

Survey of COVID-19 Vaccine Attitudes in Predominately Minority Pregnant Women

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Objectives: Despite recommendations for coronavirus disease (COVID-19) vaccination during pregnancy, some pregnant women are concerned about COVID-19 vaccines and decline to be vaccinated. This study focuses on attitudes in a sample of mostly minority pregnant Hispanic and Black women that may influence vaccine hesitancy.

Methods: This was a cross-sectional survey of 400 pregnant women. Participants were provided with a one-page information sheet on pregnancy health, COVID-19 health, and COVID-19 vaccines. They were then asked to complete a survey on attitudes about these topics.

Results: We found that attitudes for knowing about the health topics were in the range from agree to strongly agree, whereas attitudes for knowing about topics pertaining to COVID-19 messenger RNA (mRNA) vaccines were in a lower-level range from neutral to agree. Negative vaccine attitudes were significantly associated with decreased agreement for knowing about health attitudes, but not significantly associated with COVID-19 mRNA vaccine attitudes.

Conclusions: COVID-19 vaccine mRNA technology was a lesser understood topic than attitudes for knowing about other health topics. This finding suggests the need for physician intervention and that further education about COVID-19 vaccine mRNA technology may influence patient attitudes toward acceptance of the COVID-19 mRNA vaccine in pregnancy.

Key Words: attitudes, COVID-19, minority groups, pregnant women, vaccines

The development of coronavirus disease 2019 (COVID-19) vaccines excluded pregnant women from clinical trials because of potential safety concerns regarding the effect of the

vaccine on the unborn fetus.¹ The pregnancy state leads to changes in the body that not only increase the risk of infection but also can lead to a more severe COVID-19 infection.²⁻⁴ In addition, pregnant women are at increased risk for severe COVID-19 infection when there is a history of hypertensive disorders, thromboembolic events, asthma, or diabetes mellitus.⁵ The US Centers for Disease Control and Prevention recommends the use of COVID-19 vaccines in pregnancy because the potential harm of COVID-19 infection during pregnancy outweighs any possible harm from the vaccine.⁶ Despite this recommendation, there are some pregnant women who are concerned about COVID-19 vaccines and decline to obtain the vaccine while pregnant even if they are willing to later become vaccinated during the postpartum period.⁷

Self-reported increased knowledge about COVID-19 infection is highly predictive of decreased vaccine hesitancy in pregnancy.⁸ Blacks and Hispanics have greater COVID-19 vaccine hesitancy than Whites.⁹ A reason for Black vaccine hesitancy is that they often are less likely to be persuaded by the medical literature about COVID-19 vaccines.^{10,11} For some patients, the willingness to receive non-COVID-19 vaccines in pregnancy is associated with the intention to also receive the COVID-19 vaccine in pregnancy.^{12,13} Pregnant patients reporting a low likelihood of receiving the COVID-19 vaccine are concerned about the potential long-term maternal and fetal effects from the COVID-19 vaccine because only limited information is available at this time.^{14,15}

Knowledge about the risks of COVID-19 infection in pregnancy is associated with pregnant women engaging in the COVID-19 risk-reducing behaviors of social distancing, increasing hand sanitizer use, canceling scheduled events such as baby

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Key Points

- Attitudes for knowing about the health topics were in the range from agree to strongly agree.
- Attitudes for knowing about topics pertaining to coronavirus disease 2019 messenger RNA vaccines were in a lower level range from neutral to agree.
- Negative vaccine attitudes were significantly associated with decreased agreement for knowing about health attitudes but not significantly associated with coronavirus disease 2019 messenger RNA vaccine attitudes.

showers, or even considering a home birth.^{16–18} Knowledge that more severe COVID-19 infection in pregnancy is associated with preeclampsia, history of preterm birth, or thromboembolic events is not common knowledge among individuals in general, especially if they are not healthcare providers.^{19–21} Knowledge of the possibility of more severe disease in the presence of preeclampsia, history of preterm birth, or thromboembolic events is not associated with increased COVID-19 vaccine acceptance in patients with these conditions.²²

Patient consideration for receiving the COVID-19 vaccine in pregnancy can be largely influenced by physician recommendations as well as patient viewing data seen in the medical literature.^{23,24} It would be useful to understand attitudes of pregnant patients about pregnancy and COVID-19 vaccine topics. We are not aware of any study during the COVID-19 pandemic that specifically inquired about multiple topics of changes during pregnancy, preeclampsia, history of preterm birth or thromboembolic events, vaccine mechanisms of action, and COVID-19 vaccines. In addition, we are not aware of factors that affect COVID-19 vaccine hesitancy among pregnant Hispanic patients. One aim of this study was to identify attitudes that may influence the decision of pregnant patients to accept COVID-19 vaccination in pregnancy. Another aim was to compare these attitudes between those who received/want to receive the COVID-19 vaccine versus those who do not want to receive the COVID-19 vaccine. Finally, this study aimed to expand on specific attitudes that may influence vaccine hesitancy in a sample of mostly minority pregnant Hispanic and Black women. This knowledge may assist physicians to be more effective in counseling their pregnant patients on accepting COVID-19 vaccination.

Methods

Setting

This is an anonymous survey of 400 pregnant patients from a public county hospital in a Long Island suburb of New York City. This sample size was chosen because it is similar to sample sizes used in other surveys. To avoid any potential bias, all clinic participants who spoke Spanish or English were eligible. To protect patient anonymity, the number and details of those who declined were not recorded. We estimated that the survey response rate was >90% from the surveys that were fully completed and were included in the study. Paper surveys were distributed from November 2021 through April 2022. Patients were provided with a one-page information sheet on the topics of changes during pregnancy, preeclampsia, preterm birth, thromboembolic events, vaccine mechanisms of action, and COVID-19 vaccines (see Supplemental Digital Content Appendix, <http://links.lww.com/SMJ/A358>). They were then asked to complete a survey on their attitudes about these topics. Patients were offered the choice of receiving content in either English or Spanish. Oral informed consent was obtained from participants. The study was ethically conducted and received institutional review board approval.

Variables

Participants were asked two separate no/yes questions regarding whether they received the COVID-19 vaccine or whether they were interested in receiving the COVID-19 vaccine. These answers were combined into one variable of received/interested in receiving the COVID-19 vaccine (no/yes). The demographic variables consisted of age (years), participant self-reported race/ethnicity (Black, Hispanic, Other, White), education (grades 1–6, grades 7–12, college 2 years, college 4 years). Medical variables consisted of body mass index (kg/m^2), asthma (no/yes), and history of blood clot (no/yes).

Vaccine attitude questions were “Taking vaccines is harmful,” “Taking the COVID vaccine is harmful,” and “Taking the COVID vaccine during pregnancy is harmful.” These items were all measured on a Likert-style scale ranging from 1 = strongly disagree to 5 = strongly agree. We created a total score by adding these items; a total score indicates greater negative vaccine attitudes. The Cronbach α reliability was 0.88.

The information questions were as follows. One stated, “I was aware of all the information described on the information sheet prior to today.” There also were 21 questions on the topics of changes during pregnancy, preeclampsia, preterm birth, thromboembolic events, vaccine mechanisms of action, and COVID-19 vaccines (Table 1). These items were measured on a Likert-style scale ranging from 1 = strongly disagree to 5 = strongly agree.

Statistical Analysis

Means and standard deviations were used to describe the continuous variables. Frequency and percentage were used to describe the categorical variables. The Cronbach α was calculated for the vaccine attitudes scale items. Analysis of variance compared the continuous variables that had a normal distribution. The Mann-Whitney test compared the continuous variable that had a skewed distribution. The Pearson χ^2 test compared the categorical variables. All of the variables that were statistically significant in the univariate comparisons were included in a multivariate linear regression analysis. All of the *P* values were two tailed, with an α level of $P < 0.05$. SPSS version 28 (IBM SPSS Statistics, Armonk, NY) was used for the analyses.

Results

Approximately three-fourths of the sample was Hispanic ($n = 310/400$, 77.5%) and slightly more than one-tenth was Black ($n = 45/400$, 11.3%). Table 2 shows the comparisons for the sample characteristics. Mean age significantly differed ($P < 0.001$) where those who received or were interested in receiving the COVID-19 vaccine were older than those who did not receive or were not interested in receiving the COVID-19 vaccine. Mean attitudes that vaccines are harmful differed significantly ($P < 0.001$) where those who did not receive or were not interested in receiving the COVID-19 vaccine had greater mean scores than those who received or were interested in receiving the COVID-19 vaccine.

Table 1. Comparison of knowledge attitude items

Variable	Whole sample, mean (SD) (n = 400)	No COVID-19 vaccine, mean (SD) (n = 126)	Yes COVID-19 vaccine, mean (SD) (n = 274)	P
I now understand how COVID-19 affects women in pregnancy better than I did before reading the information sheet	4.4 (0.86)	4.3 (0.97)	4.5 (0.80)	0.10
I know how COVID-19 vaccines help me fight the virus	4.5 (0.95)	4.3 (1.08)	4.6 (0.88)	0.02
I know that because more information is available the CDC now recommends COVID-19 vaccines during pregnancy	4.4 (1.02)	4.3 (1.12)	4.4 (0.97)	0.18
I know that if I acquire COVID-19, I may develop different levels of severity of symptoms	4.5 (0.91)	4.4 (1.02)	4.5 (0.85)	0.09
I know that the severity of my symptoms can be affected by my medical conditions	4.5 (0.88)	4.3 (1.03)	4.5 (0.79)	0.02
I know that my body undergoes many changes during pregnancy	4.6 (0.82)	4.6 (0.86)	4.6 (0.80)	0.80
I know that COVID-19 can affect me differently because of the changes that occur during pregnancy	4.5 (0.91)	4.4 (0.96)	4.5 (0.88)	0.35
I know that preeclampsia is a diagnosis related to high blood pressure in pregnancy	4.4 (1.04)	4.2 (1.20)	4.4 (0.94)	0.01
I know that COVID-19 can lead to preeclampsia	4.1 (1.15)	3.9 (1.27)	4.2 (1.09)	0.02
I know that COVID-19 can make preexisting preeclampsia worse	4.2 (1.09)	4.1 (1.20)	4.3 (1.03)	0.04
I know that preterm birth is delivery before 37 weeks	4.5 (0.90)	4.4 (0.98)	4.5 (0.86)	0.82
I know that COVID-19 can lead to preterm birth	4.3 (1.05)	4.1 (1.18)	4.4 (0.96)	0.001
I know that COVID-19 increases the risk of blood clots, which have an additive worsening effect during pregnancy	4.3 (1.03)	4.2 (1.05)	4.3 (1.02)	0.55
I know that I can die if a blood clot that formed in my body breaks away and goes into my lung	4.3 (0.99)	4.3 (0.97)	4.3 (1.00)	0.75
I know how a virus enters the body	4.3 (1.02)	4.4 (0.92)	4.3 (1.06)	0.23
I know how my immune system recognizes viruses to destroy them and protect me	4.3 (1.03)	4.3 (0.95)	4.3 (1.07)	0.64
I know how mRNA is used in the body	3.8 (1.30)	3.6 (1.41)	3.9 (1.24)	0.11
I know that the Pfizer and Moderna COVID-19 vaccines use mRNA to form the protein that helps my immune system learn to recognize the virus	3.9 (1.27)	3.6 (1.44)	4.0 (1.17)	0.01
I know that the mRNA from the COVID-19 vaccine is destroyed by my body after a few hours to days and it does not stay in my body forever	3.7 (1.35)	3.5 (1.48)	3.9 (1.26)	0.01
I know that the Johnson & Johnson COVID-19 vaccine, which was associated with clots, uses a different method than mRNA vaccines to teach my immune system to recognize the virus	3.5 (1.41)	3.3 (1.55)	3.6 (1.33)	0.03

Mann-Whitney test used for "I know that my body undergoes many changes during pregnancy" because of the presence of skewness. CDC, Centers for Disease Control and Prevention; COVID-19, coronavirus disease 2019; mRNA, messenger RNA; SD, standard deviation.

Race/ethnicity, education, body mass index, history of asthma, and history of blood clots did not differ significantly between the vaccine groups. Education categories (grades 1–6: mean 2.8, standard deviation [SD] 1.59; grades 7–12: mean 3.2, SD 1.66; college 2 years: mean 3.0, SD 1.51; college 4 years: mean 3.2, SD 1.57) did not differ significantly ($P = 0.17$) for the item "I was aware of all the information described on the information sheet prior to today."

Table 1 shows the knowledge attitude items. Overall, mean attitudes for almost all of the items ranged from agree to strongly agree for knowing about the items except for the four messenger RNA (mRNA) COVID-19 vaccine items, which ranged from neutral to agree. In the univariate analyses, there were nine attitude items that differed significantly, with greater means for those who received or were interested in receiving the COVID-19 vaccine. These significant items were "I know how COVID vaccines help me fight the virus," "I know that the severity of my symptoms can be affected by my medical conditions," "I know that preeclampsia is a diagnosis related to high blood pressure in pregnancy," "I

know that COVID can lead to preeclampsia," "I know that COVID can make preexisting preeclampsia worse," "I know that preterm birth is delivery before 37 weeks," "I know that the Pfizer and Moderna COVID vaccines use mRNA to form the protein that helps my immune system learn to recognize the virus," "I know that the mRNA from the COVID vaccine is destroyed by my body after a few hours to days and it does not stay in my body forever," and "I know that the Johnson & Johnson COVID vaccine, which was associated with clots, uses a different method than mRNA vaccines to teach my immune system to recognize the virus."

Tables 3 and 4 show the multivariate linear regression analyses for attitudes. Receipt/interest in the COVID-19 vaccine was not significantly associated with any of the nine attitudes. Increased age was significantly positively associated with agreeing for all nine attitudes. Attitudes that vaccines are harmful were significantly negatively associated with the four attitudes of "I know how COVID vaccines help me fight the virus," "I know that COVID can lead to preeclampsia," "I know that COVID can make preexisting preeclampsia worse," and "I know that preterm

Table 2. Comparisons of sample characteristics

Variable	No COVID-19 vaccine, mean (SD) or no. (%) (n = 126)	Yes COVID-19 vaccine, mean (SD) or no. (%) (n = 274)	P
Age, y (mean)	28.1 (6.31)	30.5 (6.17)	<0.001
Race/ethnicity (mean)			0.91
Black	16 (12.7)	29 (10.6)	
Hispanic	95 (75.4)	215 (78.5)	
Other	7 (5.6)	15 (5.5)	
White	8 (6.3)	15 (5.5)	
Education (mean)			0.09
Grades 1–6	44 (34.9)	63 (23.0)	
Grades 7–12	43 (34.1)	114 (41.6)	
College 2 y	25 (19.8)	59 (21.5)	
College 4 y	14 (11.1)	38 (13.9)	
Body mass index, kg/m ² (mean)	26.6 (5.88)	26.8 (4.96)	0.69
Asthma (yes)	11 (8.7)	23 (8.4)	0.91
Blood clot (yes)	5 (4.0)	14 (5.1)	0.62
Vaccine attitudes (mean)	10.1 (3.71)	6.1 (3.49)	<0.001

Other race/ethnicity included 3 Asian/Asian American, 4 South Asian, and 10 not identifying with White, Black, Hispanic, Asian/Asian American, or South Asian. COVID-19, coronavirus disease 2019; SD, standard deviation.

birth is delivery before 37 weeks.” Attitudes that vaccines are harmful were not significantly associated with the mRNA COVID-19 vaccine attitude items.

Discussion

We found overall that for the whole sample, attitudes for knowing about the health topics of changes during pregnancy, preeclampsia, preterm birth, thromboembolic events, and vaccine mechanisms of action were in the range from agree to strongly agree, as well as that attitudes for knowing about topics pertaining to COVID-19 mRNA vaccines were in a lower-level range from neutral to agree. The multivariate analyses did not show any significant differences between those who received or were interested

in receiving the COVID-19 vaccine versus those who were not interested in receiving the COVID-19 vaccine for attitudes toward knowing about any of the health or COVID-19 vaccine topics. Increased age was significantly associated with increased agreement for knowing about health and COVID-19 vaccine attitudes. Negative vaccine attitudes were significantly associated with decreased agreement for knowing about health attitudes but not significantly associated with COVID-19 vaccine attitudes.

We found that attitudes for knowing about health topics were in the range from agree to strongly agree; however, attitudes for knowing about the topics of COVID-19 mRNA vaccines were lower and in the range from neutral to agree. The literature reports that although pregnant women often know a lot about health topics in pregnancy, knowledge about mRNA vaccines is scarce.²⁵ Our findings are similar to this pattern. We suggest that because the COVID-19 mRNA vaccines are relatively new, pregnant women were not that knowledgeable.

We did not find any significant differences between those who received or were interested in receiving the COVID-19 vaccine versus those who were not interested in receiving the COVID-19 vaccine for attitudes regarding knowing about any of the health or COVID-19 vaccine topics. We are not aware of any literature published about pregnant women on this topic. The literature has identified that personal perceptions about knowledge of vulnerability to more severe COVID-19 infection enhanced vaccine uptake.²⁶ Our findings with pregnant patients, despite increased knowledge about other COVID-19 health topics, differ from this pattern. We suggest that additional concerns may influence COVID-19 vaccine hesitancy in pregnant patients. We found that increased age was significantly associated with increased agreement for knowing about health and COVID-19 vaccine attitudes. In general, increased age is associated with increased knowledge about a multitude of health topics.⁸ Our findings in pregnancy are similar to this pattern. Furthermore, increasing age also may lead to increased knowledge about vaccines because of a longer period of familiarity with the use of vaccinations.

We found that negative vaccine attitudes were significantly associated with decreased agreement on knowing about health

Table 3. Multivariate linear regression analyses for attitudes

Variable	KN3 B (SE)	KN6 B (SE)	KN9 B (SE)	KN10 B (SE)	KN11 B (SE)
COVID-19 vaccine (yes)	0.02 (0.11)	0.08 (0.11)	0.10 (0.12)	0.04 (0.14)	0.01 (0.13)
Age, y	0.02 (0.01)**	0.02 (0.01)**	0.04 (0.01)***	0.02 (0.01)*	0.03 (0.01)**
Vaccine attitudes	−0.04 (0.01)**	−0.02 (0.01)	−0.02 (0.01)	−0.05 (0.02)**	−0.04 (0.02)**
Constant	4.16 (0.28)***	3.88 (0.26)***	3.38 (0.30)***	3.88 (0.34)***	3.71 (0.32)***

KN3, I know how COVID-19 vaccines help me fight the virus; KN6, I know that the severity of my symptoms can be affected by my medical conditions; KN9, I know that preeclampsia is a diagnosis related to high blood pressure in pregnancy; KN10, I know that COVID-19 can lead to preeclampsia; KN11, I know that COVID-19 can make preexisting preeclampsia worse. B, unstandardized beta; COVID-19, coronavirus disease 2019; SE, standard error.

*P < 0.05.

**P < 0.01.

***P < 0.001.

Table 4. Multivariate linear regression analyses for attitudes

Variable	KN12 B (SE)	KN19 B (SE)	KN20 B (SE)	KN21 B (SE)
COVID-19 vaccine (yes)	-0.20 (0.11)	0.16 (0.15)	0.22 (0.16)	0.19 (0.17)
Age, y	0.02 (0.01)**	0.03 (0.01)***	0.03 (0.01)**	0.03 (0.01)**
Vaccine attitudes	-0.04 (0.01)***	-0.03 (0.02)	-0.03 (0.02)	-0.02 (0.02)
Constant	4.35 (0.27)***	2.96 (0.37)***	2.90 (0.40)***	2.63 (0.42)***

KN12, I know that preterm birth is delivery before 37 weeks; KN19, I know that the Pfizer and Moderna COVID-19 vaccines use mRNA to form the protein that helps my immune system learn to recognize the virus; KN20, I know that the mRNA from the COVID-19 vaccine is destroyed by my body after a few hours to days and it does not stay in my body forever; KN21, I know that the Johnson & Johnson COVID vaccine, which was associated with blood clots, uses a different method than mRNA vaccines to teach my immune system to recognize the virus. B, unstandardized beta; COVID-19, coronavirus disease 2019; mRNA, messenger RNA; SE, standard error.

* $P < 0.05$.

** $P < 0.01$.

*** $P < 0.001$.

attitudes but not significantly associated with knowing about COVID-19 vaccine attitudes. Previous literature reports that those opposed to vaccines in general believe that they are knowledgeable about vaccine topics and because they are concerned about vaccines do not want to be vaccinated.²⁶ We suggest that because pregnant women may have additional concerns beyond vaccines in general, overall vaccine attitudes were not associated with specific attitudes toward knowing about COVID-19 vaccines.

With regard to race/ethnicity, we did not find any differences between racial/ethnic groups for interest and/or receipt of the COVID-19 vaccine. The literature suggests the importance of cultural tailoring of COVID-19 vaccines to different racial/ethnic groups. For example, Blacks are more likely to make their decision to accept the COVID-19 vaccine in pregnancy based on testimony from friends and family who have already received the COVID-19 vaccine and did not experience harmful effects, as opposed to recommendations from official information sources.^{10,14,23} Whites are more likely to consider receiving the COVID-19 vaccine based on published data or on physician recommendation.^{10,11} We are not aware of any cultural factors influencing COVID-19 vaccine hesitancy among Hispanics.

This study has a strength in that it surveys a mostly minority sample of Hispanics and Blacks. This study has several limitations. First, we are not aware of the impact of the information sheet on patient attitudes toward the health and COVID-19 vaccine topics because we provided the information sheet at the same time as the survey without measuring attitudes before providing the information sheet. Second, this study is from one site in the northeastern United States and thus may not generalize to other sites in different regions that may have different attitudes.

In conclusion, we found that pregnant women had greater levels of knowing about pregnancy health topics than about COVID-19 vaccine mRNA topics. We recommend that it would be useful for physicians to be aware of the attitudes of their pregnant patients about COVID-19 and COVID-19 vaccine topics to focus appropriate patient education on these topics. Because COVID-19 vaccine mRNA technology was a lesser understood

topic for the whole sample despite adequate knowledge about other COVID-19 topics, education on COVID-19 vaccine mRNA technology may influence patient attitudes toward acceptance of the vaccine.

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