

Original Article

COVID-19 Vaccine Uptake Among Pregnant Women Attending Antenatal Clinic in A Tertiary Health Institution In South-Western, Nigeria – Decisions And Lessons Learnt

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Abstract

Background: COVID-19 infection is a pandemic of global public health importance. COVID-19 vaccination was rapidly adopted and shown to be an important strategy to control the spread of the disease. However, pregnant women were reluctant to receive the vaccines for various reasons. This study assessed the prevalence of COVID-19 vaccination among pregnant women and the willingness of the unvaccinated women to receive the vaccine during or after pregnancy. **Methods:** This was a descriptive cross-sectional study conducted using pretested interviewer-administered questionnaires among antenatal clinic attendees from 1st October to 31st December 2022. Information obtained includes socio-demographic data, COVID-19 vaccination history, acceptance among the unvaccinated, and COVID-19 prevention measures. Data was analyzed using Statistical Product and Service Solutions version 25.0 software (IBM Inc. New York, United States). Level of significance was $p < 0.05$. **Results:** Mean age of the participants was 31.55 years (SD ± 5.522). About 48.5% of participants were vaccinated against COVID-19 before the index pregnancy. Participants' occupation ($p = 0.001$), and parity ($p = 0.024$) were associated with pre-pregnancy vaccination. There was a significant association between the level of education and willingness to receive the COVID-19 vaccine ($p = 0.015$). About 14.4% and 21.0% of the unvaccinated participants were willing to be vaccinated during- and after pregnancy respectively. The reason for remaining unvaccinated in pregnancy was predominantly due to vaccine unavailability (1.1%). **Conclusion:** This study revealed that the vaccine uptake and willingness to accept the vaccine during- and after pregnancy was poor. Health education, intensified vaccination campaigns and increased availability to the pregnant population will improve vaccine uptake and coverage.

Keywords: COVID-19 Infection, Vaccine, Pregnant Women, Nigeria,

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Introduction

Coronavirus disease-2019 (COVID-19) is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) which was first identified following an outbreak of respiratory illnesses in Wuhan City, Hubei Province, China.¹ COVID-19 rapidly spread beyond China to become a global health emergency.² The deployment of public health strategies such as social distancing, hand hygiene, isolation of infected individuals, and use of facemasks with vaccination has resulted in the prevention and control of its spread; and a drop in the number of cases in many countries. Despite these measures, there have been several waves of the disease with outbreak of other variants of the virus.³ Although the incidence has reduced, SARS-CoV-2 infection persists, between the 25th of February to 24th of March, 2024 there were 224,222 new cases and 4,878 deaths.⁴

A breakthrough in curbing the spread of the virus was the development of the COVID-19 vaccines with efforts to ensure mass vaccination to achieve herd immunity. In March 2020, the first COVID-19 vaccine human trials began with the Moderna mRNA vaccine.^{5,6} Clinical trials subsequently demonstrated that Pfizer, Moderna, BioNTech, and the AstraZeneca COVID-19 vaccines were over 90% effective. In less than a year (December 2020), the World Health Organization (WHO) issued its first validation of the COVID-19 vaccine for emergency use; and a positive step towards making COVID-19 vaccines globally available - a necessary step towards ending the pandemic. Currently, there are about nine different brands of COVID-19 vaccines approved by WHO.⁶ In about 2 years, approximately 67% of the world population had received at least one dose of a COVID-19 vaccine. However, only 19.9% of people in low-income countries received at least one dose. In Nigeria, the vaccine prevalence rate was 17%, of which more than 5% of these individuals were partially vaccinated.^{6,7}

With the uncertainties, constant evolution of the virus, and attendant high burden of the disease on the healthcare systems; the vaccines have the potential to abate the pandemic and improve disease outcomes. It was proven effective in reducing the rate of severe infection and hospitalization.⁸ However, despite the proven effectiveness of these vaccines, their uptake among various populations and settings including pregnant women was low.⁹

Vaccine hesitancy was prevalent and associated with various myths and misconceptions during the COVID-19 pandemic by individuals and groups, with no scientific evidence to support their stance.^{10,11} In Nigeria, there was low uptake of the vaccine in the general population¹¹ including the pregnant population. Pregnant women were not considered as being at higher risk for COVID-19 infection than the general population; however, the incidence of severe infection and fetal-maternal morbidity and mortality is significantly higher in those

infected with SARS-CoV-2.¹² In addition, studies have shown that severe COVID-19 infection in pregnant women significantly increases the risk of adverse fetal and maternal outcomes.^{12,13} Pregnant patients with COVID-19 disease were more likely to need intensive care and admission of their babies to the special care baby unit.¹³⁻¹⁵

Generally, the COVID-19 vaccine reduced the incidence of severe disease and the need for hospitalization from SARS-CoV-2 infection.⁸ Given the safety of the vaccine and the risk of adverse pregnancy outcomes, the COVID-19 vaccine was recommended for pregnant women. There are few studies on the uptake of COVID-19 vaccines among pregnant women; in addition, there is a need to understand the reasons for pregnant women's aversion to the COVID-19 vaccines.^{9,16} There is a paucity of studies that assessed the vaccine status and willingness of pregnant women to receive the COVID-19 vaccine during pregnancy and the barriers to vaccination in our environment.^{10,11} This study aimed to assess the COVID-19 vaccine status and willingness to receive the vaccine among pregnant women presenting for antenatal care at the University College Hospital, Ibadan.

Methodology

This was a cross-sectional study conducted over three months among pregnant women attending antenatal and delivery care at the health facility during the study period. The study was conducted in Ibadan, Southwest Nigeria. Ibadan is the capital and largest city in Oyo State, in Southwest, Nigeria. It is a metropolitan city made up of eleven local government areas. The study was conducted at the University College Hospital (UCH), Ibadan - a tertiary hospital with over 950 bed-capacity providing various specialty and sub-specialty services. There are five subspecialty units in the Department of Obstetrics and Gynecology; all offering specialist services and maternal healthcare to women in Ibadan and its environs. It is the main referral hospital for maternal and child health care in Ibadan with an annual delivery rate of about 2,500.

The sample size was calculated using the Leslie Kish formula, $Z_{\alpha}=1.96$, using a prevalence of subjects' willingness for COVID-19 vaccination of 34.7% and a difference of 5%.¹⁷ A minimum sample size of 349 participants was calculated; adding a 10% non-response rate, a minimum sample size of 384 participants was obtained.

Participants were counseled on the purpose and their role in the study, and written informed consent was obtained. Thereafter, participants were recruited at the antenatal clinic and obstetric wards using a simple random sampling technique. Data was collected using a pre-tested semi-structured self- and interviewer-administered questionnaire.

Data was entered and analyzed using the Statistical Package and Service Solutions (SPSS) version 25.0. A descriptive analysis was done. Categorical variables were

summarized as frequencies and proportions; while the continuous variables were summarized as mean (standard deviations). Bivariate analysis was done using the Chi-square test of association for the factors associated with the vaccination and the deterrents. The level of significance was $p < 0.05$. Ethical Considerations: Ethical approval was obtained from the University of Ibadan/University College Hospital (UI/UCH) ethics review committee with ethical approval number - UI/EC/22/0289.

Results

This study assessed the COVID-19 vaccination status among pregnant women receiving antenatal and delivery care at UCH. Three hundred and seventy-seven questionnaires were completed and analyzed. Table 1 shows the average age of the participants was 31.55 years (SD ± 5.522). The majority of the participants had no pregnancy co-morbidities (85.4%). The gestational age at enrollment was across all trimesters of pregnancy. Most of the participants were in the second trimester (49.9%) and third trimester (38.5%). About 48.5% of the participants had received COVID-19 vaccination before the index pregnancy. Of the pregnant women (48.5%) who were vaccinated before pregnancy, about 26.3% were fully vaccinated with two doses of the vaccine. While the remaining 22.2% only had one dose.

Table 2 shows the relationship between COVID-19 vaccination status and the sociodemographic and obstetric characteristics of the participants. Healthcare professionals showed higher COVID-19 vaccination rates compared to non-healthcare professionals ($p = 0.001$). Participants with lower parity (less than 3) had higher vaccination rates compared to those with higher parity (3 or more) ($p = 0.010$). The sources of information on COVID-19 vaccines are shown in Figure 1. Information from the healthcare provider was uncommon.

Perception about COVID-19 vaccination

Table 3 presents the perceptions of participants about COVID-19. This study found that there was an association between belief in the existence of COVID-19 and vaccination status ($p = 0.009$). Also, there was an association between the belief that pregnant women can take vaccines and pre-pregnancy vaccination status ($p = 0.007$). In addition, the perception of COVID-19 vaccine safety in pregnancy was associated with pre-pregnancy vaccination status ($p = 0.000$). However, the perception of being at risk of the disease did not influence vaccination rates. The willingness to receive the COVID-19 vaccine during and after pregnancy is shown in Figure 2. Only 7.4% of all participants were willing to be vaccinated during pregnancy. More pregnant women (21%) were willing to be vaccinated after pregnancy.

Table 1: Socio-Demographic, Obstetric, and Clinical Characteristics of Participants

Variables	Frequency N=377 n (%)
Age Mean (\pm SD) -	31.55 \pm 5.522
Age (years)	
< 24	41(10.9)
25-29	104 (27.6)
30-34	117 (31.0)
35-39	84 (22.3)
\geq 40	31 (8.2)
Marital Status	
Married	364 (96.5)
Single/Separated/ Divorced	13 (3.5)
Level of education	
Primary	4 (1.1)
Secondary	52 (13.8)
Tertiary	321 (85.1)
Ethnicity	
Yoruba	342 (90.7)
Ibo	21 (5.6)
Hausa/others	14 (3.7)
Occupation	
Student /Unemployed	23 (6.1)
Skilled	45(11.9)
Unskilled	143(37.9)
Professionals	166(44.0)
Health worker	
Yes	18(4.8)
No	359(95.2)
Parity	
Para-0	116 (30.8)
Para 1-2	217 (57.6)
\geq Para 3	44 (11.6)
Pregnancy co-morbidity	
Hypertensive Disorder	24 (6.4)
Gynaecologic conditions	10 (2.7)
Hemoglobinopathies	6 (1.6)
Diabetes	5 (1.3)
Others	10 (2.7)
None	322 (85.4)
Pregnancy complication	
Maternal Complication	29(7.7)
Fetal complication	8 (2.1)
No complication	340 (90.2)
COVID-19 vaccine status	
Yes	183 (48.5)
No	194 (51.5)
Number of vaccine doses taken	
1 dose	99(26.3)
2 doses	84(22.2)

Table 2: Relationship between COVID-19 vaccination status, socio-demographic and obstetrics characteristics of participants

Variables	COVID-19 Vaccine Status		P value
	Yes n=183 (48.5%)	No n=194 (51.5%)	
Age			0.297
< 24	16 (8.7%)	25 (12.9%)	
25-29	48 (26.2%)	56 (28.9%)	
30-34	57 (31.2%)	60 (30.9%)	
35-39	42 (23.3%)	42 (21.6%)	
≥ 40	20 (10.9%)	11 (5.7%)	
Ethnicity			0.063
Yoruba	166(90.7%)	176 (90.7%)	
Igbo	14 (7.7%)	7 (3.6%)	
Hausa/ Others	3 (1.6%)	11 (5.7%)	
Level of Education			0.067
Primary/Secondary	35 (19.1%)	21 (10.8%)	
Tertiary	148(80.9%)	173 (89.2%)	
Occupation			1.546
Students/Unemployed	8 (4.3%)	13 (6.7%)	
Skilled	19 (10.4%)	28 (14.4%)	
Unskilled	66 (36.1%)	74 (38.1%)	
Professionals	90 (49.2%)	79 (40.7%)	
Healthcare Professional			
Yes	14 (7.7)	4 (2.1)	0.001
No	169 (92.3)	190 (97.9)	
Marital Status			0.141
Single	6 (3.3%)	1 (0.5%)	
Married	171(93.4%)	193 (99.5%)	
Separated/ Divorced	6 (3.3%)	0 (0%)	
Parity			
Para-0	48 (26.3)	68 (35.1)	0.010
Para 1-2	105 (57.4)	112 (57.7)	
≥ Para 3	30 (16.4)	14 (7.2)	

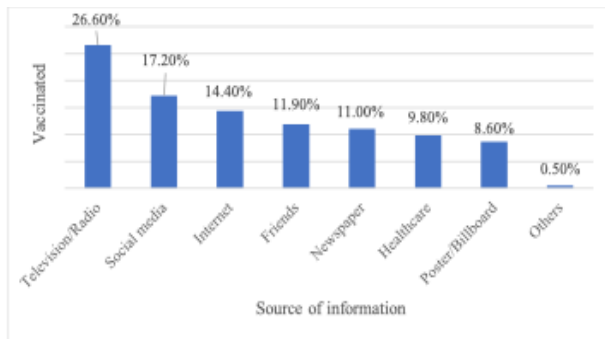


Figure 1: COVID-19 Vaccination Status and Sources of Information

Table 3: Perception of COVID-19 versus Vaccination

Variables	COVID-19 Vaccinated		Test Statistic	P value
	Yes (N=183)	No (N=194)		
	n (48.5%)	n (51.5%)		
Believe COVID-19 is real			9.520	0.009
Yes	179 (97.8%)	175 (90.2%)		
No/Not sure	4 (2.2%)	19 (9.8%)		
Perception of risk of COVID-19			0.158	0.924
Yes	20 (10.9%)	23 (11.9%)		
No	163 (89.1%)	171 (88.1%)		
Willingness for COVID-19 testing in pregnancy			3.322	0.190
Yes	53 (29%)	47 (24.2%)		
No/Not sure	130 (71.1%)	147 (75.7%)		
Vaccination in pregnancy is acceptable			12.027	0.007
Yes	75 (41.0%)	48 (24.7%)		
No/ Not Sure	108 (59.0%)	146 (75.2%)		
Perception of COVID-19 vaccine safety in pregnancy			31.721	0.000
Yes	60 (32.8%)	24 (12.4%)		
No/Not sure	123 (67.2%)	170 (87.6%)		
Previous COVID-19 testing			60.342	0.000
Yes	83 (45.4%)	19 (9.8%)		
No	100 (54.6%)	175 (90.2%)		
Previous COVID-19 status			66.128	0.000
Positive	11 (6%)	0 (0%)		
Negative	172 (94%)	194 (100%)		

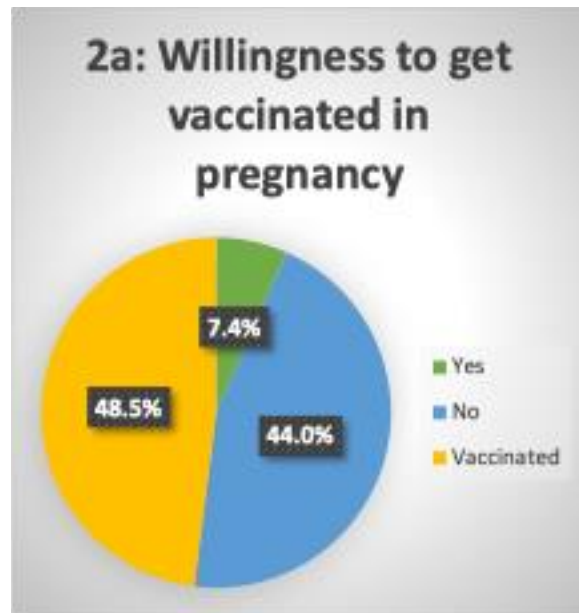


Fig. 2 a

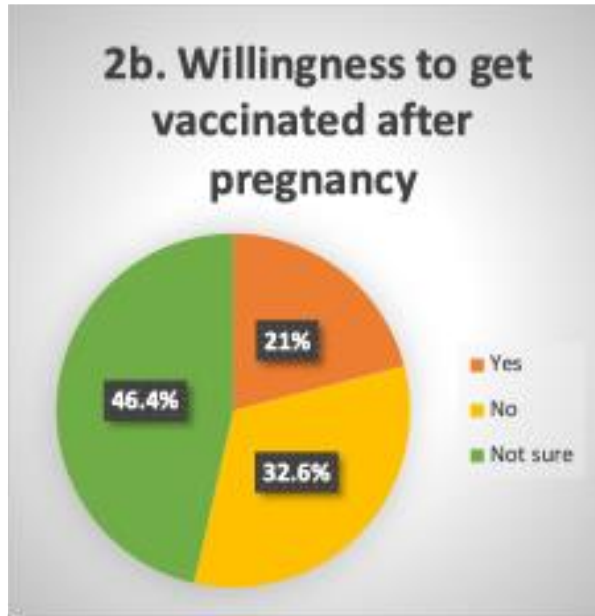


Fig. 2 a
Figure 2: Figure 2a: Pie charts showing the pregnant women’s willingness to be vaccinated during pregnancy. Figure 2b: Pie charts showing the pregnant women’s willingness to be vaccinated after pregnancy

Socio-demographic, clinical, and obstetric factors associated with willingness to receive COVID-19 vaccine among unvaccinated pregnant women

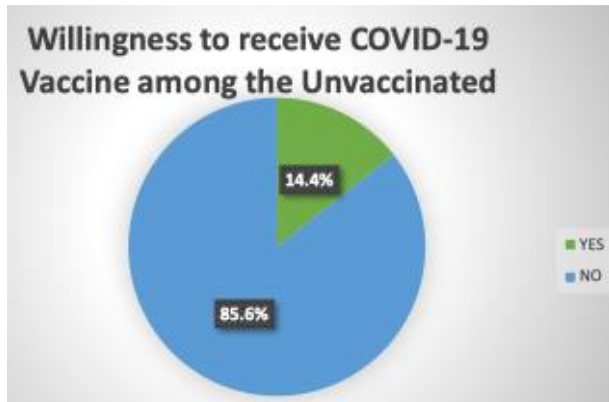


Figure 3: Willingness of the unvaccinated pregnant women to receive the COVID-19 vaccine during pregnancy

In Figure 3, 14.4% of the unvaccinated women were willing to receive the COVID-19 vaccine. Table 4, shows that there was no association between age, ethnicity, and willingness to receive the COVID-19 vaccine among unvaccinated pregnant women. However, there was an association between the level of education and willingness to receive the COVID-19 vaccine among unvaccinated pregnant women (p=0.037). In addition, parity was not associated with willingness to receive the COVID-19 vaccine (p=0.196).

Table 4: Association between Socio-demographic factors, obstetrics factors, and willingness to receive COVID-19 vaccine among unvaccinated pregnant women

Variables	Willingness to Receive COVID-19 Vaccine N=194		Test Statistic	P value
	Yes (n=28)	No (n=166)		
Age (years)				
< 24	3 (10.7)	22 (13.1)	3.115	0.539
25-29	9 (32.1)	47 (28.3)		
30-34	6 (21.4)	54 (32.5)		
35-39	9 (32.1)	33 (19.9)		
≥ 40	1 (3.6)	10 (6.0)		
Ethnicity				
Yoruba	27 (96.4)	149 (89.9)	1.552	0.460
Igbo	0 (0.0)	7 (4.2)		
Hausa/Others	1 (3.6)	10 (6.0)		
Level of Education				
Primary	1 (3.6)	0 (0.0)	6.612	0.037
Secondary	4 (14.3)	16 (9.6)		
Tertiary	23 (82.1)	150 (90.4)		
Occupation				
Students	0 (0.0)	10 (6.0)	9.087	0.106
Unemployed	1 (3.6)	4 (2.4)		
Skilled	8 (28.6)	18 (10.8)		
Unskilled	11 (39.3)	66 (39.8)		
Professionals	8 (28.6)	68 (41.0)		
Healthcare professionals				
Yes	1 (3.6)	3 (1.8)	0.369	0.543
No	27 (96.4)	163 (98.2)		
Parity				
0	7 (25.0)	61 (36.7)	3.26	0.196
1-2	17 (60.7)	95 (57.2)		
≥ 3	4 (14.3)	10 (6.0)		
Pregnancy complication				
Maternal	2 (7.1)	13 (7.8)	0.895	0.639
Fetal	0 (0.0)	5 (3.0)		
None	26 (92.9)	148 (89.2)		

Barriers to Vaccination in Pregnancy

Various reasons were stated as barriers to vaccination among unvaccinated pregnant women. The reason for not taking the vaccine among those who had attempted was the unavailability of the vaccine (1.1%), refusal by the immunization team, and overcrowding. Some of the participants did not attempt vaccination during pregnancy due to advice from friends and family members 50.0%, health workers 44.8%, colleagues 0.3% and reading about it 0.3%.

Discussion

This study assessed the COVID-19 vaccination status among pregnant women and their willingness to receive

vaccines during or after pregnancy. The main finding of this study is that the prevalence of pre-pregnancy COVID-19 vaccination was 48.5% among the participants. The pre-pregnancy uptake of the COVID-19 vaccine among the respondents was associated with parity and being a healthcare professional. Pregnant women who were vaccinated were more likely to believe in the existence of COVID-19, accept vaccination during pregnancy, and be previously infected with COVID-19. Very few (14.40%) of the unvaccinated pregnant women were willing to receive the vaccine in pregnancy and this was associated with level of education and parity.

The average age of the participants was 31.5 years. Most participants were married, had tertiary education, were in the second trimester of pregnancy, had no pregnancy comorbidities, and were predominantly of the Yoruba ethnic group in South-west Nigeria. The vaccination rate among pregnant women in this study was 48.5%. In Nigeria, as of November 2023, only 37.2% of the population were fully vaccinated against COVID-19.¹⁸ In another study, about 32.8% were vaccinated; 34.4% of people living in urban areas compared to 30.9% of those in rural areas.¹⁹ This is in contrast to the findings of Razzaghi and colleagues in the USA who reported COVID-19 vaccination prevalence of 63.2% among women aged 18-49 years and 45.1% among pregnant women, the Non-Hispanic black pregnant and breastfeeding women had significantly lower vaccination coverage in the study.²⁰ In Morocco, the prevalence of COVID-19 vaccination among women within two years of last childbirth was 61.8%, the date of last confinement and absence of gestational diabetes mellitus were associated with increased uptake of the vaccine.²¹ Vaccination rate among pregnant women was lower in many regions compared to the general population. In our study, the vaccination status was associated with the number of deliveries, being a healthcare professional, perception of COVID-19 existence, perception of the safety of vaccination in pregnancy, previous COVID-19 screen, and previously positive COVID-19 test. Poor knowledge or lack of correct knowledge may be contributory. A previous study among pregnant women demonstrated fair knowledge of COVID-19 disease; level of education, occupation, and exposure to social media were determinants of correct knowledge.²² The correct knowledge of COVID-19 and perception will impact positively on attitude to COVID-19 and vaccine uptake.

Among the participants, only a few pregnant women were interested in the uptake of the vaccine; about one in ten women during pregnancy, and one in five women were willing to get the vaccine after the pregnancy. Willingness to get vaccinated was associated with the level of education, occupation, being a healthcare professional, and parity. Similar findings by Januszek et al reported that the strongest factors co-existing with the acceptance of the COVID-19 vaccination in pregnancy were trust, perceived importance and effectiveness of the vaccine, explicit communication about the safety of COVID-19 vaccines for pregnant women, mass vaccination in the country, anxiety

about COVID-19, trust in public health agencies/health science as well as older age, higher education, and socioeconomic status.²³ The decision for the uptake of COVID-19 vaccination in pregnancy during the pandemic is complex and poorly understood as it was further reported by Lee et al that prior vaccinations, higher levels of trust in medical professionals, education, confidence, and collective responsibility predicted increased vaccine uptake in pregnant and breastfeeding individuals.²⁴

Among the previously unvaccinated women, only a few (less than one in five) participants were willing to receive the COVID-19 vaccine in pregnancy if offered the vaccine. This is lower than the findings from other countries such as India, Brazil, the UK, and the USA where the willingness to be vaccinated among pregnant women was 87%, 71%, 59%, and 52% respectively.²⁵ The finding from a similar study in Sudan reported that only 2.7% of pregnant women were willing to be vaccinated in the index pregnancy.²⁶ In Cameroon, less than a third of pregnant women (31.0%) were interested in the vaccine.^{26,27} These varied rates of vaccine uptake may be reflective of the COVID-19 vaccination uptake by the general population in their environment.

The COVID-19 vaccination rate in Nigeria is low; hence the a lower rate of vaccination in pregnant women. Similarly, the willingness for vaccine acceptance is also low among other low- and middle-income countries.^{26,27} This may be due to the level of education, exposure to COVID-19 information, the sources of information, and initial concerns about vaccine safety which could have contributed despite recommendations for vaccination in pregnancy by health organizations including the Centre for Disease Control and Prevention (CDC) and WHO.^{28,29} The willingness to be vaccinated may also be influenced by various unknown personal reasons. Benayad et al reported that among unvaccinated women, nearly two-thirds wanted to be vaccinated for reasons such as believing that the vaccines were useful; or they wanted to get the vaccine pass.²¹

Some studies reported the lowest vaccination rates and associated aversion to vaccination among pregnant women.^{9,20,30,31} Our study suggests similar findings as less than one-tenth of all respondents and less than a fifth of unvaccinated pregnant women were willing to be vaccinated during pregnancy.

Some participants reported that they were advised against vaccination in pregnancy. Notably, nearly half revealed that they were advised by health personnel.²⁴ This is worrisome as healthcare providers are supposed to be trusted sources of information for health advice to the populace. The lack of reliable information by the health personnel is detrimental to appropriate informed decision-making for the population. Therefore, it is of utmost importance that adequate and timely information is available to the healthcare providers and target population for important health decision-making.

Certain barriers to COVID-19 vaccination in pregnancy constituted challenges to achieving universal

vaccination in pregnant women despite the official declaration of the safety of the vaccines in pregnancy by the WHO and CDC to achieve wide coverage. Interestingly, about (97.9%) of the participants reported that they did not face any barriers to receiving vaccination in our study. The barriers to vaccination reported by unvaccinated pregnant women include safety concerns, unavailability of the vaccine, refusal by the vaccination team, and crowding at the immunization sites. Some pregnant women did not attempt vaccination during pregnancy due to advice from friends and family members, health workers, and colleagues. There is a need for decentralization and widespread distribution of vaccines to the populace to increase vaccine coverage. A study by Omar et al reported the fear of side effects as the commonest barrier to vaccination.²⁶

Of the pregnant women who were vaccinated before pregnancy (nearly half), only about a quarter (26.3%) had two doses of the vaccine. While the others (22.2%) only had one dose before pregnancy and had not received the second dose. There is a great need for concerted effort and improved motivation for pregnant women and other individuals to receive complete doses of COVID-19 and other vaccines to help achieve vaccination coverage and herd immunity for the population. Raising awareness about the safety of vaccines especially in pregnancy will increase uptake while reducing misinformation and the rate of vaccination fall-outs.

There is a temptation to forget a pandemic that is not over. Despite the sustained drop in the number of cases of COVID-19; the infection persists and isolated cases occur. The findings from this study imply that a proportion of women may not be vaccinated at the onset of pregnancy or at the time of enrolment for antenatal care. In addition, pregnant women are at significant risk of severe disease and poor perinatal outcomes, hence a need to be vaccinated. Also, the SARS-CoV-2 virus undergoes mutations from time to time with new variants emerging, and evidence shows that being immunized to a similar or closely related strain may offer protection or result in less severe disease and better outcomes.^{32,33} Vaccination before pregnancy is associated with fewer concerns. Hence, women in the reproductive age group who have the potential or desire to get pregnant should be counseled and encouraged to receive beneficial vaccines such as the COVID-19 vaccine before pregnancy to improve their clinical as well as maternal-fetal outcomes. Several vaccines may be required by women during pregnancy, deliberate effort should be made to educate women by providing accurate information and encouraging the uptake of vaccines during pregnancy.

The strengths of this study include the fact that the survey assessed the previous COVID-19 vaccination history of the respondents while evaluating the perception and attitude of pregnant women to vaccination during pregnancy. The sample size was adjudged adequate to power the findings of the study. However, the limitations of this study include the fact that our study could not detail the barriers to the acceptance of vaccination during

pregnancy by our participants. Also, the study could not fully elucidate the determinants of the barriers to vaccination experienced by the respondents.

Conclusion

In conclusion, our study demonstrated that about half of the respondents had received the COVID-19 vaccine before pregnancy. In addition, the willingness to be vaccinated in pregnancy was poor. This reflects the need for increased awareness about the benefits and vaccine safety while addressing the barriers to vaccination. Pregnant women have some aversion to vaccination in pregnancy for non-routine antenatal vaccines like the COVID-19 vaccine, hence, efforts should be made to improve the uptake of vaccination among reproductive-aged women before pregnancy. It is important to maximize vaccine information, and campaigns and improve the availability and utilization of the vaccine to the populace, especially in resource-poor settings. Overall, this study provides crucial insights that will guide public health efforts to promote the COVID-19 vaccine and other vaccines among pregnant women to ensure optimal maternal and perinatal outcomes.

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Author's Contribution:

Abdus-salam RA (RA) – Design, planning, conduct, data analysis, interpretation of results, and manuscript writing
 Ifebude Joshua (IJ) – Design, planning, conduct, interpretation of results, and manuscript writing
 Sanusi Aishat (SA) – Data analysis, interpretation of results, and manuscript writing
 Adesina Olubukola (AO) – Design, planning, conduct, interpretation of results, and manuscript writing

Ethical Approval

This study was approved by the institutional ethics Review Committee of University College Hospital and the College of Medicine, University of Ibadan (UI/UCH Ethics committee – UI/EC/20/0289). Voluntary and informed consent of the participants was obtained.

Statement of Informed Consent: All participants in this study gave voluntary informed consent.

Conflicting Interest: None.

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