COVID-19 Vaccine Acceptance Among Pregnant, Breastfeeding and Non-pregnant Reproductive Aged Women

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Short Title: COVID-19 Vaccine Acceptance Among Women

Condensation: Pregnant and breastfeeding women were more likely to decline vaccination against COVID-19 and healthcare workers were no more accepting of vaccination compared to non-healthcare workers.

Short Title: COVID-19 Vaccine Acceptance Among Reproductive Aged Women

AJOG at a glance

A. Why was this study conducted?

Although mass vaccination against COVID-19 may prove to be the most efficacious end to this deadly pandemic, there remains concern and indecision among pregnant and reproductive-aged women. This survey study aims at investigating their current attitudes and beliefs

B. What are the key findings?

Pregnant respondents were more likely to decline vaccination compared to non-pregnant and breast-feeding respondents due to lack of sufficient research and fear of harming their fetus. Working in healthcare was not associated with vaccine acceptance.

C. What does this study add to what is already known?

Both pregnant and breast-feeding women were less likely to accept vaccination compared to non-pregnant women with no increased likelihood of acceptance among healthcare workers.

Keywords: COVID-19, Vaccine, breastfeeding, risk reduction

ABSTRACT

Background: Although mass vaccination against COVID-19 may prove to be the most efficacious end to this deadly pandemic, there remains concern and indecision among the public towards vaccination. As pregnant and reproductive-aged women account for a large proportion of the population with particular concerns regarding vaccination against COVID-19, this survey aims at investigating their current attitudes and beliefs within our own institution.

Objective: To understand vaccine acceptability among pregnant, non-pregnant and breastfeeding respondents and elucidate factors associated with COVID-19 vaccine acceptance.

Methods:

We administered an anonymous online survey to all women (including patients, providers and staff) at our institution assessing rates of acceptance of COVID-19 vaccination. Respondents were contacted in one of three ways: by email, advertisement flyers and distribution of QR codes at virtual townhalls regarding the COVID-19 vaccine. Based on their responses, respondents were divided into three mutually exclusive groups: (1) non-pregnant respondents (2) pregnant respondents and (3) breastfeeding respondents. The primary outcome was acceptance of vaccination. Prevalence ratios were calculated to ascertain the independent effects of multiple patient-level factors on vaccine acceptability.

Results:

The survey was administered from January 7, 2021 to January 29, 2021 with 1,012 respondents of whom 466 (46.9%) identified as Non-Hispanic White, 108 (10.9%) as Non-Hispanic Black, 286 (28.8%) as Hispanic, and 82 (8.2) as Non-Hispanic Asian. The median age was 36 (IQR 25-47) years. Of all the respondents, 656 respondents (64.8%) were non-pregnant, 216 (21.3%) were pregnant and 122 (12.1%) were breastfeeding. There was no difference in chronic comorbidities when evaluated as a composite variable (Table 1). 390 respondents (39.2%) reported working in healthcare. Non-pregnant respondents were most likely to accept vaccination (457 respondents, 76.2%, $p<0.001$) with breastfeeding respondents the second most likely (55.2%). Pregnant respondents had the lowest rate of vaccine acceptance (44.3%, $p<0.001$). Prevalence ratios revealed all non-White races except for non-Hispanic Asian respondents and Spanish speaking respondents were less likely to accept vaccination(Table 3). Working in healthcare was not found to be associated with vaccine acceptance among our cohort.

Conclusions and Relevance:

In this survey study of only women at a single institution, pregnant respondents of non-White or non-asian races were more likely to decline vaccination compared to non-pregnant and breast-feeding respondents. Working in healthcare was not associated with vaccine acceptance.

INTRODUCTION

Early in 2020, New York City became the epicenter of the COVID-19 pandemic in the United States. The morbidity and mortality from COVID-19 infection has reached historically tragic heights with significant racial/ethnic disparities in disease prevalence[1]. Compared to non-pregnant women, pregnant women are at higher risk of severe illness and complications from COVID-19. A report from the Centers for Disease Control and Prevention (CDC) found that pregnant women were 3 times more likely to be admitted to the ICU or require intubation and 1.5 times more likely to die from COVID-19 compared to non-pregnant women[2]. Based on phase III randomized trials, vaccination against COVID-19 has been shown to be the most effective way thus far to prevent severe disease[3]. Given this increased risk, it would follow that our patient population would welcome the introduction of a COVID-19 vaccine. Broad distribution and acceptance are required to achieve herd immunity and expedite the end of the pandemic. To this end, eligible patients declining vaccination could significantly delay or potentially preclude herd immunity leading to more morbidity and mortality from the disease. While we await further trails on the effects of the COVID-19 vaccine in pregnancy, understanding patient perception and barriers to vaccine acceptance is imperative in helping to end the pandemic.

The American College of Obstetricians and Gynecologists (ACOG) and the Society for Maternal-Fetal Medicine (SMFM), following the Emergency Use Authorization of both the Pfizer and Moderna vaccines by the FDA, allowed for autonomy of pregnant people in receipt of the vaccine after a shared decision-making discussion with their obstetric providers[4]. Since the recent publication of data on COVID-19 vaccination and its subsequent implementation there have been no data on vaccine acceptance for pregnant women and those of reproductive age. In this study, we aimed to understand vaccine acceptability among pregnant women either receiving care or working within our department at the _ compared to non-pregnant women. Additionally, we aimed to evaluate racial/ethnic disparities in vaccine acceptance in pregnant and non-pregnant individuals receiving care in our institution. Lastly, we desired to elucidate factors associated with COVID-19 vaccine acceptance.

METHODS

We administered an online survey from January 7, 2021 to January 29, 2021 to evaluate individual rates of acceptance of COVID-19 vaccination. The survey was targeted to all women (including patients, providers and staff) at our institution. This study was approved by the Institutional Review Board (IRB) of _ (protocol# AAAT5404). A web-based survey was created in RedCap©, a secure web-based application designed to support data capture for research studies, and a URL link created for respondents to complete the survey. Given the low likelihood of harm, informed consent was waived by our IRB. However, there was a written description at the beginning of the survey emphasizing its purpose and our support of the patient's decision towards vaccination. Additionally, the names of the investigators were listed with contact information and they were informed that the survey was optional and not mandatory.

Study Population and Data Collection

Respondents were conveniently recruited through three primary sources with no restrictions to participation except that respondents were to be of the female sex. First, treating physicians of both privately and publicly insured patients within our institution were contacted for permission to approach their patients with our survey and encouraged to engage with patients about our survey. After permission was granted, all patient emails were obtained from the electronic medical record (EMR) and respondents were sent email invitations (example provided in supplemental material) explaining the purpose of the survey with the link included. The second source came from advertisement flyers that were posted in the waiting rooms of participating physician offices as well as in the hospital informing women of the survey with a QR code which linked to the survey online. The third source came from an "Virtual COVID-19 Vaccine Townhall" targeted to women of reproductive age working in the _ system. The QR code was posted at the beginning of the event with instructions to complete it prior to its start. The QR code was then removed once the event started. Given that the survey is anonymous and not unique, the URL could be shared among receivers.

Survey

A 23-question survey was created and piloted with a convenience sample in English and Spanish. At the start of the survey, respondents were informed that our department supports the personal decision of women regarding acceptance or declination of vaccination against COVID-19 and that the purpose of the survey was to better understand their thoughts and concerns regarding vaccination. Respondents were asked their age, pregnancy status, breastfeeding status, race, ethnicity, chronic medical conditions, employment and their health care provider. Chronic comorbidities included asthma, chronic obstructive pulmonary disease (COPD), sickle cell disease, heart condition, diabetes, diabetes of pregnancy, chronic hypertension, immunocompromised state (HIV, cancer, etc.) and tobacco use. On our 9th multiple choice

question respondents were asked if they planned on taking the vaccine once it was available to them. Respondents who responded “yes” or “I have already been vaccinated” were classified under vaccine acceptance. The remainder of their survey inquired about factors associated with vaccine acceptance. Those who responded “no” were classified under vaccine declination and the remainder of their survey focused on factors associated with declination. Those who responded “unsure” were classified as undecided and answered all questions associated with vaccine acceptance and declination. All respondents were then queried on factors that would influence their decision to accept and decline the COVID-19 vaccine. Factors against vaccination included concerns of its effect on pregnancy, suffering side effects, permanent injury, infertility, and risk of infection with COVID-19 from the vaccine. Factors in favor or vaccination included fear of severe COVID-10 infection, fear of infecting others with COVID-19, current available data from vaccine trials, healthcare workers acceptance of vaccination, current employment in healthcare and fear of suffering severe illness due to their race and or ethnicity. The complete survey is found in Supplemental Table 1.

Once the links were opened by respondents, the survey had to be completed and could not be saved and returned to. The survey did not have required fields therefore respondents were not required to complete every question. Answer choices of “not applicable” or “not sure” were listed where appropriate. There was no incentive to complete the survey. None of the collected data had identifying information, so it could not be used to trace respondents’ answers to their patient charts. On condition of grant of waiver for informed consent by the IRB, no unique identifiers (ie cookies or IP addresses) could be used to determine unique respondents. Since the QR code linked to the survey was posted on flyers at the virtual events, we were unable to determine an absolute response rate.

Statistical Analysis

Participants' characteristics were summarized for the overall sample and by group of pregnancy status into three categories: (1) non-pregnant non-breastfeeding respondents, (2) non-pregnant breastfeeding respondents and (3) pregnant. Medians with interquartile ranges were used to describe continuous variables and frequencies (percentages) for categorical variables. Group difference in baseline characteristics were compared using in Kruskal-Wallis test, chi-squared test, or fisher's exact test where appropriate. We used Poisson regression models to estimate the bivariate associations between multiple patient-level factors and vaccine acceptability. For the binary outcome of vaccine acceptability, prevalence ratios were calculated. Omitted answers were not included in the analysis. All analyses were conducted using SAS (version 9.4, SAS institutes, Cary, NC). Two-sided $p \leq 0.05$ was considered statistically significant.

RESULTS

In total, we had 1,012 respondents. Of all the respondents who completed the survey 466 (46.9%) were Non-Hispanic White, 108 (10.9%) were Non-Hispanic Black, 286 (28.8%) were Hispanic, 82 (8.2%) were Non-Hispanic Asian, 52 (5.2%) classified as other and 18 (1.8%) did not report any race or ethnicity. The median age was 36 (IQR 25-47) years. 390 (39.2%) were healthcare workers but only 5.8% were physicians. Of all respondents, 790 (79.6%) were employed with 317 (31.9%) reporting working from home either primarily or partially. Six hundred fifty-six respondents (64.8%) were pregnant, 216 (21.3%) were non-pregnant non-breastfeeding, 122 (12.1%) were non-pregnant breastfeeding and 18 (1.8%) respondents did not answer this question and were not included in the analysis. Of these, 390 respondents (39.2%) classified as working in healthcare. 106 (10.7%) specified their position in healthcare as "other", 61 (6.1%) were nurses, 58 (5.8%) were doctors and 57 (5.7%) were support staff (secretary, environmental services, patient educators, phlebotomist). The remainder of healthcare

professions were represented in smaller numbers and included social workers, dieticians, physical therapists, medical/nurse assistants, nurse practitioners, nurse midwives, therapists, psychologist, physician assistants and dentists (Supplemental table 1). Between the three mutually exclusive groups, pregnant respondents tended to be younger, more likely to have had a conversation with a doctor regarding the vaccine, as well as more likely to be working from home. Non-pregnant respondents were more likely to have chronic hypertension at 11.1% compared to 3.2% and 6.6% among pregnant and breastfeeding respondents respectively ($p=0.001$) with the remainder of comorbidities the same between the three groups except for gestational diabetes (table 1).

Non-pregnant respondents were more likely to accept vaccination with an overall rate of 76.2%, with 370 (56.4%) respondents planning to take the vaccine and 87 (13.3%) having already received the vaccine ($p<0.001$). Breastfeeding respondents were the second most likely to accept vaccination with an overall acceptance rate of 55.2%, with 60 (49.2%) reporting plan to take the vaccine and 4 (3.3%) reporting already have received the vaccine. Pregnant respondents had the lowest percentage of responses indicating vaccine acceptance with an overall rate of 44.3%, with only 82 (38.0%) respondents planning to be vaccinated and 4 (1.9%) respondents who were already vaccinated ($p<0.001$). Additionally, pregnant respondents had the highest percentage responses indicating vaccine declination with 59 (27.3%) stating they did not plan on getting the vaccine ($p<0.001$). Breastfeeding respondents were the most likely to report indecision towards vaccination with 32 (26.2%) stating that they were “not sure” if they would accept or decline the vaccine compared to 49 (22.7%) of pregnant respondents and 91 (13.9%) of non-pregnant respondents (table 2).

Prevalence ratios were calculated for characteristics associated with vaccine acceptance. For race and ethnicity, prevalence ratios were calculated using non-Hispanic White respondents as reference. We found that all races were less likely to accept vaccination compared to White respondents except for non-Hispanic Asian respondents (Table 3). Additionally, pregnancy and breastfeeding status were found to not be associated with vaccine acceptance. Using English language as the reference, Spanish speaking respondents were less likely to accept vaccination compared to English speaking respondents. Working in healthcare was not associated with vaccine acceptance (Table 3). When examined by individual profession using doctors as reference, nurses were no more or less likely to accept vaccination. When we analyzed three responses (acceptance, declination, undecided) between healthcare workers and non-healthcare workers we found no significant differences between the groups even when subdivided by type of healthcare worker (supplemental table 5). Having at least one chronic condition among those queried was not associated with vaccine acceptance. When analyzing chronic conditions separately, there were some marginal differences. Receipt of the flu vaccine was associated with vaccine acceptance (PR 2.25 95%CI 1.66-3.05).

When queried regarding specific concerns about the vaccines, we found that of those who declined vaccination were highly concerned that the vaccine would make them sick or harm them (Fig 1a). The next highest reported contributions to vaccine declination was the belief of having a low risk to contract and become severely ill from COVID-19 (median score 2.0/5.0 IQR 0.5-3.5). Among vaccine decliners, breastfeeding respondents shared similar concerns but were also concerned that the vaccine would cause them to become infertile (median score 4.0/5.0 IQR 2.5-5.0). Among pregnant vaccine decliners there was high concern of being vaccinated against COVID-19 in all trimesters. However, this was not uniformly shared towards all vaccines, such as vaccines against influenza or pertussis (Fig 1b). There was additional concern regarding lack of sufficient research on COVID-19 vaccination in pregnancy (median score 4.0/5.0 IQR 2.0-5.0) and fear that it could harm the fetus (median score 4.0/5.0 IQR 3.0-5.0)

Among those who accept vaccination, influences that favored vaccination included efficacy data from available publications, reassurance from available safety data, concern that if they became positive, they could infect others and seeing healthcare providers vaccinated (Fig 2a). Most of our respondents had very low concern of having a higher risk of infection due to their race or ethnicity (median score 0.0/5/0 IQR 0.0-2.0). When we examined the response to this question by race and ethnicity, we found that non-Hispanic White respondents consistently gave median scores of 0 for those questions while Hispanic and non-Hispanic Black respondents consistently chose scores that ranged from 1 to 3.5 out of 5.0 among non-pregnant, pregnant and breastfeeding respondents (Supplemental tables 2 and 3).

Among those who were undecided regarding vaccination, influences against vaccination included concern for the vaccine causing them harm as well as a belief that they themselves would not contract the virus or become severely ill from the virus (Fig 3a). Respondents were also invited to fill in their own personal reasons for accepting or declining vaccination which were aggregated under common categories (Supplemental tables 6 and 7). The most common reasons for declining vaccination included concern for short- or long-term side effects, the speed of development of the vaccine, fear of harming the pregnancy, prior allergy or anaphylaxis, lack of sufficient research and potential interaction with other medical comorbidities. The most common reasons for desiring vaccination included having family or friends who were at high risk of severe infection, personal immunity, presence of chronic comorbidities, protecting children and contribution towards herd immunity.

DISCUSSION:

Clinical Implications

Our study found that pregnant respondents were more likely to decline vaccination compared to non-pregnant and breast-feeding respondents. As a whole, healthcare workers were no more likely to be accepting of vaccines than non-healthcare workers. When examined by individual healthcare profession nurses were no more likely to accept vaccination compared to doctors. However, some professions had higher associations of vaccine acceptance, such as nurse midwives, therapists, mental health counselors and dentists. Among pregnant respondents, specific reasons for declination typically related to concerns for the vaccine causing them or their fetus harm, causing infertility as well as beliefs that they were at low risk of contracting or becoming severely ill from COVID-19. We did not find varying levels of concern by trimester nor did we see similar levels of concern with all vaccines in pregnancy. When we calculated prevalence ratios for vaccine acceptance, we found that non-White race and primarily non-English speaking respondents were more likely to decline vaccination. In all, our study is in line with findings from previously published surveys on vaccine acceptance.

A survey study conducted prior to the release of the vaccine by Schwarzinger et. al. of 1942 working-age adults found that 28.8% declined vaccination with declination significantly associated with female gender and lower perceived severity of COVID-19[5]. In the small pregnant portion of their majorly French cohort they found that most pregnant respondents declined vaccination (14/23, 60.9%). Lack of research on the effects of the vaccine in pregnancy could affect the acceptance rate in pregnant women and women hoping to become pregnant in the near future. In another recently published survey study from our institution, women who were pregnant or seeking conceive within the next 6 months were also found to be less likely to accept an mRNA COVID-19 vaccine (17.5% vs 47.3% for pregnant vs non-regnant, p=0.00001 and 41.3% vs 65.2% planning vs not planning to conceive, p=0.0062) citing concern for unknown long-term health consequences on children and risk of pregnancy loss[6]. One survey of 800

nurses in Hong Kong, China found that there was a low level of COVID-19 vaccine acceptance and a high proportion of indecision due to concerns in pregnancy[7]. We also found that health care workers were no more likely to accept vaccination. While this should be interpreted with caution, other studies have published similar findings.

A large portion of our cohort worked in healthcare with a small minority serving as physicians. This was not surprising for two reasons. Firstly, we distributed the survey at a virtual event for staff regarding COVID-19 vaccination. Secondly, a large portion of our staff utilizes the institution and our providers for healthcare. In our cohort, working in healthcare was not associated with vaccine acceptance. At first glance this may seem discrepant in comparison to other studies. Gagneux-Brunon et. al. conducted a survey of healthcare workers on the frontline during the first wave of the pandemic in France and found high rates of vaccine

acceptance at 76.9%[8]. However, when they looked factors associated with vaccine acceptance, they found older age and male gender as significant factors and found that nurses and assistant nurses were less inclined to getting the vaccine when compared to doctors. Wang et. al. also surveyed nurses in Hong Kong, China and found that only 40.0% accepted vaccination primarily due to the unknown effects of the vaccine on pregnancy[7]. Another key distinction between these studies and ours is that our data was first to be collected and reported on after the release of the COVID-19 vaccine to general public with the currently available data from clinical trials.

Research Implications

Our findings and those from previous studies further strengthen the stance of almost all major obstetric professional societies including ACOG and SMFM who were uniformly disappointed in the lack of inclusion of pregnant women in clinical trials. Safeguarding pregnancy is vital for the propagation of our population. Pregnant women should be allowed to participate and take advantage of the safety measures built into IRB approved modern clinical trials. This will allow their providers to take part in shared decision making with them utilizing high quality research in a patient population that is at high risk of morbidity and mortality. Future research also needs to further evaluate vaccine declination and indecision among minority populations.

The survey by Fisher et. al. found that Black race was associated with vaccine declination and indecision with 39% of Black respondents willing to take the vaccine compared to 64% of White respondents [7]. We found similar findings in our cohort when examining prevalence ratios comparing non-White to White respondents. As there exists significant racial disparity in morbidity and mortality from COVID-19, further investigation into reasoning behind vaccine indecision and declination among minority populations is vital [9]. While there has not yet been significant research examining the reasons behind COVID-19 vaccine declination and indecision in Black and Hispanic women, past atrocities committed by scientific investigators has been written about in multiple media publications. Much of the distrust comes from historic injustices like the Tuskegee Syphilis study where curative treatment from syphilis was withheld from hundreds of Black men in order to study the natural progression of the disease. Current disparities among Black and Hispanic patients across all of medicine likely worsens distrust. Future research should focus on identifying sources of distrust and interventions geared at dismantling those barriers. Additionally, we need continued reporting from clinical trials as well as education for all pregnant individuals, but especially for those in communities disproportionately affected by COVID-19. In our survey respondents were able to fill in their own concerns which we aggregated under common themes in supplemental tables 5 and 6. Our respondents were specifically concerned about the short-term

effects, long-term effects, overall safety and the speed of vaccine development. Future research and education geared toward these themes may aid in decision making between respondents and their healthcare provider.

Strengths and Limitations

Our study has several limitations. We are unable to report a response rate to our survey due to the nature of distribution. Although we know how many women received the survey by email, we are unable to differentiate them from those who received the survey by QR code from fliers that were posted in the hospital, at doctor's offices and at several virtual townhalls that were held for employees of our institution to discuss the COVID-19 vaccine. Survey studies with low response rates are at higher risk of sampling bias. Although the QR code was removed from view prior to the discussion at the virtual townhall, it is possible that some of the respondents answered our survey after completion of the event. However, due to the lack of research in pregnancy, many of their questions regarding the safety and efficacy of the vaccine could not be answered definitely. Thus, we would expect that their responses to the survey would still be representative of the concerns of those within their cohort. This study also used a web-based survey which required respondents to have access to or ability to navigate the internet. Strengths of this study include its large number of respondents which was very diverse in self-reported race and ethnicity. This study focuses primarily on women with a large proportion within the reproductive age range. Additionally, no other study has analyzed responses between pregnant, breastfeeding and non-pregnant women.

Conclusions

As of the publication of this study, the COVID-19 pandemic has killed over 500,000 Americans and emerging data shows that the vaccine may be the most efficacious way at limiting morbidity and mortality from the disease. As reproductive age women make up a significant portion of our population with unique concerns, studies that elucidate said concerns are vital in ensuring that proper research outcomes are investigated and efficient outreach is performed to maximize vaccine uptake and hasten the end of this deadly pandemic.

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Table 1: Baseline Characteristics

Variable	Non-pregnant (n=656, 64.8%)	Pregnant (n=216, 21.3%)	Breastfeeding (n=122, 12.1%)	p
Age	37.0 (16.0)	34.0 (6.0)	35.0 (7.0)	<0.001
Race/ethnicity				0.04
Non-Hispanic white	311 (47.4)	98 (45.4)	57 (46.7)	
Non-Hispanic black	83 (12.7)	13 (6.0)	12 (9.8)	
Hispanics	179 (27.3)	74 (34.3)	33 (27.0)	
Non-Hispanic Asian	54 (8.2)	20 (9.3)	8 (6.6)	
Others	29 (4.4)	11 (5.1)	12 (9.8)	
Language				<0.001
English	612 (93.3)	189 (87.5)	99 (81.1)	
Spanish	40 (6.1)	27 (12.5)	22 (18.0)	
Other	4 (0.6)	0 (0.0)	1 (0.8)	
Healthcare provider				0.018
Midwife	3 (0.5)	4 (1.9)	3 (2.5)	
Nurse Practitioner	38 (5.8)	10 (4.6)	8 (6.6)	
Other	16 (2.4)	3 (1.4)	8 (6.6)	
Physician	598 (91.2)	199 (92.1)	103 (84.4)	
Physician (healthcare provider)				<0.001
Family Medicine	50 (7.6)	27 (12.5)	9 (7.4)	
Internal medicine	336 (51.2)	80 (37.0)	31 (25.4)	
Ob/GYN	185 (28.2)	83 (38.4)	61 (50.0)	
Other	26 (4.0)	8 (3.7)	2 (1.6)	
Prior conversation with a healthcare provider regarding vaccination				0.04

Yes	189 (31.6)	79 (41.1)	34 (29.8)	
No	409 (68.4)	113 (58.9)	80 (70.2)	
Chronic conditions				
Composite Comorbidity	274 (41.8)	80 (37.0)	43 (35.2)	0.248
Asthma	84 (12.8)	29 (13.4)	13 (10.7)	0.75
COPD (chronic obstructive pulmonary disease)	3 (0.5)	2 (0.9)	0 (0.0)	0.49
Sickle cell disease	1 (0.2)	0 (0.0)	2 (1.6)	0.015
Heart condition	13 (2.0)	2 (0.9)	0 (0.0)	0.19
Diabetes before pregnancy	13 (2.0)	6 (2.8)	3 (2.5)	0.77
Diabetes in pregnancy (pregnant only)	15 (2.3)	10 (4.6)	14 (11.5)	<0.001
High blood pressure or Chronic hypertension	73 (11.1)	7 (3.2)	8 (6.6)	0.001
Immunocompromised (HIV, cancer, etc)	20 (3.0)	2 (0.9)	2 (1.6)	0.18
Tobacco use	5 (0.8)	1 (0.5)	1 (0.8)	0.89
Other	69 (10.5)	23 (10.6)	6 (4.9)	0.15
Currently Employed	536 (81.8)	174 (80.6)	80 (65.6)	<0.001
Currently working from home?				
Yes	165 (25.2)	77 (35.6)	34 (27.9)	0.008
No	62 (9.5)	21 (9.7)	9 (7.4)	
Partially	36 (5.5)	2 (0.9)	3 (2.5)	
Healthcare Worker	281 (42.8)	74 (34.3)	35 (28.7)	0.016
Role				0.07
Support staff (secretary, custodial staff, cleaning personnel, patient educators, phlebotomist)	47 (7.2)	7 (3.2)	3 (2.5)	
Social worker	9 (1.4)	2 (0.9)	3 (2.5)	
Dietician	13 (2.0)	1 (0.5)	1 (0.8)	

Physical or Occupational therapist	8 (1.2)	3 (1.4)	1 (0.8)	
Medical or Nurse assistant	11 (1.7)	1 (0.5)	0 (0.0)	
Mental health counselor	3 (0.5)	0 (0.0)	0 (0.0)	
Nurse	47 (7.2)	10 (4.6)	4 (3.3)	
Nurse practitioner	13 (2.0)	4 (1.9)	2 (1.6)	
Nurse midwife	2 (0.3)	0 (0.0)	0 (0.0)	
Therapist	3 (0.5)	0 (0.0)	0 (0.0)	
Psychologist	10 (1.5)	4 (1.9)	0 (0.0)	
Physician's assistant	6 (0.9)	3 (1.4)	2 (1.6)	
Doctor	33 (5.0)	20 (9.3)	5 (4.1)	
Dentist	0 (0.0)	1 (0.5)	1 (0.8)	
Other	76 (11.6)	18 (8.3)	12 (9.8)	
Receipt of flu vaccine				0.16
Yes	514 (88.3)	175 (92.6)	105 (92.1)	
No	68 (11.7)	14 (7.4)	9 (7.9)	
Receipt of flu vaccine THIS YEAR				0.002
Yes	437 (66.6)	159 (73.6)	79 (64.8)	
No	70 (10.7)	16 (7.4)	25 (20.5)	

Note: The sum of row percentages does not equal 100% because missing observations were removed

Table 2: Vaccine Responsiveness

Response	Non-pregnant	Pregnant	Breastfeeding

	(n=656, 64.8%)	**(n=216, 21.3%)**	**(n=122, 12.1%)**
Accepted	457 (76.2)	86 (44.3)	64 (55.2)
Plan to be vaccinated	370 (56.4)	82 (38.0)	60 (49.2)
Already vaccinated	87 (13.3)	4 (1.9)	4 (3.3)
Undecided	91 (13.9)	49 (22.7)	32 (26.2)
Declined	52 (8.7)	59 (30.4)	20 (17.2)

Table 3: Prevalence Ratio's for Vaccine Acceptance

Variable	Prevalence Ratio	95% Confidence interval	P
Age Median (IQR)			<.0001
Race/ethnicity			
Non-Hispanic white	REF		
Non-Hispanic black	0.69	0.58-0.82	
Hispanics	0.64	0.56-0.73	
Non-Hispanic Asian	0.99	0.86-1.13	
Others	0.76	0.60-0.97	
Language			
English	REF		
Spanish	0.75	0.61-0.93	
Patient's Healthcare provider			
Physician	REF		
Ob/GYN	REF		
Family Medicine	0.91	0.75-1.12	
Internal medicine	1.14	1.03-1.27	
Other	1.08	0.85-1.37	
Midwife	0.33	0.10-1.12	
Nurse Practitioner	0.97	0.79-1.18	
Other	0.74	0.49-1.11	
Prior conversation with a healthcare provider regarding vaccination			
No	REF		
Yes	1.04	0.95-1.15	
Chronic conditions			

No conditions	REF		
Composite condition	0.96	0.88-1.06	
Healthcare Worker			
No	REF		
Yes	1.03	0.93-1.13	
Doctor	REF		
Support staff (secretary, custodial staff, cleaning personnel, patient educators, phlebotomist)	0.81	0.61-1.09	
Social worker	0.97	0.65-1.44	
Dietician	1.12	0.82-1.51	
Physical or Occupational therapist	1.01	0.68-1.51	
Medical or Nurse assistant	0.62	0.29-1.31	
Mental health counselor	1.39	1.18-1.65	
Nurse	0.96	0.74-1.23	
Nurse practitioner	0.95	0.67-1.35	
Nurse midwife	1.39	1.18-1.65	
Therapist	1.39	1.18-1.65	
Psychologist	0.86	0.54-1.36	
Physician's assistant	0.81	0.49-1.35	
Dentist	1.39	1.18-1.65	
Other	0.94	0.76-1.17	
Prior Positive COVID-19 Test			
No	REF		
Yes	0.46	0.21-1.01	
Current pregnant			

No	REF		
Yes	0.61	0.52-0.72	
Currently breastfeeding			
No	REF		
Yes	0.73	0.61-0.86	
Receipt of flu vaccine			
No	REF		
Yes	2.25	1.66-3.05	

Figure Legends:

Figure 1 – All respondents declining vaccination were questioned on specific reasons for declination. The bars represent the mean scores from 0 meaning “low or no concern” to 5 “highly concerned”.

Figure 2 - All pregnant respondents declining vaccination were questioned on pregnancy-related reasons for declination. The bars represent the mean scores from 0 meaning “low or no concern” to 5 “highly concerned”.

Figure 3 - All respondents accepting vaccination were questioned on specific reasons for acceptance. The bars represent the mean scores from 0 meaning “little or no influence” to 5 “strongly supports”.

Figure 4 - All pregnant respondents accepting vaccination were questioned on pregnancy-related reasons for acceptance. The bars represent the mean scores from 0 meaning “little or no influence” to 5 “strongly supports”.

Figure 5 - All hesitant respondents were questioned on reasons for declination. The bars represent the mean scores from 0 meaning “low or no concern” to 5 “highly concerned”.

Figure 6 - All hesitant respondents were questioned on specific reasons for acceptance. The bars represent the mean scores from 0 meaning “little or no influence” to 5 “strongly supports”.

Figure 1: Concerns Among Respondents Who Refuse Vaccination

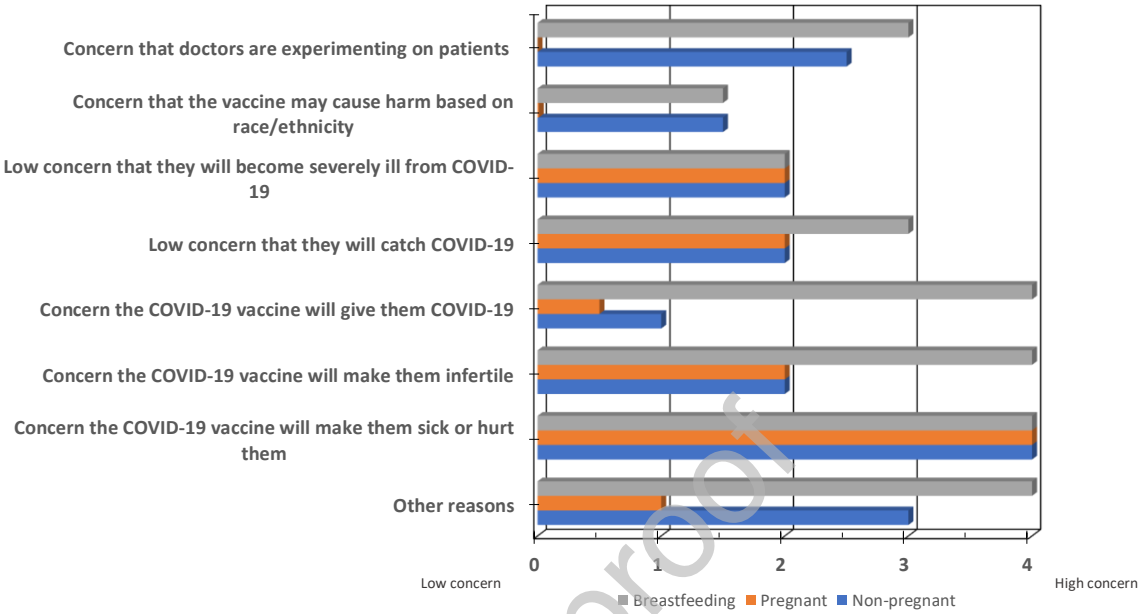

Figure 2: Pregnancy-related Concerns Among Pregnant/Breastfeeding Respondents Who Decline Vaccination

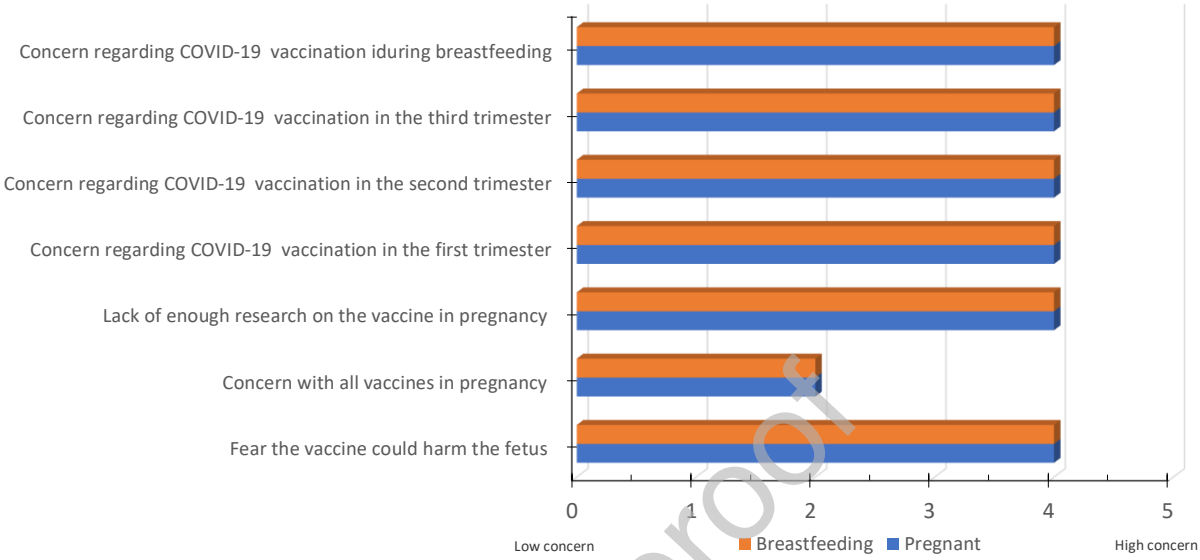

Figure 3: Influences Among Respondents Who Accept Vaccination

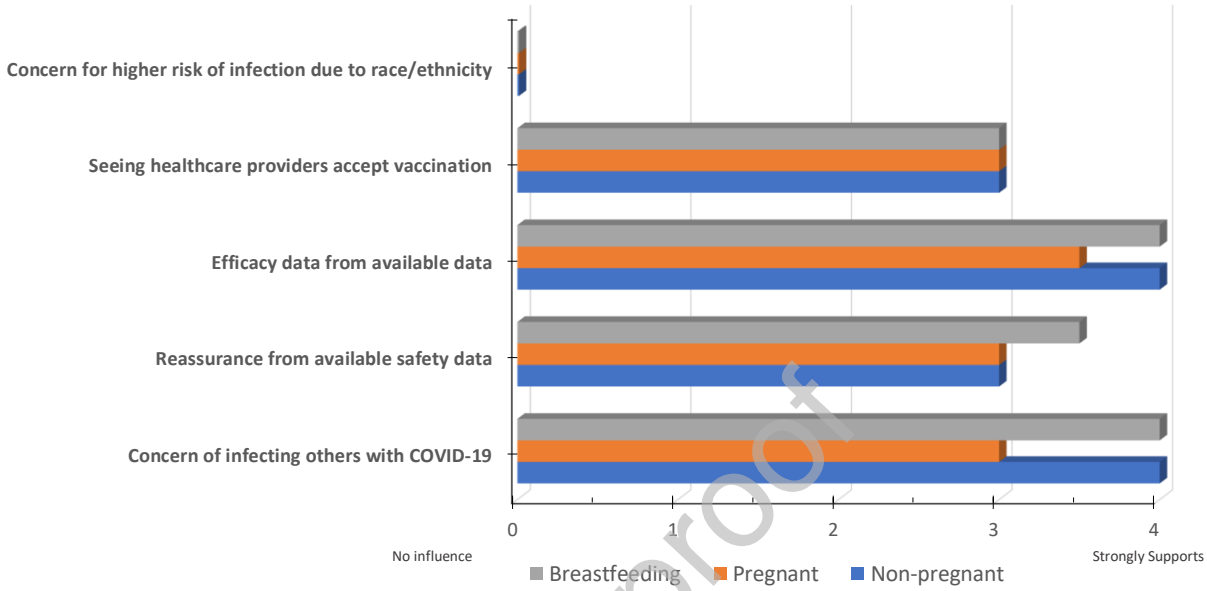

Figure 4: Pregnancy-related Influences Among Pregnant/Breastfeeding Respondents Who Accept Vaccination

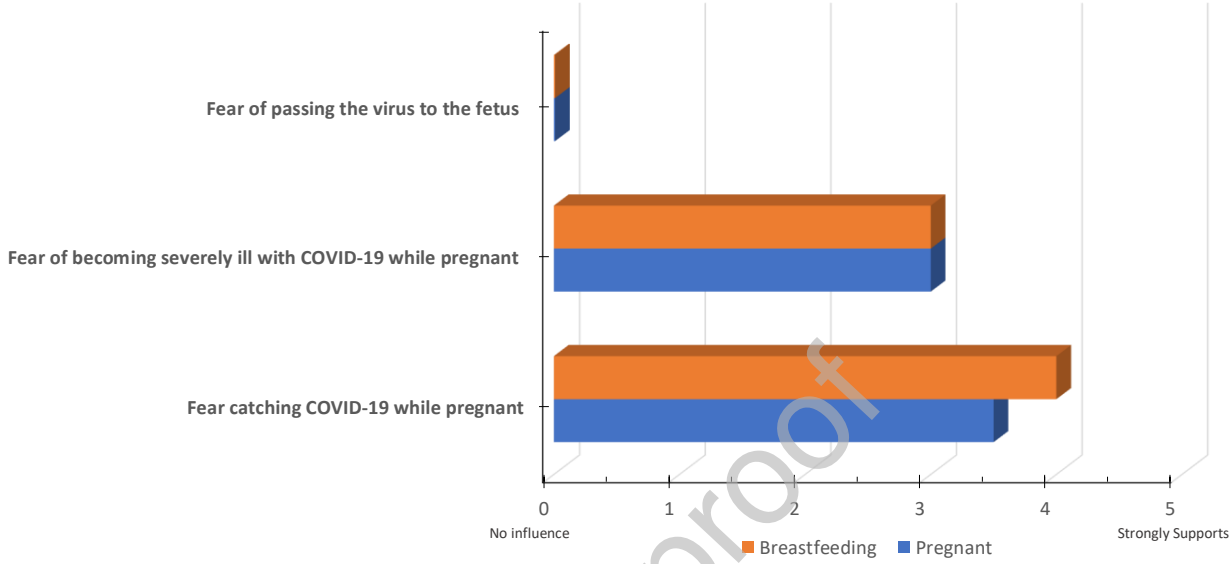

Figure 5: Concerns Among Respondents Who are Undecided Towards Vaccination

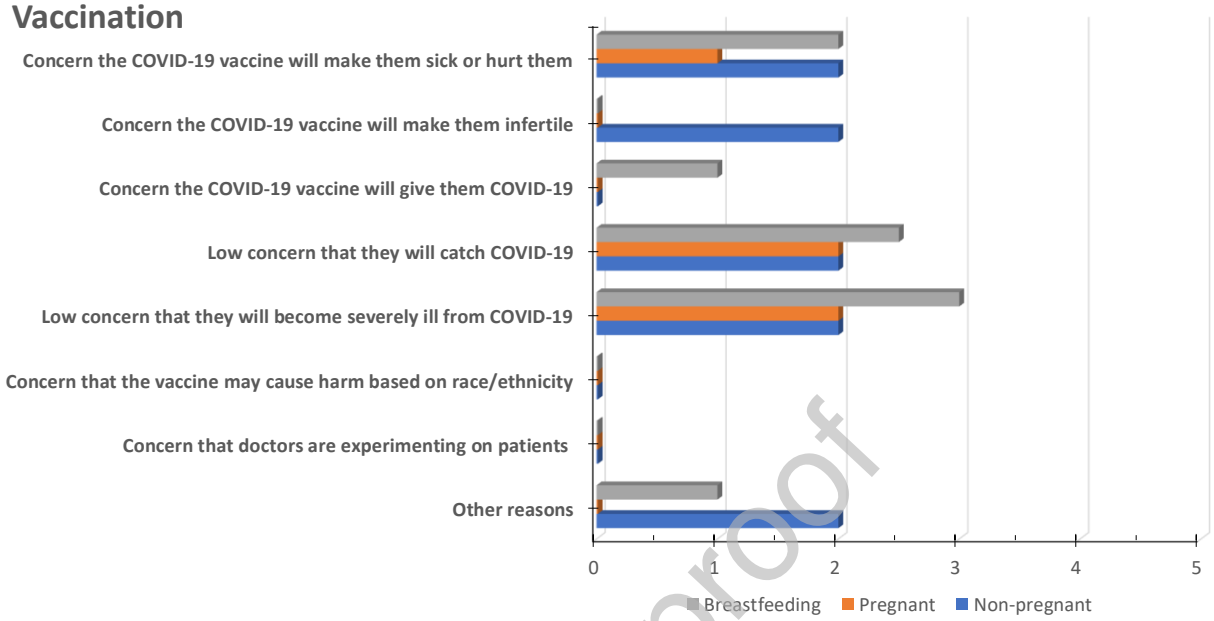

Figure 6: Influences Among Respondents Who are Undecided Towards Vaccination