Acceptability of COVID-19 Vaccines in an International Sample of Pregnant Women

Diego F Wyszynski[1*], Vanessa Gordon-Dseagu[1], Noemi Ramiro[1], Sonia Hernandez Diaz[2] and Julia W. Wu[2]

[1]*Pregistry, Los Angeles, California, USA*

[2]*Department of Epidemiology, Harvard TH Chan School of Public Health, Boston, MA, USA*

*****Corresponding author**
Diego F Wyszynski, Pregistry, Los Angeles, California, USA

Submitted: 11 Oct 2021; **Accepted**: 18 Oct 2021 **Published**: 25 Oct 2021

Abstract

Background: *There has been an unprecedented global effort to produce safe and effective vaccines for COVID-19. In less than a year, several pharmaceutical companies and research organizations have developed vaccines that effectively bring about an immune response. However, COVID-19 vaccines have not been accepted by a large percentage of the general population, especially among those excluded from the clinical trials of potential vaccines, such as pregnant women. The current study was aimed to identify predictors of vaccine acceptance in an international sample of pregnant women.*

Methods: *In 2020, data were collected from pregnant women via an anonymous, online, cross-sectional survey. The survey was hosted on the Pregistry platform for COVID-19 studies and was advertised through a variety of social media platforms and parenting forums in 16 countries. Data related to demographics and likelihood of accepting a COVID-19 vaccine were collected.*

Results: *In total, 5,356 women were included in the study. Vaccine acceptance increased as perceived vaccine efficacy increased. If the vaccine was found to be 90% effective, 30% of our sample indicated that they would be 'very likely' to get vaccinated, 11% 'fairly likely' and 12% 'somewhat likely'. Ten percent of respondents felt that they were 'very well informed' about COVID-19 vaccines, while 8% were 'very confident' that these vaccines are safe and/or effective. Over 50% held the opinion that vaccination was 'very important' for their country and that the majority of the population should be vaccinated. In a multivariate model, being a college graduate (odds ratio [OR]: 1.20, 95% confidence interval [CI]: 1.07-1.35), >30 years of age (OR: 1.11, CI: 1.00-1.23), and residing in Africa (OR: 2.37, CI: 1.52-3.73), Asia (OR: 3.63, CI: 2.96-4.48), Europe (OR: 1.17, CI: 1.03-1.33), and South America (OR: 2.22, CI: 1.92-2.58) were associated with increased vaccine acceptance. White Hispanic, Asian, Black/ Black Hispanic, and Hispanic participants had increased odds of accepting the vaccine compared with those who self-identified as White; however, when stratified by region, this increase only held in North America for Hispanic participants.*

Conclusion: *Only half of our international sample of pregnant women indicated that they would be 'somewhat likely', 'fairly likely', or 'very likely' to get vaccinated against COVID-19. Acceptance differed by region, race and ethnicity, age, and education. This fairly low acceptance suggests a need for public health campaigns that can increase confidence among pregnant women.*

Introduction

COVID-19 has impacted diverse aspects of our lives including population health, global trade, employment and education, as well as causing significant disruption to the provision of health and social care [1, 2]. By May 2021, the World Health Organization reported that there were more than 165 million confirmed cases of the virus and over 3.5 million deaths [3]. Governments across the globe have sought to control the spread of COVID-19 with policies aimed at reducing social interactions and travel, introducing quarantines and test and trace programs, while there have been unprecedented scientific efforts to develop safe and effective vaccines [4-6].

There is a growing amount of research, however with mixed re-

sults, detailing the impact of COVID-19 infection upon pregnancy outcomes. Some studies report increased rates of caesarian section, premature delivery and worse health outcomes for both mother and child [7, 8]. Others indicate no substantial impact on pregnancy due to COVID-19 [9]. Studies seeking to understand the impact of the virus on maternal mortality have also produced heterogeneous results – some find increased mortality, while others do not [9, 10]. Due to the limited evidence currently available, many scientific organizations stress the need for further research focused on understanding the impact of COVID-19 upon the health of pregnant women [11].

The work around the world to develop safe and effective COVID-19 vaccines has produced results on a timescale never seen before. By

December 2020, several countries had already initiated the rollout of authorized or approved COVID-19 vaccines. Fortunately, these vaccines have demonstrated efficacy around 90% as well as good safety profiles [12, 13]. However, there is a lack of safety and efficacy data from controlled studies in the pregnant population [14]. Nevertheless, an increasing number of organizations (including the CDC and the American College of Obstetricians and Gynecologists) recommend that vaccines be administered to pregnant women [15, 16]. This discrepancy between evidence and current recommendations may explain, in part, the low rate of vaccine acceptance among pregnant women, which we reported previously: 52% compared to 73% in women who are not pregnant [17].

As the evidence related to the safety, efficacy and uptake of COVID-19 vaccines grow, and more pregnant women receive them, it is important to understand the views of this cohort towards the available vaccines. Therefore, we focused on regional and racial/ethnicity differences to assess acceptance of, and opinions related to, the COVID-19 vaccine among a sample of pregnant women. Further, we assessed whether socioeconomic and demographic factors are associated with an individual's likelihood of vaccine acceptance.

Methods
Study Population
The population included women aged 18 years and above who self-identified as currently pregnant and who use social media platforms and online parenting forums. Participation in the study was via an online survey on the Pregistry platform for COVID-19 studies [18].

Study Design and Data Collection
Data were collected with a pilot-tested online, anonymized, cross-sectional survey conducted in 16 countries between October 28 and November 18, 2020. We invited potential participants predominantly on social media platforms and online parenting forums. The survey collected responses on COVID-19 vaccine acceptance, opinions related to the vaccine, potential predictors of acceptance, and data on demographic and socioeconomic status (age, race and ethnicity, pregnancy status, educational and economic level, medical coverage provision, and marital status). Respondents' likelihood of accepting the COVID-19 vaccine was assessed via the question "How likely would you be to get vaccinated during pregnancy if the vaccine has an efficacy of 90?" (1=Not at all likely, 2=Quite unlikely, 3=Somewhat likely, 4=Fairly likely, 5=Very likely). We also explored vaccine acceptance at lower efficacies (50% and 70%). Several questions were asked related to the opinions that participants held in relation to their knowledge of the vaccine, how important they perceived the vaccine to be and how confident they were that the vaccine would be safe and effective (a full list of the questions and results can be found in Table 3).

In terms of the race and ethnicity categories, participants were able to answer the question with multiple answers (for example, White Hispanic). Given the small number of participants who self-identified as Black Hispanic (n=4), we combined this group with Black participants. Those who self-identified as having multiple races/ethnicities were included in the Mixed Race/Multiracial category. The 'Other' category combined those race/ethnicity groups that had too few numbers to be included in our regression models as separate categories. All race/ethnicity categories were mutually exclusive. Participants were given information related to the objectives of the research and data confidentiality. Consent was sought at the time of participation. Those interested in the survey were invited to follow a link to participate in the study. The study was classified exempt by the Harvard Longwood Campus Institutional Review Board (HLC IRB) per the regulations found at 45 CFR 46.104(d)(2) on the basis that it poses no greater than minimal risk and that the recorded information cannot readily identify the subject (directly or indirectly). The study protocol was reviewed and approved by the Harvard Longwood Campus IRB.

Statistical Methods
All the descriptive methods, tabulations and statistical modelling were executed with the programming language R, using the base, stats, expss, and MASS packages.

Descriptive analysis of demographic variables was implemented through tabulations of cases and percentages.

Multivariate ordinal logistic regression models were undertaken to estimate the odds ratio (OR) and 95% confidence intervals (CI) of higher likelihood of getting vaccinated for each demographic group compared to a reference group. This method was chosen because the dependent variable is a 5-point Likert scale. The model was stratified by global region and included socioeconomic and demographic variables: economic and education status, employment, marital status, race/ethnicity, and age. All regression analyses were performed using the function polr in the R library MASS.

Results
Our sample included 5,356 pregnant women from North America (n=2,205), Europe (1,395), South America (986), Asia (355), Oceania (343), and Africa (72). Key socioeconomic and demographic information related to our sample can be found in Table 1. When asked about their likelihood of accepting a COVID-19 vaccine, the percentage of those who indicated that they would be 'very likely' to accept it increased as efficacy increased (Table 2). For example, 16.6% would be 'very likely' to accept a vaccine with 50% efficacy, while 29.6% would accept one with 90% efficacy. Even with an efficacy of 90%, 35.8% of our participants indicated that they would be 'not at all likely' to accept a vaccine; a further 12.3% indicated that they would be 'quite unlikely'.

Table 1: Descriptive characteristics of study participants

	Number and Percentage of Participants (n = 5,356)
Region of Residence	
North America	2205 (41.2)
Europe	1395 (26.0)
South America	986 (18.4)
Asia	355 (6.6)
Oceania	343 (6.4)
Africa	72 (1.3)
Race and Ethnicity	
White	3862 (72.0)
White Hispanic	175 (3.0)
Hispanic	515 (10.0)
Asian	355 (7.0)
Black/Black Hispanic	113 (2.9)
Mixed Race/Multiracial	300 (6.0)
Other⌐	36 (<1)
Age (in years)	
≤30	2718 (50.7)
>30	2638 (49.3)
Number of Children	
0	2695 (50.3)
1	1755 (32.8)
2	603 (11.3)
3	198 (3.7)
4+	105 (2.0)
Economic Status	
Poor/Extremely Poor	449 (8.4)
Lower Middle Class	1398 (26.1)
Middle Class	2581 (48.2)
Upper Middle Class	827 (15.4)
Wealthy/Extremely Wealthy	101 (1.9)
Marital Status	
Other	481 (9.0)
Living with Partner	1042 (19.5)
Married	3818 (71.5)
Highest Educational Attainment	
Did not graduate college	1598 (29.9)
College Graduate	3749 (70.1)
Employment Status	
Non-essential worker	3529 (65.9)

Essential worker - other sectors	814 (15.2)
Essential worker - health sector	1013 (18.9)
Medical Coverage	
No	877 (16.4)
Yes	4479 (83.6)

Table 2: Likelihood of accepting a COVID-19 vaccine by vaccine efficacy level

	Number and Percentage of Participants (n = 5,356) by Efficacy Level		
Vaccine Acceptance	**50%**	**70%**	**90%**
Not at all likely	2599 (48.5)	2306 (43.1)	1916 (35.8)
Quite unlikely	865 (16.2)	797 (14.9)	660 (12.3)
Somewhat likely	595 (11.1)	639 (11.9)	617 (11.5)
Fairly likely	408 (7.6)	548 (10.2)	578 (10.8)
Very likely	889 (16.6)	1066 (19.9)	1585 (29.6)

Approximately one-third of our sample felt that they were not well-informed about the development of the COVID-19 vaccine, with only 10.5% reporting that they felt 'very well informed' (Table 3). At the same time, 55.5% of our respondents indicated that it was 'very important' for the country that they live in to have a vaccine; 51.8% felt that it was 'very important' for the majority of people to get vaccinated. Only a minority of our participants reported feeling confident that the vaccine would be safe with no harmful side effects; 7.7% were 'very confident' while 19.4% were 'fairly confident'. In terms of efficacy, only 8.5% were 'very confident' that the vaccine would be effective and protect most people. A further 23.6% and 28.4% were 'fairly confident' and 'somewhat confident', respectively.

Table 3. Attitudes related to COVID-19 vaccines

	Number and Percentage of Participants (n = 5,356)
How informed do you feel about the development of COVID-19 vaccines?	
Not at all informed	457 (8.6)
Not very informed	1182 (22.2)
Somewhat informed	1715 (32.2)
Fairly informed	1414 (26.5)
Very well informed	558 (10.5)
How important is it for the country where you live to have a COVID-19 vaccine?	
Not at all important	509 (9.5)
Quite unimportant	280 (5.3)
Somewhat important	681 (12.8)
Fairly important	904 (17.0)
Very important	2956 (55.5)
How important is it that majority of people in the country where you live get vaccinated for COVID-19?	
Not at all important	585 (11.0)
Quite unimportant	339 (6.4)
Somewhat important	743 (13.9)
Fairly important	903 (17.0)
Very important	2757 (51.8)
When a COVID-19 vaccine is approved by the public health agencies in the country where you live how confident are you that the vaccine will be safe and with no harmful side effects?	

Not at all confident	1259 (23.6)
Not very confident	1408 (26.4)
Somewhat confident	1217 (22.8)
Fairly confident	1035 (19.4)
Very confident	409 (7.7)
When a COVID-19 vaccine is approved by the public health agencies in the country where you live how confident are you that the vaccine will be effective and protect most people from getting COVID-19?	
Not at all confident	984 (18.5)
Not very confident	1125 (21.1)
Somewhat confident	1512(28.4)
Fairly confident	1258 (23.6)
Very confident	451 (8.5)

We found that those living in Africa (OR: 2.37, 95% CI: 1.52-3.73), Asia (OR: 3.63, CI: 2.96-4.48), Europe (OR: 1.17, CI: 1.03-1.33), and South America (OR: 2.22, CI: 1.92-2.58) were more likely to accept the vaccine compared with those living in North America (Table 4). In the ordinal logistic models, those who had graduated from college, when compared with those who had not, were more likely to accept a COVID-19 vaccine (OR: 1.20, CI: 1.07-1.35), as were those who were over 30 years of age (OR: 1.11, CI: 1.00-1.23) compared with those under 30.

Table 4: Ordinal logistic regression for likelihood of being vaccinated against COVID-19

	OR (95% CI)
Age Category (in years)	
≤30	Reference
>30	1.11 (1.00-1.23)
Economic Status	
Poor to Extremely Poor	Reference
Lower Middle Class	0.91 (0.75-1.11)
Middle Class	0.84 (0.69-1.02)
Upper Middle Class	0.98 (0.78-1.24)
Wealthy to Extremely Wealthy	0.78 (0.52-1.18)
Highest Educational Attainment	
Non-college graduate	Reference
College Graduate	1.20 (1.07-1.35)
Occupation	
Not Essential Worker	Reference
Essential worker - Health Sector	1.02 (0.90-1.16)
Essential worker - Other Sector	0.95 (0.83-1.10)
Marital Status	
Other	Reference
Living with partner	1.11 (0.90-1.36)
Married	1.11 (0.93-1.33)
Region of Residence	
North America	Reference
Africa	2.37 (1.52-3.73)

Asia	3.63 (2.96-4.48)
Europe	1.17 (1.03-1.33)
Oceania	0.86 (0.70-1.06)
South America	2.22 (1.92-2.58)

In a second model that included race rather than region, White Hispanic (OR: 1.33, CI: 1.01-1.75), Asian (OR: 3.04, CI: 2.49-3.72), Black/Black Hispanic (OR: 1.80, CI: 1.28-2.53), and Hispanic (OR: 1.84, CI: 1.56-2.18) participants were more likely to accept the vaccine compared with those who self-identified as White (Table 5). When we stratified our analysis by region, this increase in odds only held in North America among those who self-identified as Hispanic (Table 6). None of the other regions under investigation produced statistically significant results for race/ethnicity (results not shown).

Table 5: Ordinal logistic regression for likelihood of being vaccinated against COVID-19 (race/ethnicity included in the model)

	OR (95% CI)
Age category (in years)	
≤30	Reference
>30	1.14 (1.03-1.26)
Economic status	
Poor to Extremely Poor	Reference
Lower middle class	0.86 (0.71-1.05)
Middle class	0.76 (0.62-0.92)
Upper middle class	0.82 (0.66-1.03)
Wealthy to extremely wealthy	0.73 (0.48-1.09)
Highest Educational Attainment	
Did not graduate college	Reference
College graduate	1.18 (1.04-1.32)
Occupation	
Non-essential worker	Reference
Essential worker health sector	0.97 (0.86-1.11)
Essential worker other sectors	0.91 (0.79-1.05)
Marital Status	
Other	Reference
Living with partner	1.32 (1.08-1.61)
Married	1.18 (0.99-1.42)
Race/Ethnicity	
White	Reference
White Hispanic	1.33 (1.01-1.75)
Asian	3.04 (2.49-3.72)
Black/Black Hispanic	1.80 (1.28-2.53)
Hispanic	1.84 (1.56-2.18)
Mixed Race/Multiracial	0.99 (0.80-1.22)
Other	0.89 (0.49-1.62)

Table 6: Ordinal logistic regression output for likelihood of being vaccinated vs. demographic factors (North America)

	OR (95% CI)
Age Category (in years)	
<=30	Reference
>30	1.13 (0.96-1.33)
Economic status	
Poor to Extremely Poor	Reference
Lower middle class	0.71 (0.50-0.99)
Middle class	0.64 (0.46-0.89)
Upper middle class	0.84 (0.58-1.20)
Wealthy to extremely wealthy	1.21 (0.65-2.24)
Highest Educational Attainment	
Did not graduate college	Reference
College graduate	1.76 (1.43-2.16)
Occupation	
Non-essential worker	Reference
Essential worker health sector	0.89 (0.73-1.08)
Essential worker other sectors	0.78 (0.62-0.99)
Marital Status	
Other	Reference
Living with partner	1.51 (0.96-2.38)
Married	1.22 (0.93-1.60)
Ethnicity	
White	Reference
White Hispanic	1.32 (0.87-2.01)
Asian	1.59 (0.83-3.04)
Black/Black Hispanic	1.02 (0.48-2.12)
Hispanic	2.73 (2.07-3.61)
Mixed Race/Multiracial	0.76 (0.54-1.06)
Other	0.77 (0.14-3.76)

Discussion

The current study is one of the first to assess the opinions of an international sample of pregnant women regarding COVID-19 vaccines and their likelihood of accepting it. Our finding that only 52% (29.6% 'very likely', 10.8% 'fairly likely' and 11.5% 'somewhat likely') of pregnant women would accept a COVID vaccine is lower than those in earlier investigations. For example, Malik et al. reported an overall acceptance of 67% in a general US population [19]. In agreement with the results of our study, they found age, being a college graduate, and being of Asian ethnicity to be positively associated with vaccine acceptance. A second study by Lazarus et al., also in a general population, found acceptance rates above 70% and key differences by country [20]. The low rate of vaccine acceptance found in our sample of pregnant women may be related to their particular status of being pregnant, wherein expectant mothers have to consider the future health of not only themselves but also their unborn children. At the same time, because COVID-19 vaccine trials excluded pregnant women, there is lack of controlled data on vaccine efficacy and safety for this group and this may have resulted in reduced rates of acceptance.

Given the limited information we currently have about COVID-19 vaccines in relation to the health of pregnant women, the increased hesitancy compared with the general population is understandable but of concern. In the coming months, it will be the role of governments and the international scientific community to develop research and public health programs that can effectively evaluate the safety and efficacy of the novel vaccines in this population. One auspicious project is the COVID-19 Vaccines International Pregnancy Exposure Registry (C-VIPER) (NCT04705116, EU-

PAS39096, https://c-viper.pregistry.com) [21]. Educational messaging will also have to be tailored to specifically meet the information needs of those who are pregnant.

Our results related to the opinions that pregnant women hold towards a COVID-19 vaccine demonstrate the dynamic nature of such views. Our participants simultaneously saw the importance of COVID-19 vaccination but held little faith in the safety or effectiveness of these vaccines at the present time. Overcoming low levels of confidence in this regard will be key to increasing uptake of vaccine when they become universally available.

We found significant differences in likelihood of vaccine acceptance based on region and race/ethnicity, and this finding is supported by those of earlier studies. Of note, Lazarus et al. found particularly high acceptance among a general population in China, as we did for pregnant women living in Asia [20]. Countries with lower acceptance might consider learning lessons from countries with higher acceptance. For example, this could be achieved through the investigation and implementation of policies and programs that have effectively brought about increased vaccine acceptance in other settings. The demand for COVID-19 vaccines already far exceeds supply and, as acceptance of the vaccines increases, this situation is likely to get worse before it gets better. Disparities in COVID-19 morbidity and mortality are likely to be further exacerbated by the unequal rollout of available vaccines [22].

The strengths of the current study relate to our use of a survey that was distributed internationally and was able to capture key demographic and socioeconomic information, as well as the attitudes and opinions of pregnant women towards COVID-19 vaccines. We also note key limitations related to how the survey was distributed and selection bias. Because the survey was only available online, those without internet access were excluded from participation, and this group often comprises those who are most vulnerable and socially isolated. At the same time, given limitations on travel and face-to-face interactions, it would not have been practical or advisable to conduct data collection in person. We also note that our sample was more educated than the average population, and this may have impacted our overall rates of vaccine acceptance. Finally, the current study lacked the statistical power to fully explore the impact of race and ethnicity on vaccine acceptance in the different regions included in our sample. Given the diversity and impact of race across the globe, our overall results related to race should be treated with caution. Further studies, able to utilize larger sample sizes from across the globe, are much needed in this area of investigation.

Collection of data for this study was completed in November 2020 and, since then, we have seen the development and authorization or approval of several highly effective COVID-19 vaccines. How evidence related to efficacy, safety, and improved health as a result of the vaccine is gathered, assessed and disseminated to the wider global population will have a significant impact on vaccine acceptance not only for COVID-19, but also for future pandemics. Policy makers must develop evidence-based public health campaigns that can educate the public about vaccines, their utility related to improving the health of individuals, and the wider community to reduce rates of anti-vaccine beliefs.

Conclusions
Our study assessed an international sample of pregnant women and found that only half are likely to accept a COVID-19 vaccine. Acceptance differed by region, race and ethnicity, age, and education. Public health education programs about the vaccines are much needed to increase their acceptance and reduce associated disparities. This is of particular importance for those who are pregnant and have not only their own health to consider, but also that of their unborn child.

References
1. Haleem A, Javaid M, Vaishya R (2020) Effects of COVID-19 pandemic in daily life. Curr Med Res Pract 10: 78-79.
2. Maria Nicola, Zaid Alsafi, Catrin Sohrabi, Ahmed Kerwan, Ahmed Al Jabir, et al. (2020) The socio-economic implications of the coronavirus pandemic (COVID-19): A review. Int J Surg 78: 185-193.
3. WHO (2021) WHO Coronavirus Disease (COVID-19) Dashboard. https://covid19.who.int.
4. Christopher M Weible, Daniel Nohrstedt, Paul Cairney, David P Carter, Deserai A Crow, et al. (2020) COVID-19 and the policy sciences: initial reactions and perspectives. Policy Sci. 53: 225-241 .
5. Chu IY, Alam P, Larson HJ, Lin L (2020) Social consequences of mass quarantine during epidemics: a systematic review with implications for the COVID-19 response. J Travel Med 27: 1-14.
6. Hanney SR, Wooding S, Sussex J, Grant J (2020) COVID-19 research to vaccine application: why might it take 17 months not 17 years and what are the wider lessons? Health Res Policy Syst 18: 61.
7. Chi J, Gong W, Gao Q (2021) Clinical characteristics and outcomes of pregnant women with COVID-19 and the risk of vertical transmission: a systematic review. Arch Gynecol Obstet 303: 337-345.
8. Sascha Ellington, Penelope Strid, Van T Tong, Kate Woodworth, Romeo R Galang, et al. (2020) Characteristics of Women of Reproductive Age with Laboratory-Confirmed SARS-CoV-2 Infection by Pregnancy Status - United States, January 22-June 7, 2020. MMWR Morb Mortal Wkly Rep 69: 769-775.
9. Francesca Di Toro, Mattheus Gjoka, Giovanni Di Lorenzo, Davide De Santo, Francesco De Seta, et al. (2021) Impact of COVID-19 on maternal and neonatal outcomes: a systematic review and meta-analysis. Clin Microbiol Infect 27: 36-46.
10. Ramy Abou Ghayda, Han Li, Keum Hwa Lee, Hee Won Lee, Sung Hwi Hong, et al. COVID-19 and Adverse Pregnancy Outcome: A Systematic Review of 104 Cases. J Clin Med 9: 3441.
11. Juan J, Gil MM, Rong Z, Zhang Y, Yang H, et al. (2020) Effect of coronavirus disease 2019 (COVID-19) on maternal, perinatal and neonatal outcome: systematic review. Ultrasound Obstet Gynecol 56: 15-27.
12. Fernando P Polack, Stephen J Thomas, Nicholas Kitchin, Judith Absalon, Alejandra Gurtman, et al. (2020) Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine. N Engl J

Med 383: 2603-2615.

13. RAPS (2020) COVID-19 vaccine tracker. https://www.raps.org/news-and-articles/news-articles/2020/3/covid-19-vaccine-tracker. Published 2020. Accessed 11/4/2020.

14. Knight M, Morris RK, Furniss J, Chappell LC (2020) Include pregnant women in research-particularly covid-19 research. BMJ 370: 3305.

15. ACOG (2020) Vaccinating Pregnant and Lactating Patients Against COVID-19. https://www.acog.org/en/clinical/clinical-guidance/practice-advisory/articles/2020/12/vaccinating-Pregnant-and-Lactating-Patients-Against-COVID-19.

16. CDC (2021) Information about COVID-19 Vaccines for People who Are Pregnant or Breastfeeding. https://www.cdc.gov/coronavirus/2019-ncov/vaccines/recommendations/pregnancy.html.

17. Malia Skjefte, Michelle Ngirbabul, Oluwasefunmi Akeju, Daniel Escudero, Sonia Hernandez-Diaz, et al. (2021) COVID-19 vaccine acceptance among pregnant women and mothers of young children: results of a survey in 16 countries. Eur J Epidemiol 36: 197-211.

18. Pregistry (2020) International Registry of Coronavirus (COVID-19) Exposure in Pregnancy (IRCEP). https://clinicaltrials.gov/ct2/show/NCT04366986.

19. Malik AA, McFadden SM, Elharake J, Omer SB (2020) Determinants of COVID-19 vaccine acceptance in the US. EClinicalMedicine 26: 100495.

20. Jeffrey V Lazarus, Scott C Ratzan, Adam Palayew, Lawrence O Gostin, Heidi J Larson, et al. (2020) A global survey of potential acceptance of a COVID-19 vaccine. Nat Med 27: 225-228.

21. C-VIPER (2021) COVID-19 Vaccines International Pregnancy Exposure Registry (C-VIPER). https://clinicaltrials.gov/ct2/show/NCT04705116.

22. Clouston SAP, Natale G, Link BG (2021) Socioeconomic inequalities in the spread of coronavirus-19 in the United States: A examination of the emergence of social inequalities. Soc Sci Med 268: 113554.