007).

Association Between Demographic/Obstetric Variables and Adherence to Preventive Strategies

As demonstrated in Table 6, there was no association between the respondents' age and adherence to COVID-19 preventive strategies. However, a lower proportion of unemployed people adhered to the preventive measures of alcohol-based hand sanitization (P<0.001), proper face masking (P<0.001), 2-meter physical distancing (P=0.013), and avoidance of face touching (P=0.005). A higher proportion of those with parity 0-1 adhered to alcohol hand sanitization (P<0.001), proper face masking (P=0.006), avoidance of touching the face (p=0.008), and avoidance of crowded places (P<0.001). A lower proportion of those with polytechnic level of education adhered to handwashing with soap (P<0.001), alcohol-based hand sanitization (P<0.001), proper face masking (P=0.019), and avoidance of crowded places (P=0.016).

Qualitative Analysis

We interviewed a total of 25 respondents (age range = 23-42 years; mean = 30.68 years). Their gestational age range was 7-39 weeks with a mean of 29.68 weeks. The major themes identified were lack of vaccine safety, non-acceptance of the COVID-19 vaccines, mistrust in the government, and inadequate information to the populace about the vaccines.

COVID-19 Vaccine Safety

The majority of respondents (17 or 68%) believed that

Table 4. Association Between Demographic Variables With Knowledge of Symptoms of COVID-19 Among Pregnant Nigerian Women

Variable	Fever		P Value	Cough		P Value	Resp Distress		P Value	Diarrhea		P Value	Lack of smell		P Value
	Yes	No		Yes	No		Yes	No		Yes	No		Yes	No	
Age (y)															
20-29	100	14		94	20		114	0		34	80		65	49	
30-39	72	19	0.095	76	15	<0.001*	83	8	0.004*	16	75	0.056	60	31	0.01*
40-49	3	2		0	5		5	0		0	5		0	5	
Occupation															
Unemployed	45	10		49	6		52	3		10	45		32	23	
Unskilled	53	17	0.044	47	23	0.001*	65	5	0.052	14	56	0.159	28	42	<0.001*
Skilled	77	8		74	11		85	0		26	59		65	20	
Parity															
0-1	136	18		132	22		152	2		42	112		100	54	
2-3	39	12	0.001*	38	13	<0.001*	45	6	0.003*	8	43	0.109	25	26	0.003*
4 or more	0	5		0	5		5	0		0	5		0	5	
Education															
Secondary	7	3		4	6		7	3		2	8		2	8	
Polytechnic	21	7	0.198	26	2	0.001*	26	2	<0.001*	2	26	0.075	12	16	0.003*
University	147	25		140	32		169	3		46	126		111	61	

Note: *Statistically significant P value <0.05.

Table 5. Association Between Demographic Variables With the Knowledge of COVID-19 Preventive Strategies Among Pregnant Nigerian Women

Variable	Handwash		Hand-Sanitizer		Not Touching Face		Proper Face Masking		2-Metre Physical Distancing		Avoid Crowded Places	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Age (y)												
20-29	112	2	105	9	106	8	103	11	106	8	101	13
30-39	85	6	82	9	82	9	84	7	86	5	79	12
40-49	5	0	3	2	3	2	3	2	3	2	3	2
P value	0.179		0.056		0.039*		0.057		0.014*		0.173	
Occupation												
Unemployed	53	2	52	3	50	5	50	5	50	5	49	6
Unskilled	67	3	56	14	59	11	57	13	61	9	52	18
Skilled	82	3	82	3	82	3	83	2	84	1	82	3
P value	0.968		0.001*		0.031*		0.003*		0.016*		<0.001*	
Parity												
0-1	150	4	146	8	147	7	144	10	149	5	142	12
2-3	47	4	41	10	41	10	43	8	43	8	41	10
4 or more	5	0	3	2	3	2	3	2	3	2	0	5
P value	0.214		<0.001*		<0.001*		<0.01*		<0.001*		<0.001*	
Education												
Secondary	10	0	7	3	7	3	7	3	7	3	7	3
Polytechnic	26	2	26	2	26	2	26	2	28	0	26	2
University	166	6	157	15	158	14	157	15	160	12	150	22
P value	0.524		0.075		0.06		0.075		0.007*		0.179	

Note: *Statistically significant *P* value <0.05.

Table 6. Association Between Demographic Variables With Adherence to the Preventive Strategies Among Pregnant Nigerian Women

Variable	Handwash		Hand Sanitizer		Not Touching Face		Proper Face Masking		2-Metre Physical Distancing		No Crowded Places	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Age												
20-29	103	11	94	20	96	18	76	38	77	37	78	36
30-39	82	9	69	22	78	13	61	30	60	31	57	34
40-49	5	0	3	2	3	2	3	2	3	2	3	2
P value	0.762		0.291		0.306		0.949		0.92		0.662	
Occupation												
Unemployed	48	7	29	26	37	18	30	25	28	27	34	21
Unskilled	62	8	58	12	55	15	44	26	55	15	49	21
Skilled	80	5	79	6	85	0	66	19	57	28	55	30
P value	0.323		<0.001*		<0.001*		0.013*		0.005*		0.613	
Parity												
0-1	143	11	134	20	137	17	105	49	108	46	113	41
2-3	42	9	29	22	37	14	32	19	29	22	22	29
4 or more	5	0	3	2	3	2	3	2	3	2	3	2
P value	0.066		<0.001*		0.006*		0.736		0.008*		<0.001*	
Education												
Secondary	10	0	10	0	10	0	10	0	10	0	10	0
Polytechnic	17	11	14	14	19	9	17	11	16	12	14	14
University	163	9	142	30	148	24	113	59	114	58	114	58
P value	<0.001*		<0.001*		0.019*		0.063		0.046*		<0.016*	

Note: *Statistically significant *P* value <0.05.

the vaccines were not safe. The safety concerns stemmed from information obtained from the acquaintances who had received the vaccines.

Regarding the safety of COVID-19 vaccines, a respondent expressed that:

"Not sure… I haven't taken it, so I don't know. Those who have taken it say it magnets light to the area of vaccination" (25-year-old, businesswoman, primigravida at 28 weeks GA).

This was corroborated by another respondent who said:

"I don't know if it is safe or not. Some people who took the vaccine have complained of body swelling and other medical complications "(35-year-old banker, G3P2+0, 2 alive (SVD), 32 weeks GA).

However, some respondents (32%) mentioned that COVID-19 vaccine was safe:

"It is safe because I know many people who have taken it and say it has no side effects" (25-year-old seamstress, BSc Guidance and Counselling, Primigravida at 7 weeks GA).

This was corroborated by another respondent who stated that:

"It is safe because it has reduced the death rate drastically since vaccination commenced (36-year-old telecommunication staff" (Primigravida at 39 weeks + 5 days).

Acceptance of the COVID-19 Vaccines

The majority of respondents did not accept to receive COVID-19 vaccines for themselves, even if their spouses had received the vaccines.

"I am not willing to accept it because the dosing schedule and side effects are not yet clear to me. Even if it is said to be 90% safe, I won't be willing to take it. However, my husband has taken two doses" (33-year-old staff-nurse-midwife, Primigravida at 36 weeks GA).

This was corroborated by another respondent:

"I will not accept vaccination, even if told that it is 90% effective because I don't want to gamble, especially as I am pregnant and I'm living in Nigeria. My husband has taken two doses" (28-year-old lawyer, primigravida at 38 weeks GA).

Some respondents were not willing to receive the vaccines for their family members due to safety concerns. According to a respondent:

"I am not willing to take the vaccine even if it is said to be 90% safe. I will rather continue with the preventive precautions. I won't advise any of my relations to vaccinate. No one knows the effect of the vaccine on those that have taken it in future" (42-year-old receptionist, BSc Economics, G4P3+0, with 4 living children, 38 weeks GA).

However, a few respondents were willing to take the vaccines but only after delivery due to fear of the effect on their fetus.

"I am willing to take it after delivery because I have

concerns about reactions following vaccination and its effect on my unborn baby. If said to be safe and effective in pregnancy, I will be glad to take it. My husband has taken 2 doses" (35-year-old Baker, BSc Food and Nutrition, G4P3+0, 37 weeks GA).

Those who received the vaccines had taken the vaccines prior to realizing that they were pregnant. A respondent said:

"I had 2 doses of the vaccine last year before I realized I was pregnant. Though my husband has not been vaccinated because he works from home, I believe the children can be vaccinated via the national program on immunization if it is safe for them" (38-year-old Sales Rep, G3P2+0, BSc Economics, 18 weeks GA).

Similarly, another respondent said:

"My husband and I received 2 doses before I tested positive for pregnancy. Despite the vaccination, my husband caught COVID-19 but it was mild and I believe I also caught it without exhibiting any noticeable symptoms. Imagine if we hadn't been vaccinated" (31-year-old Nurse, BSc Nursing G3P1+1, 22 weeks GA).

Government Mistrust

Many respondents were distrustful of the government due to the lack of confidence in the medical professionals. There was also lack of credible information about COVID-19 from the trusted sources. According to a respondent:

"The report given by the Nigerian government is not accurate. They just formulate the report. In our country, there is no guarantee. It may be real in other countries, but not in Nigeria. During Ebola outbreak, people were better informed, but in this case, the information from government is not adequate. Young people going for the National Youth Service Corps buy the vaccination cards without being vaccinated. We don't have confidence in the health personnel… why should we vaccinate? There is too much corruption in Nigeria" (35-year-old banker, G3P2+0, 2 alive (SVD), 32 weeks GA).

Similarly, another respondent said:

"People do not trust the government and it is affecting the whole health institutions. There is news about expired vaccines being brought into the country. If the government can convince people, more people will be willing to receive the vaccines" (23-year-old Pharmacy intern, primigravida at 37 weeks GA).

Discussion

Overall, the majority of our participants were aware of the COVID-19 pandemic. This shows that COVID-19 awareness creation campaigns across the country have had some positive impacts on the knowledge of the disease. Our study participants also had good knowledge of the mode of transmission, symptoms, and preventive strategies. This is similar to the results obtained among

pregnant women in Lebanon (23) and Northern Ghana (24), but differs from the findings among obstetric women in Abakaliki, Nigeria (25). This is probably because Abakaliki is a more rural community compared to our study area.

Respiratory distress was the commonest known symptom among our study participants unlike in Guraghe Zone Hospitals Ethiopia (26) where only 32.84% of their participants identified it as a symptom. This may be due to the fact that the Ethiopian study was conducted in the early months of COVID-19 infection when the different symptoms of this novel disease was still evolving. Anosmia and diarrhea were the least identified symptoms of COVID-19 infection among our participants, probably because these symptoms are less common in occurrence compared with fever, cough, and respiratory distress (27). This agrees with the findings by Besho et al (28) among pregnant women in West Ethiopia, where only 15.2% of their respondents had knowledge of diarrhea as a symptom. More than four-fifths of our respondents knew the preventive precautions, and handwashing with soap was the commonest identified precaution method; this is consistent with the findings in another study (29). However, it differs from a similar Nigerian study (30) where knowledge of COVID-19 among pregnant antenatal attendees was 60.9%. This difference might be related to the time the study, because information delivery and awareness creation programs about the pandemic were in the early stages at that time.

More than four-fifth of our study participants adhered to the COVID-19 preventive precautions. This agrees with findings among nurses in Edo State, Nigeria and Ethiopian antenatal attendees (31), but differs from a Ghanaian study where compliance to preventive strategies was low (32). The difference may have resulted because only about one-third of the respondents in the Ghanaian study had secondary/university education.

A higher proportion of people aged 40-49 years and those with parity 4 or more had poor knowledge of the modes of transmission, symptoms, preventive precautions, and poorly adhered to the preventive strategies. This may have been resulted because these women are preoccupied with challenges of providing services to their families rather than being distracted with COVID-19 information. This differs from other studies where increasing age and living with chronic illnesses were associated with higher prevalence of wearing a face mask, handwashing/hand sanitizing, and social distancing (33).

While a higher proportion of those with university education had knowledge of the symptoms, a higher proportion of people employed in unskilled labor had no knowledge of the symptoms. Educated women are more likely to access information on COVID-19, understand the various messages being disseminated on COVID-19 by the government and non-governmental organizations (NGOs), and are more likely to grasp its importance (34).

While there was no significant difference between the level of education and knowledge of the preventive precautions, a higher proportion of those employed in unskilled labor had no knowledge of the preventive precautions. This may be related to their level of education and the nature of their jobs.

There was also no significant difference between age and adherence to the preventive precautions, but the higher proportion of unemployed people poorly adhering to the precautions is probably due to lack of funds for face masks and hand sanitizers, as well as not having easy access to water. This agrees with the findings of an Iraqi study (35), where being unemployed was significantly associated with negative attitude scores.

Acceptance of COVID-19 Vaccines

The majority of our in-depth interview respondents believed that COVID-19 vaccines were not safe. This was primarily based on the interactions with those who had received the vaccine and reported different side effects. This is similar to the 29.0% acceptance rate reported in an earlier knowledge, attitudes and practices survey study towards COVID-19 from North-Central Nigeria (36) and agrees with findings in a poll conducted in 16 countries where pregnant mothers were less inclined to accept vaccinations for themselves (37). They were also unwilling to accept the COVID-19 vaccine for themselves even if they were told it was 90% effective; this agrees with recent studies indicating that pregnant women are inclined to resist physician vaccination recommendation during pregnancy (38).

However, our results differ from the 65.2% acceptance rate reported by Lazarus et al (39), which may be because they surveyed the general population, and males have been shown to be more inclined to accept COVID-19 vaccines. This may be related to males' higher perception of COVID-19 dangers and lower belief in conspiratorial claims surrounding the disease (40). It is noteworthy that some of the spouses of the pregnant women in our study had been fully vaccinated, while the females remained adamant that they did not trust its efficacy. It is documented that many mothers are wary about their young daughters receiving COVID-19 vaccines due to the absence of research studies on its effect on reproductive and procreative health (41), which may explain why most of our participants were not willing to receive the vaccines despite their spouses having received two doses.

The major reasons given for vaccine hesitancy were safety and lack of trust in the vaccination efficacy, which is similar to the findings of a Turkish study among pregnant women with 37% acceptance rate (42). In addition to fear of adverse events, inaccurate information about vaccines and sociocultural/religious factors are among the top three reasons for mistrust in vaccines (43). Some of our respondents believed that there was no COVID-19 pandemic in Nigeria because they expected to see deaths

on the streets judging from fake social media reports of what was occurring in other countries. This is similar to the findings by Wonodi et al(44), where respondents believed that it was just being used by the government to swindle public funds.

Another major reason for non-acceptance of the COVID-19 vaccines by our participants was the lack of trust in the government, which is supported by other studies where psychosocial predictors such as media/social media, trust in the government, the pharmaceutical industry, and healthcare professionals, partners, and a positive risk-benefit ratio were significant promoters for COVID-19 vaccine acceptance (45).

It has been shown that countries with a higher degree of public corruption have been less successful in the vaccination of their population despite controlling for other determinants of immunization progress (46). Some of the respondents complained of media reports of expired vaccines being given to the populace and that young graduates going for NYSC obtained the COVID-19 vaccine certificates without vaccination after offering bribes to health care workers, who are supposed to be educating and enforcing the vaccination program. This differs from reports from other studies where health workers were the most trusted sources of guidance about COVID-19 vaccines (47). There is need for the Nigerian government to assess these allegations to improve vaccine uptake among the community.

Those who accepted the vaccines agreed that vaccines are important in preventing infections. Some of the respondents who accepted vaccination also had relatives who received the vaccine or personal experience of receiving the vaccine with no untoward side effects, as well as relatives who had COVID-19 infection but recovered as a result of prior COVID-19 vaccination; this is consistent with other findings (48). However, most of the participants indicated that delayed acceptance, with vaccine safety for their unborn babies, was their primary concern. This is in line with the findings by Geoghegan et al(49), where the first top priority of pregnant and lactating women was vaccine safety for children.

According to the Health Belief Model (HBM), it can be assumed that higher vaccine-related knowledge should be associated with increased odds of vaccine acceptance (50). Knowledge of the risk benefit ratio was found to be a strong predictor of vaccine uptake (51), thereby representing a point of emphasis for public health interventions aiming to increase vaccine uptake. It is therefore suggested that local religious, political, and civic leaders whom people in their community feel they can trust could be used to allay fears, correct ignorant beliefs, and increase COVID-19 vaccine uptake (52).

Limitations
Our study sample was drawn from a single health facility in Enugu Metropolis to elicit their knowledge and adherence to COVID-19 precautions and vaccine uptake. Therefore, the findings may not be generalizable to the whole population. However, we presented some important results and recommendations to improve both adherence to preventive strategies and vaccine acceptance among pregnant women in Nigeria.

Conclusion
The majority of our participants were aware of the COVID-19 pandemic, had good knowledge of the symptoms and precautionary measures for combating the spread of the pandemic, with proper adherence to the precautionary measures. However, those aged 40-49 years with parity of 4 or more had poor knowledge of the symptoms and precautionary measures and poorly adhered to the precautionary measures. In addition, while there was no significant difference between age and adherence to the preventive precautions, a greater proportion of the unemployed were poorly adherent to the precautionary measures. Despite the fairly good adherence to the COVID 19 preventive strategies, the Nigeria Primary Health Care Development Agency and health care providers should further scale up community awareness through townhall, market and religious group meetings as well as radio and television programs. Provision of free facemasks and hand sanitizers can help to empower the unemployed and encourage adherence to the preventive precautions.

Acceptance of the COVID-19 vaccine was low among our respondents due to fear of adverse effects on their fetuses and the pregnant women themselves, as well as lack of trust in the government. Prior COVID-19 vaccination and/or knowledge of someone who was vaccinated without adverse reactions were strong determinants of COVID-19 vaccine acceptance among our participants.

Interventions to increase vaccine uptake need to stress the perceived susceptibility of pregnant women to COVID-19 infection that can lead to pregnancy complications such as preterm birth, preterm premature rupture of the membranes, and even maternal mortality, as well as highlight the possible benefits of vaccination during pregnancy, including protection of prospective mothers from COVID-19 infection and potential immunologic benefits for the fetuses. These interventions will be better conveyed through trusted community influencers while the government has to search for ways to re-earn the trust of the populace, possibly by sanctioning corrupt employees giving out vaccine certificates for a fee.

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Conflict of Interests
Authors declare that they have no conflict of interests.

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