



# MIDIRS Search Pack

## Search Pack P201

### Coronavirus (COVID-19) - vaccination in pregnancy

Information on vaccination against COVID-19 for pregnant and breastfeeding women and those considering pregnancy. Includes records on safety, fertility, pregnancy outcome, decision-making, accessibility and take-up of vaccination, exclusion of pregnant women from clinical trials, and parliamentary questions.

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**P201 - Coronavirus (COVID-19) - vaccination in pregnancy  
(462)**

**2025-03955**

**Adverse perinatal outcomes of unvaccinated pregnant women with respiratory symptoms during the COVID-19 pandemic: Evidence from a Brazilian multicenter study.** Da-Costa-Santos J, Dos Reis Junior PS, Luz AG, et al (2025), International Journal of Gynecology & Obstetrics 14 February 2025, online

**Objective**

The current study aimed to describe risk factors for adverse perinatal outcomes (APOs) among pregnant women nonvaccinated for COVID-19 who had respiratory symptoms.

**Methods**

A nested case-control study was performed within the REBRACO (in Portuguese, the Brazilian Network of COVID-19 During Pregnancy) initiative. Women were recruited during pregnancy in 15 maternity hospitals in Brazil from February 1, 2020, to February 28, 2021, while seeking medical care for respiratory symptoms, and were followed up until childbirth regardless of confirmation of COVID-19. For this analysis, women were divided into two groups: (1) those with APOs, defined as the occurrence of fetal or neonatal death, preterm delivery, 5-min Apgar score <7, neonatal respiratory distress, neonatal mechanical ventilation, admission to the neonatal intensive care unit, small-for-gestational-age newborn, or any neonatal morbidity; and (2) those without APOs.

**Results**

The total number of women included in this analysis was 481, with 210 having APOs (43.7%). The characteristics independently associated with APOs were a composite outcome of severe acute respiratory syndrome, maternal admission at the intensive care unit, or maternal death (relative risk [RR], 3.30 [95% confidence interval (CI), 1.38–7.89]), living in the North and Northeastern regions of Brazil (RR, 3.09 [95% CI, 1.13–8.41]), and pre-eclampsia (RR, 2.77 [95% CI, 1.19–6.43]).

**Conclusion**

Severe maternal illness was strongly associated with APO regardless of COVID-19 confirmation. It is essential to provide sufficient and timely health care for women who have respiratory symptoms compatible with COVID-19.

(Author)

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**2025-03871**

**Sinopharm COVID-19 Vaccination during Pregnancy Triggers Thyroid Stimulating Hormone Levels in Newborns.**

Vatanparast A, Daghigh F, Akbari H, et al (2025), American Journal of Perinatology 6 March 2025, online

**Objective**

The effects of covid vaccination on the fetus and placenta make pregnant women a special group in the vaccination series. Coronavirus vaccines are associated with endocrine complications such as thyroid disease.

**Study Design**

The study included pregnant women who received the corona virus disease 2019 (COVID-19) vaccine. Pregnant women were divided into three study groups; group A (who have not received the COVID-19 vaccine), group B (who received the Sinopharm vaccine during pregnancy), and group C (who received the Sinopharm vaccine before pregnancy). Blood samples were taken to measure thyroid stimulating hormone (TSH) levels in infants 3 to 5 days old. Neonatal TSH values below 5 mU/L are considered normal.

**Results**

Sinopharm/BBIBP-CorV during and/or before pregnancy was associated with a slight increase in mean TSH in

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newborns.

#### Conclusion

Vaccination with Sinopharm/BBIBP-CorV during or before pregnancy may slightly increase neonatal TSH levels, but this is not clinically significant.

#### Key Points

COVID-19 vaccines linked to endocrine disruption.

Sinopharm CorV during pregnancy triggers TSH in infants.

Sinopharm vaccination in pregnancy increases neonatal TSH levels. (Author)

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#### 2025-03644

**Antenatal Vaccination: Uptake in Northern Ireland [written answer].** Northern Ireland Assembly (2025), Hansard Written question AQW 23213/22-27, 24 February 2025

The Minister of Health responds to a written question from Ms Diane Forsythe to the Northern Ireland Assembly, requesting details of the level of uptake of antenatal vaccinations in each of the last three years, broken down by Health and Social Care Trust.

(JSM)

Full URL: <https://aims.niassembly.gov.uk/questions/printquestionssummary.aspx?docid=429577>

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#### 2025-03166

**Are vaccinations in Pregnancy safe?.** Anon (2024), The Motherhood Group 25 October 2024

Pregnancy alters the way the body handles infections and it can be harder for your body to fight off diseases, so you're more likely to get a virus like flu or COVID-19, and more likely to develop serious health problems when you do get ill.

(Author)

Full URL: <https://themothhoodgroup.org/are-vaccinations-in-pregnancy-safe/>

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#### 2025-03149

**Motherhood, Pregnancy & the Vaccine.** Savage O (2021), The Motherhood Group 15 June 2021

Dr. Olamide Savage and Sandra Igwe discuss pregnancy, motherhood and the COVID-19 vaccine. Dr. Olamide Savage answers questions on this topic. (EA)

Full URL: <https://themothhoodgroup.org/motherhood-pregnancy-the-vaccine-ft-dr-olamide-savage/>

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#### 2025-02871

**FIGO Statement: COVID-19 Vaccination for Pregnant and Breastfeeding Women.** International Federation of Gynecology and Obstetrics (FIGO) (2021), 2 March 2021

Although the absolute risk of severe COVID-19 in pregnancy remains low, it is now established that pregnant women are at increased risk of severe COVID-19-associated illness compared with non-pregnant women.1,2,3,4 Such illness can require hospitalisation, intensive care unit admission, mechanical ventilation and even cause death. Thus, preventing critical COVID-19 infection is of paramount importance for both the mother and her fetus. (Author)

Full URL: <https://www.figo.org/covid-19-vaccination-pregnant-and-breastfeeding-women>

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#### 2025-02285

**COVID-19 in pregnancy.** Greer O, Saeed Z, Von Woon E, et al (2025), Obstetrician and Gynaecologist vol 27, no 1, January 2025, pp 43-56

In this review, the authors summarise current understanding of the impact of the SARS-CoV-2 virus and pandemic on pregnant and recently pregnant women and the recommended management. (Author, edited)

Full URL: <https://doi.org/10.1111/tog.12956>

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2025-01935

**COVID-19 Vaccine Decision-Making Among Black Pregnant and Postpartum Women.** Avorgbedor F, Gondwe KW, Aljarrah A, et al (2024), Journal of Racial and Ethnic Health Disparities vol 11, no 4, August 2024, pp 2073-2082

**Introduction:** The history of biomedical research is marred by racially discriminatory and abusive practices that impacted Black/African Americans. Medical racism impacts the trust and utilization of new medical interventions, such as the COVID-19 vaccine. This study aimed to understand Black pregnant and postpartum women's perspectives and decision-making about the COVID-19 vaccine.

**Methods:** We used a qualitative descriptive design and recruited 23 pregnant and postpartum Black women aged 18 years and above. Data was collected using a semi-structured interview guide. Data were analyzed using content analysis.

**Findings:** The participants described factors influencing their decision to receive or not receive the COVID-19 vaccines. These factors included individual, cultural, ethnicity, religious, and family-related factors (individual-personal beliefs influenced decisions about the vaccine; ethnicity, culture, and religion influenced vaccine decision-making; group-family and friends played a role in decision-making), vaccine or vaccination-related issues (concerns about vaccination and pregnancy outcomes and mistrust in the vaccine information), and contextual influence (sources of vaccine information influenced decision-making and healthcare providers influenced decision-making).

**Conclusion:** Understanding the vaccine decision-making process of underserved populations likely to decline vaccination due to pregnancy, postpartum, and breastfeeding status will help design tailored interventions to improve vaccine acceptance in minority communities, especially for pregnant and postpartum women.

**Keywords:** COVID-19 vaccine; Postpartum women; Pregnant women; Vaccine decision; Vaccine hesitancy.

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2025-01822

**Racial and Ethnic Differences in Maternal and Child COVID-19 Vaccination Intent Among Pregnant and Postpartum Women in the USA (April–June 2020): an Application of Health Belief Mode.** Obasanya M, Igenzoza O, Gupta S, et al (2023), Journal of Racial and Ethnic Health Disparities vol 10, no 5, October 2023, pp 2540-2551

This study investigated racial/ethnic differences in pregnant and postpartum women's intentions to receive the COVID-19 vaccination (maternal COVID-19 vaccination intent) and intentions to vaccinate their children against COVID-19 (child COVID-19 vaccination intent) during the early months of the COVID-19 pandemic (April-June 2020). This study also assessed Health Belief Model constructs to examine their influence on maternal and child COVID-19 vaccination intent by race/ethnicity. This study includes 489 US pregnant and postpartum women (18-49 years) recruited via Prolific Academic to complete a 55-item cross-sectional online survey. Crude and adjusted logistic regression analyses were conducted to determine the associations between race/ethnicity, maternal COVID-19 vaccination intent, and child COVID-19 vaccination intent. Among pregnant women, the odds of maternal COVID-19 vaccination intent (aOR = 2.20, 95% CI: .862, 5.61) and child COVID-19 vaccination intent (aOR = .194, 95% CI: .066, .565) among NH Black women were statistically significantly lower than that of NH White women after adjustment for demographic, health, and health belief model variables. Among postpartum women, although some racial differences in maternal or child COVID-19 vaccination intent were observed, these differences were not statistically significant in unadjusted and adjusted models. The findings have implications for future research and interventions which should adopt a racial health equity lens and identify strategies grounded in institutional trustworthiness and systems perspectives to address racial/ethnic disparities in COVID-19 vaccination intent among pregnant and postpartum women during novel pandemics.

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## 2025-01767

**Midwives' perceptions and experiences of recommending and delivering vaccinations to pregnant women following the Covid-19 pandemic: a qualitative study.** Grimley C, Atherton H, Bick D, et al (2025), *Midwifery* vol 140, January 2025, 104206

### Background

Pregnant women and their unborn babies are at an increased risk of hospitalisation, morbidity, and mortality from illness. However, uptake of influenza, pertussis and Covid-19 vaccinations offered during pregnancy is below the desired rate. This research aims to explore UK midwives' experiences of approaching and discussing vaccinations with pregnant women, and their perceived role in pregnant women's vaccination decisions.

### Methods

Midwives in the West Midlands, UK were recruited via participating hospitals and midwife specific social media groups. Interviews were conducted remotely from April to July 2023 and analysed with a deductive codebook coding strategy using thematic analysis.

### Findings

Semi-structured interviews were conducted with 16 midwives identifying the following key themes:

Recommendations to have vaccinations reported on the contents of recommendations and how they are communicated; Messages and guidance included the importance of up-to-date informational needs for midwives to administer vaccinations and the barriers caused by uncertainty and conflicting messages about the Covid-19 vaccine during pregnancy; Delivery of vaccinations included the convenience of offering vaccinations during standard antenatal appointments; and Midwives' barriers explored the pandemic specific and other barriers midwives face in the administering of vaccinations.

### Discussion

These findings contribute to the understanding of how midwives discuss the topic of vaccinations with pregnant women. This research highlights the importance for midwives to receive clear and consistent information. A strong emphasis on why vaccines are important when recommending to pregnant women in addition to standard information on the availability and timing may have a bearing in helping women to make informed decisions about accepting vaccinations. (Author)

**Full URL:** <https://doi.org/10.1016/j.midw.2024.104206>

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## 2025-00447

**Factors associated with vaccination against Covid-19 in pregnant and hospitalized postpartum women: A retrospective cohort study.** de Andrade Pereira Silva M, Ribeiro HF, de Oliveira RR, et al (2022), *PLoS ONE* vol 17, no 6, June 2022, e0269091

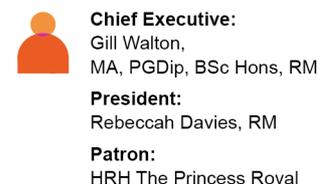
### Objective

To analyze the characteristics associated with vaccination against Covid-19 in pregnant and postpartum women with Severe Acute Respiratory Syndrome in Brazil and to investigate a possible association between vaccination and the clinical course and outcome of the disease.

### Methods

Retrospective cohort study of hospitalized pregnant and postpartum women diagnosed with Severe Acute Respiratory Syndrome (SARS) by SARS-CoV-2, presenting onset of signs and symptoms between May and October 2021. Secondary data were used, available in the Influenza Epidemiological Surveillance Information System (SIVEP-Gripe). Data were analyzed using the SPSS statistical program, medians were applied to present continuous variables and frequencies, and proportions were calculated for categorical variables, using logistic and multivariate regression analysis.

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## Results

The final study population included 3,585 pregnant and postpartum women, of whom 596 (16.6) were vaccinated: 443 (74.3%) received one dose and 153 (25.7%) received two doses. They were factors associated with non-vaccination against Covid-19 age  $\leq 19$  anos (OR: 2.57; IC95% 1.40;4.71), non-white women (OR: 1.34; IC95% 1.07;1.67) and those who required ventilatory support (OR: 1.51; IC95% 1.19;1.90) and invasive ventilation (OR: 2.05; IC95% 1.37;3.08). On the other hand, vaccination was associated with advanced maternal age (OR: 0.60; IC95% 0.48;0.76), presence of comorbidities (OR: 0.57; IC95% 0.45;0.72) and loss of taste (OR: 0.63; IC95% 0.48;0.82).

## Conclusions

Demographic, ethnic-racial and clinical characteristics were associated with the vaccination status of pregnant and postpartum women with SARS by SARS-CoV-2 in Brazil. Vaccination against Covid-19 in the obstetric population has already shown positive results in the evolution of severe cases, which reiterates its importance. It is essential that health services advance vaccination against Covid-19 in the obstetric population, especially adolescents and non-white women. (Author)

**Full URL:** <https://doi.org/10.1371/journal.pone.0269091>

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## 2024-13116

**Adverse events of COVID-19 vaccines in pregnant and postpartum women in Brazil: A cross-sectional study.** Covas DT, de Jesus Lopes de Abreu A, Dias CZ, et al (2023), PLoS ONE vol 18, no 1, January 2023, e0280284

### Background

By the fact that pregnant and postpartum women are currently using COVID-19 vaccines, ensure their safety is critical. So, more safety evidence is crucial to include this new technology to their vaccine's calendar and to develop public policies regarding the support and training of Health Care Personnel. This study aims to describe the adverse events (AE) of COVID-19 vaccines in pregnant and postpartum women in the early stage of vaccination campaign in Brazil.

### Methods

An observational cross-sectional study using data from the Brazilian surveillance information system to characterize the AE of COVID-19 vaccines (Sinovac/Butantan, Pfizer/BioNTech, AstraZeneca and Janssen) in Brazilian pregnant and postpartum women from April to August 2021. Frequency and incidence rate of AE for COVID-19 vaccines were assessed.

### Results

3,333 AE following immunization were reported for the study population. AE incidence was 309.4/100,000 doses (95% CI 297.23, 321.51). Within the vaccines available, Sinovac/Butantan had the lowest incidence (74.08/100,000 doses; 95% CI 63.47, 84.69). Systemic events were the most frequent notified (82.07%), followed by local (11.93%) and maternal (4.74%), being most of them classified as non-severe (90.65%).

### Conclusion

Our results corroborate the recommendation of vaccination for these groups. Even though, further studies appraising a longer observation time are still needed to provide a broader safety aspect for the vaccines currently under use for this population. (Author)

**Full URL:** <https://doi.org/10.1371/journal.pone.0280284>

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## 2024-12741

**Barriers and facilitators of vaccine hesitancy for COVID-19, influenza, and pertussis during pregnancy and in mothers of infants under two years: An umbrella review.** Nichol B, McCready JL, Steen M, et al (2023), PLoS ONE vol 18, no 3, March 2023, e0282525

### Background

Vaccination during pregnancy has been repeatedly demonstrated to be safe and effective in protecting against

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infection and associated harms for the mother, developing baby, and subsequent infant. However, maternal vaccination uptake remains low compared to the general population.

## Objectives

An umbrella review to explore the barriers and facilitators to Influenza, Pertussis and COVID-19 vaccination during pregnancy and within 2 years after childbirth, and to inform interventions to encourage uptake (PROSPERO registration number: CRD42022327624).

## Methods

Ten databases were searched for systematic reviews published between 2009 and April 2022 exploring the predictors of vaccination or effectiveness of interventions to improve vaccination for Pertussis, Influenza, or COVID-19. Both pregnant women and mothers of infants under two years were included. Barriers and facilitators were organised using the WHO model of determinants of vaccine hesitancy through narrative synthesis, the Joanna Briggs Institute checklist assessed review quality, and the degree of overlap of primary studies was calculated.

## Results

19 reviews were included. Considerable overlap was found especially for intervention reviews, and the quality of the included reviews and their primary studies varied. Sociodemographic factors were specifically researched in the context of COVID-19, exerting a small but consistent effect on vaccination. Concerns around the safety of vaccination particularly for the developing baby were a main barrier. While key facilitators included recommendation from a healthcare professional, previous vaccination, knowledge around vaccination, and communication with and support from social groups. Intervention reviews indicated multi-component interventions involving human interaction to be most effective.

## Conclusion

The main barriers and facilitators for Influenza, Pertussis and COVID-19 vaccination have been identified and constitute the foundation for policy development at the international level. Ethnicity, socioeconomic status, concerns about vaccine safety and side effects, and lack of healthcare professionals' recommendations, are the most relevant factors of vaccine hesitancy. Adapting educational interventions to specific populations, person-to-person interaction, healthcare professionals' involvement, and interpersonal support are important strategies to improve uptake.

(Author)

Full URL: <https://doi.org/10.1371/journal.pone.0282525>

## 2024-12725

**The effect of COVID-19 vaccine tele-educational program on vaccine hesitancy and receiving the vaccine among women planning for pregnancy, pregnant or breast-feeding mothers.** Momani A, Hamaideh SH, Masadeh AB, et al (2023), PLoS ONE vol 18, no 3, March 2023, e0282627

## Background

COVID-19 hesitancy among women planning to become pregnant, who are pregnant, and who are breast-feeding is still a global phenomenon. Unfortunately, there is a lack of national educational programs that provide those groups of people with the information they need about the vaccine.

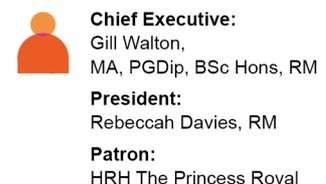
## Objective

This study investigated the effect of the COVID-19 vaccine tele-educational program on vaccine hesitancy and receiving the vaccine among women planning for pregnancy, pregnant and breast-feeding mothers.

## Methods

This study implemented a quasi-experimental pre-post design and was conducted in Jordan. It was a two-time study and had two groups of women; 220 women participated in the control group, and 205 women participated in the intervention group (those received the tele-educational program). All participating women answered the

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demographic characteristics sheet and the Arabic version of Hesitancy About COVID-19 Vaccination Questionnaire twice.

## Results

Results showed that after conducting the program the interventional group reported significantly higher vaccination rate and lower mean score of hesitancy than the control group ( $M = 24.67$ ,  $SD = 5.11$ ;  $M = 27.45$ ,  $SD = 4.92$ ; respectively)  $t(423) = -4.116$ ,  $p\text{-value} < 0.001$ . Moreover, before the program, women in the intervention group reported significantly higher levels of hesitancy compared to those in the same group after the program ( $M = 28.35$ ,  $SD = 4.91$ ;  $M = 24.66$ ,  $SD = 5.11$ ; respectively)  $t(204) = 17.83$ ,  $p\text{-value} < 0.001$ .

## Conclusions

The study concluded that awareness of pregnant women after being given the tele-education program about COVID-19 vaccination decreased their hesitancy and improved their willingness to participate in the COVID-19 vaccination. Therefore, health workers should focus on providing scientific-based information about the vaccine to reduce the doubts of pregnant women about participating in the COVID-19. (Author)

**Full URL:** <https://doi.org/10.1371/journal.pone.0282627>

## 2024-12719

### **Pregnant women's awareness, perception, and acceptability of COVID-19 vaccine attending antenatal clinics in**

**Bharatpur, Nepal.** Dhakal R, Shapkota S, Shrestha P, et al (2023), PLoS ONE vol 18, no 3, March 2023, e0278694

#### Background

Vaccine is the cost-effective and reliable public health intervention to combat the emerging COVID-19 pandemic. The vaccination is considered safe and effective at any stage of pregnancy; however, pregnant women show more vaccine hesitation than the general population. This study aims to assess pregnant women's awareness, perception, and acceptability of COVID-19 vaccine attending antenatal clinics.

#### Methods

An institutional-based cross-sectional analytical study design was used to assess the acceptance of the COVID-19 vaccine and associated factors among pregnant women between Feb-1 to March-30-2022 at antenatal clinics of Bharatpur Chitwan using systematic random sampling. A semi-structured interview schedule was used to collect data from 644 respondents. Collected data were analysed using descriptive and inferential statistics like the Pearson chi-square test and logistic regression analysis.

#### Results

The COVID-19 vaccine acceptance was found to be 22% and ethnicity (AOR = 1.826; 95% CI = 1.215–2.745), education level (AOR = 1.773; 95%CI = 1.025–3.068;), history of COVID-19 infection (AOR = 3.63; 95% CI = 1.323–9.956;), number of child (AOR = 5.021; 95% CI 1.989–12.677;), trimester (week of pregnancy) (AOR = 2.437; 95% CI 1.107–5.366) and level of perception (AOR = 2.152; 95% CI 1.109–4.178) were found to be statistically significant for acceptance of COVID-19 vaccine among pregnant mother.

#### Conclusions

In this study, low levels of vaccine acceptance were found. Several influential factors like occupation, history of COVID-19 infection, number of pregnancies, week of gestation, and level of attitude were found to be significant for acceptance of COVID-19 vaccine among pregnant women. Everyone needs vaccine acceptance to get herd immunity and reduce the COVID-19 infection. But Vaccine hesitancy is one of the significant threats to the COVID-19 rollout and successful pandemic mitigation. Therefore, properly disseminating information and removing misperceptions about the COVID-19 vaccine is necessary to raise the acceptance. (Author)

**Full URL:** <https://doi.org/10.1371/journal.pone.0278694>

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2024-11975

**Evaluating TRAIL and IP-10 alterations in vaccinated pregnant women after COVID-19 diagnosis and their correlation with neutralizing antibodies.** Chen WC, Chu SY, Cheng CM, et al (2024), *Frontiers in Immunology* 3 September 2024, online

Background: This study evaluates tumor necrosis factor-related apoptosis-inducing ligand (TRAIL) and interferon- $\gamma$ -induced protein-10 (IP-10) in pregnant women with COVID-19 and their newborns, exploring the effects of antiviral treatments and vaccine-induced neutralizing antibody (Nab) inhibition on these key viral infection biomarkers.

Methods: We studied 61 pregnant women with past COVID-19 and either three (n=56) or four (n=5) doses of vaccination, and 46 without COVID-19 but vaccinated. We analyzed them and their newborns' blood for TRAIL, IP-10, and Nab levels using enzyme-linked immunosorbent assays (ELISA), correlating these with other clinical factors.

Results: Our study found lower TRAIL but higher IP-10 levels in maternal blood than neonatal cord blood, irrespective of past COVID-19 diagnosis. Cases diagnosed with COVID-19 < 4 weeks previously had higher maternal blood TRAIL levels (16.49 vs. 40.81 pg/mL, p=0.0064) and IP-10 (154.68 vs. 225.81 pg/mL, p=0.0170) than those never diagnosed. Antiviral medication lowered TRAIL and IP-10 in maternal blood without affecting Nab inhibition (TRAIL: 19.24 vs. 54.53 pg/mL, p=0.028; IP-10: 158.36 vs. 255.47 pg/mL, p=0.0089). TRAIL and IP-10 levels were similar with three or four vaccine doses, but four doses increased Nab inhibition (p=0.0363). Previously COVID-19 exposed pregnant women had higher Nab inhibition (p < 0.0001). No obvious correlation was found among TRAIL, IP-10, and Nab inhibition level.

Conclusions: Our study suggests that lower maternal TRAIL and higher IP-10 levels compared to neonatal cord blood coupled with a rise in both markers following COVID-19 diagnosis that could be reduced by antivirals indicates a correlation to infection severity. Higher vaccine doses enhance Nab inhibition, irrespective of antiviral medication use and independent of TRAIL or IP-10 levels, highlighting the significance and safety of adequate vaccination and antiviral use post-diagnosis in pregnant women. (Author)

Full URL: <https://doi.org/10.3389/fimmu.2024.1415561>

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2024-11966

**SARS-CoV-2 Antibodies in Human Milk After mRNA and Adenovector-Based Vaccination: A Systematic Review and Meta-Analysis.** Li X, Hu Y, Yu H, et al (2024), *Journal of Human Lactation* vol 40, no 3, August 2024, pp 425-433

Background:

SARS-CoV-2 specific antibodies exist in human milk expressed by lactating parents after vaccination. In the existing research, the effects of vaccine types on human milk are inconsistent.

Research Aim:

This study aims to perform a systematic review and meta-analysis of the existing observational studies to compare the positive rates of SARS-CoV-2 specific antibodies in human milk according to mRNA and adenovector-based vaccination.

Methods:

PubMed, Web of Science, Elsevier Science Direct and Cochrane Library databases were systematically searched for relevant articles published from December 30, 2019 to February 15, 2023. Observational studies were considered eligible provided they reported data on SARS-CoV-2 specific antibodies in human milk. The risk of bias in non-randomized studies of interventions (ROBINS-I) tool, the Newcastle-Ottawa Scale (NOS), and the Agency for Healthcare Research and Quality (AHRQ) were used to assess risk of bias. Seven studies, including 511 lactating participants, were included in this review and meta-analysis.

Results:

The positive rate of SARS-CoV-2 IgA is higher in mRNA vaccine groups than in adenovector-based vaccine groups (OR = 4.80, 95% CI [3.04, 7.58], p < 0.001). The positive rate of SARS-CoV-2 IgG was higher in mRNA vaccines than in adenovector-based vaccines.

Conclusions:

Compared to adenovector-based vaccines, mRNA vaccines present a higher positivity rate of IgA and IgG in human milk after vaccination. In other words, mRNA vaccinations may offer breastfed children a higher level of protection

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than adenovector-based vaccinations. Further high-quality data is still required to substantiate these findings.

(Author)

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## 2024-11776

### **COVID-19 Vaccine Safety in Pregnancy, A Nested Case–Control Study in Births From April 2021 to March 2022, England.**

Mensah AA, Stowe J, Jardine JE, et al (2024), BJOG: An International Journal of Obstetrics and Gynaecology vol 131, no 13, December 2024, pp 1882-1893

#### Objective

Assessment of COVID-19 vaccine safety in pregnancy using population-based data.

#### Design

Matched case–control study nested in a retrospective cohort.

#### Setting

April 2021–March 2022, England.

#### Population or Sample

All pregnant individuals aged between 18 and 50 years with valid health records.

#### Methods

Individuals identified from the national Maternity Services Data Set (MSDS) had their records linked to hospital admission, national COVID-19 vaccine and COVID-19 testing databases. Matching included participant's age and estimated week of conception. We compared outcomes across multiple COVID-19 vaccine exposures using conditional multivariable logistic regression, adjusting for demographic and health characteristics.

#### Main Outcome Measures

Adverse pregnancy, maternal and neonatal outcomes.

#### Results

514 013 individuals were included. We found lower odds of giving birth to a baby who was low birthweight (aOR = 0.86, 95% CI: 0.79–0.93), preterm (aOR = 0.89, 95% CI: 0.85–0.92) or who had an Apgar score < 7 at 5 min of age (aOR = 0.89, 95% CI: 0.80–0.98) for individuals who received at least one dose of COVID-19 vaccine during pregnancy. The odds of admission to intensive care unit during pregnancy were lower in those vaccinated (aOR = 0.85, 95% CI: 0.76–0.95). There was no association between vaccination in pregnancy and stillbirth, neonatal death, perinatal death and maternal venous thromboembolism in pregnancy.

#### Conclusions

COVID-19 vaccines are safe to use in pregnancy. Our findings generated important information to communicate to pregnant individuals and health professionals to support COVID-19 maternal vaccination programmes. (Author)

**Full URL:** <https://doi.org/10.1111/1471-0528.17949>

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## 2024-11418

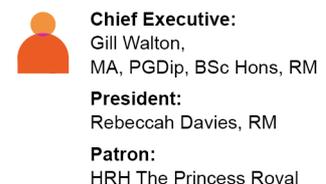
### **COVID-19 vaccinations pre- and antepartum: a consideration of the evidence and discussion of issues.** Isaacs TF, Dahan

MH (2024), Archives of Gynecology and Obstetrics vol 310, no 4, October 2024, pp 1805 - 1810

#### Purpose

The COVID-19 vaccine should be universally offered to pregnant women and women planning pregnancies. This is on the basis that COVID-19 infection can complicate the pregnancy and have adverse health implications in pregnancy, as compared to non-pregnant women, which the vaccine helps to mitigate. This is the recommendation of many governing bodies in medical care. However, certain issues require consideration, which are not discussed in the

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current guidelines. These include the induction of fever by the vaccines and the role fever can play in teratogenicity, the induction of hyper-coagulable and thrombocytopenic states by the vaccines and other known contraindications to the vaccines. In this article, we develop strategies to minimize risks in these situations. We also discuss the theoretical advantage of calling for a booster COVID-19 vaccine in all pregnant women in the late second or early third trimester, even if previously immunized, and encourage further research, to investigate the possible benefits of this proposed intervention. This article acts as an educational supplement to help clinicians manage pregnant women and addresses many issues, not discussed in most COVID-19 vaccine recommendations by international societies related to pregnant women.

#### Methods

This article is a literature review of the current, limited data. The information extrapolated allowed for suggestions regarding COVID-19 vaccination during pregnancy.

#### Results and conclusions

The study discusses hypothetical issues, to minimize any risks associated with COVID-19, and serves as a compilation of data to further the current literature, in proving that COVID-19 vaccines have minimal risks in pregnancy. (Author)

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#### 2024-10912

##### **Pregnant individuals perspectives towards receiving COVID-19 vaccination during their pregnancy: an in-depth qualitative study.** Zilver SJM, Rietveld AL, Schonewille NN, et al (2024), *Frontiers in Public Health* 21 August 2024, online

Introduction: Pregnant individuals have an increased risk of severe illness from coronavirus disease 2019 (COVID-19) infection. Vaccination is an effective strategy to prevent severe illness and complications for pregnant individuals. Pregnant individuals are often excluded from research and remain hesitant to receive vaccination against COVID-19. It is pivotal to study factors related to vaccine uptake and hesitancy among pregnant individuals. We studied barriers and facilitators for pregnant individuals choice and motivation regarding vaccination against COVID-19 during pregnancy to aid future pregnant individuals in their decision to vaccinate against various infectious agents.

Methods: In this qualitative study, pregnant individuals were interviewed between October 2021 and January 2022 using a semi-structured approach. A topic list was used to explore their feelings, perceptions and ideas regarding vaccination against COVID-19 during pregnancy. Interviews were transcribed verbatim and thematic analyses was performed using MAX QDA.

Results: After nine interviews, saturation was reached. Three main themes were identified that influenced pregnant individuals choice and motivation regarding vaccination: health consequences, ambiguity of information and societal motivation. Health consequences mainly concerned the effect for their offspring, and the unknown long-term effects of COVID-19 vaccination. The advice from the Dutch institute for Public Health and Environment changed from not vaccinating pregnant individuals after release of the developed vaccine, to routinely vaccinating all pregnant individuals after research data were available from the United States of America (USA). This change of policy fuelled doubt and confusion for vaccination. Arguments in favor of vaccination from the social perspective were specific behaviour rules and restrictions due to the pandemic. E.g. without vaccination people were unable to travel abroad and having to take a COVID-19 test every time entering a public place.

Conclusion: Pregnant individuals need clear, unambiguous information concerning health consequences, short- and long-term, particularly for their offspring, in the decision-making process regarding COVID-19 vaccination. Additionally, the societal perspective needs to be addressed. Besides the aforementioned themes, general counselling should focus on misperceptions of vaccine safety and the role of misinformation which are also important in the non-pregnant population. This study underlines the importance of including pregnant individuals in research programs to obtain specific information targeted to their needs. (Author)

**Full URL:** <https://doi.org/10.3389/fpubh.2024.1415548>

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2024-10833

**COVID-19 vaccine preferences for pregnant and lactating women in Bangladesh and Kenya: a qualitative study.** Schue

JL, Fesshaye B, Miller E, et al (2024), *Frontiers in Public Health* 14 August 2024, online

COVID-19 was responsible for more than 7 million deaths globally, as well as numerous morbidities and social and economic effects. While COVID-19 vaccines were seen as a marvel of science by the scientific community, much of the public had concerns related to COVID-19 vaccines, with certain groups—such as pregnant and lactating women—having specific concerns related to vaccine effects on their pregnancy and breast milk. In this qualitative study, we interviewed stakeholders in Bangladesh (n = 26) and Kenya (n = 94) who affect the decision-making process related to COVID-19 vaccine acceptance among pregnant and lactating women. These included pregnant and lactating women themselves, community gatekeepers or family members, healthcare workers, and policymakers. Several themes related to confidence and vaccine preference emerged. Stakeholders indicated a lack of confidence related to non-mRNA vaccines due to safety concerns, number of doses, and media coverage; lack of confidence related to mRNA vaccines due to safety concerns; and preference for non-mRNA vaccines due to health system compatibility and availability. While COVID-19 vaccine availability in much of the world—particularly in low-and middle-income countries—affected the public's ability to have a choice in the vaccine they received, there were evident vaccine preferences. As the public health world will continue to face other infectious disease outbreaks, bolstering vaccine confidence broadly and specifically related to new technologies will be paramount to realize the individual-and population-level benefits of life-saving vaccines. (Author)

Full URL: <https://doi.org/10.3389/fpubh.2024.1412878>

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2024-10505

**COVID-19 Vaccination in the First Trimester and Major Structural Birth Defects Among Live Births.** Kharbanda EO, DeSilva

MB, Lipkind HS, et al (2024), *JAMA Pediatrics* vol 178, no 8, August 2024, pp 823-829

**Importance** COVID-19 vaccination is recommended throughout pregnancy to prevent pregnancy complications and adverse birth outcomes associated with COVID-19 disease. To date, data on birth defects after first-trimester vaccination are limited.

**Objective** To evaluate the associated risks for selected major structural birth defects among live-born infants after first-trimester receipt of a messenger RNA (mRNA) COVID-19 vaccine.

**Design, Setting, and Participants** This was a retrospective cohort study of singleton pregnancies with estimated last menstrual period (LMP) between September 13, 2020, and April 3, 2021, and ending in live birth from March 5, 2021, to January 25, 2022. Included were data from 8 health systems in California, Oregon, Washington, Colorado, Minnesota, and Wisconsin in the Vaccine Safety Datalink.

**Exposures** Receipt of 1 or 2 mRNA COVID-19 vaccine doses in the first trimester, as part of the primary series.

**Main Outcomes and Measures** Selected major structural birth defects among live-born infants, identified from electronic health data using validated algorithms, with neural tube defects confirmed via medical record review.

**Results** Among 42 156 eligible pregnancies (mean [SD] maternal age, 30.9 [5.0] years) 7632 (18.1%) received an mRNA COVID-19 vaccine in the first trimester. Of 34 524 pregnancies without a first-trimester COVID-19 vaccination, 2045 (5.9%) were vaccinated before pregnancy, 13 494 (39.1%) during the second or third trimester, and 18 985 (55.0%) were unvaccinated before or during pregnancy. Compared with pregnant people unvaccinated in the first trimester, those vaccinated in the first trimester were older (mean [SD] age, 32.3 [4.5] years vs 30.6 [5.1] years) and differed by LMP date. After applying stabilized inverse probability weighting, differences in baseline characteristics between vaccinated and unvaccinated pregnant persons in the first trimester were negligible (standardized mean difference <0.20). Selected major structural birth defects occurred in 113 infants (1.48%) after first-trimester mRNA COVID-19 vaccination and in 488 infants (1.41%) without first-trimester vaccine exposure; the adjusted prevalence ratio was 1.02

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(95% CI, 0.78-1.33). In secondary analyses, with major structural birth defect outcomes grouped by organ system, no significant differences between infants vaccinated or unvaccinated in the first trimester were identified.

**Conclusions and Relevance** In this multisite cohort study, among live-born infants, first-trimester mRNA COVID-19 vaccine exposure was not associated with an increased risk for selected major structural birth defects. (Author)

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## 2024-10465

### **COVID-19 vaccine acceptance and associated factors among pregnant and lactating women attending maternity care clinics in refugee camps in Jordan.** Dalky A, Quran TO, Abuhammad S, et al (2024), PLoS ONE vol 19, no 6, June 2024, e0305314

**Background:** Despite the advantages of vaccination in preventing maternal and fetal problems, there were many concerns in the medical community regarding vaccine safety for pregnant women, and this has put obstetricians in a challenging situation when it comes to advising their pregnant patients on whether to obtain the vaccine.

**Aim:** This study was performed to define the level of acceptance of COVID-19 vaccination and assess the impact of COVID-19 attitudes and knowledge on vaccine acceptance between pregnant and lactating Syrian women who are seeking prenatal care services at the clinics in Azraq refugee camp in Jordan.

**Method:** A quantitative, cross-sectional study utilizing a non-probability convenience sample. A validated and reliable self-administered questionnaire consisting of four sections was used.

**Results:** A total of 412 pregnant/lactating women was recruited. The acceptance rate of the COVID-19 vaccine among participants was 86.5%. There was a significant positive moderate association between respondents' attitudes and knowledge around the COVID-19 vaccine and their acceptance of the vaccine ( $r = .468, p < .001, r = .357, p < .001$ ), respectively.

**Conclusion:** To effectively mitigate the COVID-19 pandemic and achieve collective protection, decision-makers must intensify the efforts in promoting the importance of maternal vaccination, especially in vulnerable communities that suffer the most from pandemic outcomes.

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**Full URL:** <https://doi.org/10.1371/journal.pone.0305314>

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## 2024-10026

### **Pregnant women's perceptions of the COVID-19 vaccine: A French survey.** Eglhoff C, Couffignal C, Cordier AG, et al (2022), PLoS ONE vol 17, no 2, February 2022, e0263512

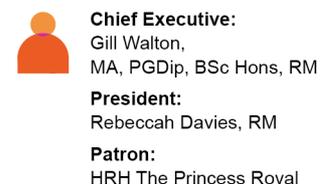
#### Introduction

Pregnant women are at increased risk for COVID-19, and COVID-19 vaccine is the most promising solution to overcome the current pandemic. This study was conducted to evaluate pregnant women's perceptions and acceptance of COVID-19 vaccination.

#### Materials & methods

A cross-sectional study was conducted from February 18 to April 5 2021. An anonymous survey was distributed in 7 French obstetrics departments to all pregnant women before a prenatal visit. All pregnant women attending a follow-up consultation were asked to participate in the study. An anonymous web survey was available through a QR code and participants were asked whether or not they would agree to be vaccinated against SARS-CoV-2, and why. The questionnaire included questions on the patients' demographics and their knowledge of COVID-19 vaccines.

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## Results

Of the 664 pregnant women who completed the questionnaire, 29.5% (95% CI 27.7; 31.3) indicated they would agree to be vaccinated against COVID-19. The main reason for not agreeing was being more afraid of potential side effects of the SARS-CoV-2 vaccine on the fetus than of COVID-19. Factors influencing acceptance of vaccination were: being slightly older, multiparity, having discussed it with a caregiver and acceptance of the influenza vaccine.

## Discussion

Nearly one-third of pregnant women in this population would be willing to be vaccinated. In addition to studies establishing fetal safety, public health agencies and healthcare professionals should provide accurate information about the safety of COVID-19 vaccines. (Author)

**Full URL:** <https://doi.org/10.1371/journal.pone.0263512>

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## 2024-09907

**mRNA Covid-19 vaccines in pregnancy: A systematic review.** Pratama NR, Wafa IA, Budi DS, et al (2022), PLoS ONE vol 17, no 2, February 2022, e0261350

## Objective

Pregnancy is a known risk factor for severe Coronavirus disease 2019. It is important to develop safe vaccines that elicit strong maternal and fetal antibody responses.

## Methods

Registries (ClinicalTrials.gov, the WHO Clinical Trial Registry, and the European Union Clinical Trial Registry) and databases (MEDLINE, ScienceDirect, Cochrane Library, Proquest, Springer, medRxiv, and bioRxiv) were systematically searched in June 20–22, 2021, for research articles pertaining to Covid-19 and pregnancy. Manual searches of bioRxiv and medRxiv were also conducted. Inclusion criteria were studies that focused on Covid-19 vaccination among pregnant women, while review articles and non-human studies were excluded. Infection rate, maternal antibody response, transplacental antibody transfer, and adverse events were described.

## Results

There were 13 observational studies with a total of 48,039 pregnant women who received mRNA vaccines. Of those, three studies investigated infection rate, six studies investigated maternal antibody response, seven studies investigated antibody transfer, three studies reported local adverse events, and five studies reported systemic adverse events. The available data suggested that the mRNA-based vaccines (Pfizer–BioNTech and Moderna) can prevent future SARS-CoV-2 infection. These vaccines did not show clear harm in pregnancy. The most commonly encountered adverse reactions were pain at the injection site, fatigue, and headache, but these were transient. Antibody responses were rapid after the first vaccine dose. After the booster, antibody responses were stronger and associated with better transplacental antibody transfer. Longer intervals between first vaccination dose and delivery were also associated with higher antibody fetal IgG and a better antibody transfer ratio.

## Conclusions

The SARS-CoV-2 mRNA vaccines are encouraged for pregnancy. These vaccines can be a safe option for pregnant women and their fetuses. Two vaccine doses are recommended for more robust maternal and fetal antibody responses. Longer latency is associated with higher fetal antibody responses. Further research about its long-term effect on pregnancy is needed. (Author)

**Full URL:** <https://doi.org/10.1371/journal.pone.0261350>

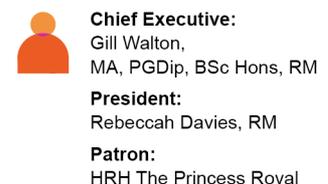
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## 2024-09711

**Barriers and facilitators to vaccination for COVID-19, pertussis, and influenza during pregnancy: Protocol for an umbrella review.** Nichol B, Simonetti V, McCready J, et al (2022), PLoS ONE vol 17, no 9, September 2022, e0275105

Pregnant women are particularly vulnerable to infection. Furthermore, infection from pertussis, influenza and

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COVID-19 increases the likelihood of adverse consequences to the mother and developing baby such as stillbirth, ICU admission, and pre-term caesarean birth. Increased rates of transmission and risk of adverse consequences from infection justifies the provision of national maternal vaccination programmes. Additionally, maternal vaccination helps protect the infant until they are able to receive their own vaccinations; a time when they are most at risk of mortality from influenza and pertussis. Vaccination during pregnancy has been repeatedly demonstrated as safe and effective in reducing harm, although rates of uptake remain low compared to the general population. The current protocol describes the methodology for an umbrella review aiming to explore the barriers and facilitators of vaccination during pregnancy for pertussis, influenza, and COVID-19. Systematic reviews that investigate the barriers and facilitators of at least one of either pertussis, influenza, or COVID-19 will be included in this review. Multiple databases will be searched, and included reviews assessed for quality (using the Joanna Briggs Institute (JBI) quality assessment for systematic reviews) and degree of overlap of included primary studies. Included reviews will be analysed according to the WHO SAGE model of determinants of vaccine hesitancy and separated by whether these explore influenza and pertussis, or COVID-19. The outcomes of this review will help inform the development of interventions to increase uptake of vaccination during pregnancy, and on whether interventions need to be tailored depending on the infectious disease. The key findings will identify the specific barriers and facilitators of vaccination hesitancy by considering contextual influences (e.g. sociodemographic variables), individual/social group influences (e.g. trust in the institutions), and vaccine-specific issues (e.g. safety and recommendations). (Author)

Full URL: <https://doi.org/10.1371/journal.pone.0275105>

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## 2024-09704

**COVID-19 vaccine acceptance among pregnant women worldwide: A systematic review and meta-analysis.** Azami M, Nasirkandy MP, Ghaleh HEG, et al (2022), PLoS ONE vol 17, no 9, September 2022, e0272273

### Background

The COVID-19 pandemic has led to the death of many people worldwide. The World Health Organization (WHO) has declared vaccine resistance as one of the greatest health threats in the world even before the COVID-19 epidemic. The aim of this study was to evaluate the acceptance of COVID-19 vaccine in pregnant women.

### Method

We performed this systematic review and meta-analysis in accordance with the PRISMA guidelines. We applied the standard search strategy to the PubMed/Medline, Web of Science (ISI), Scopus, Science Direct, Cochrane Library, EMBASE, and EBSCO databases, and the Google Scholar search engine. Heterogeneity between studies was relatively high and therefore meta-analyses were performed based on random effects model with 95% CI using STATA version 16.

### Results

In 16 articles with a sample size of 19219 pregnant women, the acceptance of COVID-19 vaccine was estimated 53.46% (95%CI: 47.64%-59.24%). Subgroup analysis was performed based on continent ( $p = 0.796$ ), data collection method ( $p = 0.450$ ) and meta-regression based on the month of the study ( $P < 0.001$ ), and only meta-regression was significant based on the month of the study. The effect of some variables such as gravidity (OR = 1.02 [95%CI: 0.90–1.16]), maternal age was (OR = 1.02 [95%CI: 0.93–1.11]) and history of influenza vaccination (OR = 0.87 [95%CI: 0.71–1.06]) on COVID-19 vaccine acceptance was evaluated, which was not significant.

### Conclusion

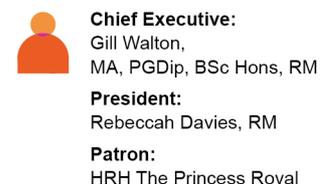
The prevalence of COVID-19 vaccine acceptance in pregnant women was 53.46%, which was much lower than the general COVID-19 vaccination. Therefore, necessary interventions should be taken to increase the acceptance of the vaccine, address safety concerns and educate about it. (Author)

Full URL: <https://doi.org/10.1371/journal.pone.0272273>

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## 2024-09636

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## COVID-19 vaccine acceptance and perceived risk among pregnant and non-pregnant adults in Cameroon, Africa.

Gunawardhana N, Baecher K, Boutwell A, et al (2022), PLoS ONE vol 17, no 9, September 2022, e0274541

### Background

The public health response to the global COVID-19 pandemic has varied widely by region. In Africa, uptake of effective COVID-19 vaccines has been limited by accessibility and vaccine hesitancy. The aim of this study was to compare perceptions of COVID-19 infection and vaccination between pregnant women and non-pregnant adults in four regions of Cameroon, located in Central Africa.

### Methods

A cross-sectional survey study was conducted at urban and suburban hospital facilities in Cameroon. Participants were randomly selected from a convenience sample of adult pregnant and non-pregnant adults in outpatient clinical settings between June 1st and July 14th, 2021. A confidential survey was administered in person by trained research nurses after obtaining written informed consent. Participants were asked about self-reported sociodemographics, medical comorbidities, perceptions of COVID-19 infection, and vaccination. Descriptive statistics were used for survey responses and univariate and multivariable logistic regression models were created to explore factors associated with COVID-19 vaccine acceptability.

### Results

Fewer than one-third of participants were interested in receiving the COVID-19 vaccine (31%, 257/835) and rates did not differ by pregnancy status. Overall, 43% of participants doubted vaccine efficacy, and 85% stated that the vaccine available in Africa was less effective than vaccine available in Europe. Factors independently associated with vaccine acceptability included having children (aOR = 1.5;  $p = 0.04$ ) and higher education (aOR = 1.6 for secondary school vs primary/none;  $p = 0.03$ ). Perceived risks of vaccination ranged from death (33%) to fetal harm (31%) to genetic changes (1%). Health care professionals were cited as the most trusted source for health information (82%,  $n = 681$ ).

### Conclusion

COVID-19 vaccine hesitancy and misinformation in Cameroon was highly prevalent among pregnant and non-pregnant adults in 2021 while vaccine was available but not recommended for use in pregnancy. Based on study findings, consistent public health messaging from medical professionals about vaccine safety and efficacy and local production of vaccine are likely to improve acceptability. (Author)

Full URL: <https://doi.org/10.1371/journal.pone.0274541>

## 2024-09595

### Perception of risk regarding the use of COVID-19 vaccine among pregnant women in Motta town and Hulet Eji Enese district, northwest Ethiopia.

Asratie MH, Kassie BA, Belay DG, et al (2022), PLoS ONE vol 17, no 8, August 2022, e0269591

### Background

COVID-19 vaccination during pregnancy is a common practice in developing countries like Ethiopia. Despite there being a rumor from the community that the use of COVID-19 vaccination during pregnancy is associated with many pregnancy adverse outcomes. However, there is a paucity of empirical evidence on the perception of risk COVID-19 vaccination during pregnancy in Ethiopia. This study assessed the perception of risk COVID-19 vaccination during pregnancy and associated factors in Motta town and Hulet Eji Enese district, northwest Ethiopia.

### Methods

A community-based cross-sectional study was conducted from December 12 to February 12, 2021. A total of 851 women were selected using the stratified cluster sampling technique. Data were collected by face-to-face interview using a semi-structured pretested and interviewer-administered questionnaire. A multivariable logistic regression model was fitted to identify factors associated with the perception of risk COVID-19 vaccination during pregnancy. The adjusted odds ratio (AOR) with a 95% confidence interval at a  $p$ -value of  $\leq 0.05$  was used to declare the level of significance.

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## Results

Perception of risk COVID-19 vaccination during pregnancy was 34.2% (95%CI (Confidence Interval): 31–37). Unplanned pregnancy (AOR = 3.66; 95%CI: 2.31–5.81), long travel time to the nearby health care facility (AOR: 4.57; 95% CI: 2.34–8.91), have no formal education (AOR: 3.15; 95%CI: 1.71–5.79), attending secondary educational level (AOR: 5.18; 95% CI: 2.17–12.4), no ANC (Antenatal Care) service utilization (AOR: 7.07; 95% CI: 4.35–11.5) and negative attitude towards COVID-19 vaccination (AOR: 6.05; 95%CI: 3.88–9.43) were significantly associated with the perception of risk COVID-19 vaccination during pregnancy.

## Conclusions

Most of the participants perceive COVID-19 vaccination during pregnancy as a risk for the outcome of pregnancy. Designing strategies to increase women's educational status, promoting the need for maternal and child health services, and awareness creation regarding COVID-19 vaccination will have a great role in changing the perception of pregnant women. Therefore, the government should design public health programs targeting the identified factor, and should minimize the perception of risk acquiring infection from COVID-19 vaccine to improve maternal and neonatal health outcome. (Author)

**Full URL:** <https://doi.org/10.1371/journal.pone.0269591>

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## 2024-09422

**COVID-19 vaccination uptake in 441 socially and ethnically diverse pregnant women.** Husain F, Powys VR, White E, et al (2022), PLoS ONE vol 17, no 8, August 2022, e0271834

## Objective

To explore COVID-19 vaccination uptake, facilitators and barriers in ethnically-diverse pregnant women.

## Design and setting

An anonymous quality improvement questionnaire survey exploring COVID-19 vaccination uptake, causes of vaccine hesitancy and trusted sources of information among pregnant women in two acute district general hospitals in England (Berkshire and Surrey) between 1.9.21 and 28.2.22.

## Population

441 pregnant women attending routine antenatal clinic appointments.

## Methods

Consented pregnant women completed the survey either electronically using a QR code or on paper. Descriptive data were summarised and free text responses were thematically analysed.

## Results

441 pregnant women, mean age 32 years (range 17–44), completed the survey. Twenty-six percent were from ethnic minority groups, and 31% had a co-morbid health condition. Most respondents (66.2%) had been vaccinated against COVID-19 with at least one dose (White British 71.9%, Asian 67.9%, White-other 63.6%, Black 33%). The most common reasons for not being vaccinated were concerns about effects on the unborn baby and future pregnancies, anxiety about possible adverse impact on the mother, not enough known about the vaccine, and lack of trust in vaccines. Comments included: "I'd rather not risk injecting the unknown into my body", and "I don't trust it." Although 23% used social media for information on COVID-19 vaccination, the most trusted sources were the patient's GP and midwife (43%) and official health-related websites such as NHS (39%).

## Conclusions

A third of these pregnant women had not been vaccinated against COVID-19. Trusted health professionals like midwives and GPs could have a crucial role in increasing vaccination uptake. (Author)

**Full URL:** <https://doi.org/10.1371/journal.pone.0271834>

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2024-09419

**Facilitators and barriers to COVID-19 vaccine uptake among women in two regions of Ghana: A qualitative study.**

Afrifa-Anane GF, Larbi RT, Addo B, et al (2022), PLoS ONE vol 17, no 8, August 2022, e0272876

Although COVID-19 vaccines are available, evidence suggests that several factors hinder or facilitate their use. Several studies have found gender differences in COVID-19 vaccine uptake, with women less likely to vaccinate than men in many countries, including Ghana. These studies, however, have primarily been quantitative. This study used a qualitative approach to examine the facilitators and barriers to vaccine uptake among women in Ghana. Using a cross-sectional descriptive qualitative research design, 30 women in the Greater Accra and Ashanti regions of Ghana were conveniently sampled and interviewed using a semi-structured interview guide. Fifteen (15) interviews were conducted in each region. The data were transcribed verbatim and analysed thematically using QSR NVivo version 10 software. Among the key factors that facilitate COVID-19 vaccination are the desire to protect oneself and family against COVID-19, education about COVID-19 vaccines, seeing others receive the COVID-19 vaccine, and vaccine being cost-free. On the other hand, long queues at the vaccination centres, fear of side effects, misconceptions about the vaccines, and shortage of vaccines were the main barriers against COVID-19 vaccination. The study results show that individual, institutional, and vaccine-related factors facilitate or hinder COVID-19 vaccination among women.

Addressing these factors need continuous comprehensive health education, and ensuring vaccine availability at vaccination sites will improve women's uptake of the COVID-19 vaccines. (Author)

Full URL: <https://doi.org/10.1371/journal.pone.0272876>

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2024-09291

**Timing of maternal vaccination against COVID-19 for effective protection of neonates: cohort study.** Nowakowska A, Lee

SM, Kim M, et al (2024), Frontiers in Immunology 8 July 2024, online

Introduction: Although the safety and effectiveness of COVID-19 vaccination during pregnancy have been proven, there is still little data explaining neonatal outcomes of maternal pre-pregnancy vaccination.

Methods: Here, we investigated the impact of vaccination and SARS-CoV-2 infection on maternal-neonate immune response in a cohort study involving 141 pregnant individuals, and defined the importance of maternal COVID-19 vaccination timing for its effectiveness.

Results and discussion: Our data indicate that vertically transferred maternal hybrid immunity provides significantly better antiviral protection for a neonate than either maternal post-infection or post-vaccination immunity alone. Higher neutralization potency among mothers immunized before pregnancy and their newborns highlights the promising role of pre-pregnancy vaccination in neonatal protection. A comparison of neutralizing antibody titers calculated for each dyad suggests that infection and pre-/during-pregnancy vaccination all support transplacental transfer, providing the offspring with strong passive immunity against SARS-CoV-2. Analysis of neutralizing antibody levels in maternal sera collected during pregnancy and later during delivery shows that immunization may exert a positive effect on maternal protection. (Author)

Full URL: <https://doi.org/10.3389/fimmu.2024.1359209>

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2024-09268

**Disparities in perinatal COVID-19 infection and vaccination.** Dubois B, Mills AN, Jessel RH, et al (2024), Seminars in

Perinatology vol 48, no 4, June 2024, 151923

The COVID-19 pandemic exposed and exacerbated persistent health inequities in perinatal populations, resulting in disparities of maternal and fetal complications. In this narrative review, we present an adapted conceptual framework of perinatal social determinants of health in the setting of the COVID-19 pandemic and use this framework to contextualize the literature regarding disparities in COVID-19 vaccination and infection. We synthesize how elements of the structural context, individual socioeconomic position, and concrete intermediary determinants influence each other and perinatal COVID-19 vaccination and infection, arguing that systemic inequities at each level contribute to observed disparities in perinatal health outcomes. From there, we identify gaps in the literature, propose

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## 2024-09038

### **Covid-19 infection and vaccination during first trimester and risk of congenital anomalies: Nordic registry based study.**

Magnus MC, Söderling J, Örtqvist AK, et al (2024), BMJ 17 July 2024, online

**Objectives** To evaluate the risk of major congenital anomalies according to infection with or vaccination against covid-19 during the first trimester of pregnancy.

**Design** Prospective Nordic registry based study.

**Setting** Sweden, Denmark, and Norway.

**Participants** 343 066 liveborn singleton infants in Sweden, Denmark, and Norway, with an estimated start of pregnancy between 1 March 2020 and 14 February 2022, identified using national health registries.

**Main outcome measure** Major congenital anomalies were categorised using EUROCAT (European Surveillance of Congenital Anomalies) definitions. The risk after covid-19 infection or vaccination during the first trimester was assessed by logistic regression, adjusting for maternal age, parity, education, income, country of origin, smoking, body mass index, chronic conditions, and estimated date of start of pregnancy.

**Results** 17 704 (5.2%) infants had a major congenital anomaly. When evaluating risk associated with covid-19 infection during the first trimester, the adjusted odds ratio ranged from 0.84 (95% confidence interval 0.51 to 1.40) for eye anomalies to 1.12 (0.68 to 1.84) for oro-facial clefts. Similarly, the risk associated with covid-19 vaccination during the first trimester ranged from 0.84 (0.31 to 2.31) for nervous system anomalies to 1.69 (0.76 to 3.78) for abdominal wall defects. Estimates for 10 of 11 subgroups of anomalies were less than 1.04, indicating no notable increased risk.

**Conclusions** Covid-19 infection and vaccination during the first trimester of pregnancy were not associated with risk of congenital anomalies. (Author)

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## 2024-08990

### **COVID-19 vaccination in pregnancy: A quantitative and qualitative analysis of the effect of strong public health**

**messaging in an Australian cohort.** Malone S, Walsh S, Butters Z, et al (2024), Australian and New Zealand Journal of Obstetrics and Gynaecology (ANZJOG) vol 64, no 6, December 2024, pp 580-587

#### **Background**

SARS-CoV-2 infection in pregnancy predisposes women and their offspring to adverse health outcomes, while internationally reported rates of vaccination uptake remain low. Our study objective was to quantify the uptake of COVID-19 vaccination in pregnant women, and to assess their attitudes toward vaccination in pregnancy with both quantitative and qualitative analyses.

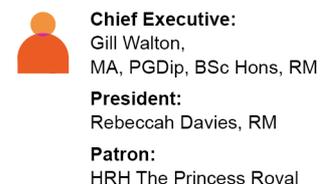
#### **Materials and methods**

This is a prospective, cross-sectional survey at Australia's largest quaternary level maternity centre. A total of 351 pregnant women, at 6–42 weeks gestation receiving antenatal care at our hospital, completed an online voluntary, anonymous, 17 question survey. This was conducted during a five-week period in November to December 2021. The main outcome measures were demographic data, prior SARS-CoV-2 infection and COVID-19 vaccination status, knowledge and attitudes surrounding COVID-19 disease and vaccination in pregnancy.

#### **Results**

High rates of COVID-19 vaccination were observed in this pregnant population. Of the 351 respondents, 82% had received at least one dose of the COVID 19-vaccination. This increased compared to estimates of 15% in June 2021

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which were obtained from the hospital's electronic health record.

#### Conclusions

Our survey demonstrates that a strong public health campaign with clear messaging regarding the beneficial effects of COVID-19 vaccination in pregnancy can lead to high vaccination uptake rates. (Author)

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#### 2024-08954

**Coronavirus Disease 2019 (COVID-19) Vaccination and Stillbirth in the Vaccine Safety Datalink.** Denoble AE, Vazquez-Benitez G, Sheth SS, et al (2024), *Obstetrics & Gynecology* vol 144, no 2, August 2024, pp 215-222

#### OBJECTIVE:

Coronavirus disease 2019 (COVID-19) vaccination is recommended in pregnancy to reduce the risk of severe morbidity from COVID-19. However, vaccine hesitancy persists among pregnant people, with risk of stillbirth being a primary concern. Our objective was to examine the association between COVID-19 vaccination and stillbirth.

#### METHODS:

We performed a matched case–control study in the Vaccine Safety Datalink (VSD). Stillbirths and live births were selected from singleton pregnancies among persons aged 16–49 years with at least one prenatal, delivery, or postpartum visit at eight participating VSD sites. Stillbirths identified through diagnostic codes were adjudicated to confirm the outcome, date, and gestational age at fetal death. Confirmed antepartum stillbirths that occurred between February 14, 2021, and February 27, 2022, then were matched 1:3 to live births by pregnancy start date, VSD site, and maternal age at delivery. Associations among antepartum stillbirth and COVID-19 vaccination in pregnancy, vaccine manufacturer, number of vaccine doses received, and vaccination within 6 weeks before stillbirth (or index date in live births) were evaluated using conditional logistic regression.

#### RESULTS:

In the matched analysis of 276 confirmed antepartum stillbirths and 822 live births, we found no association between COVID-19 vaccination during pregnancy and stillbirth (38.4% stillbirths vs 39.3% live births in vaccinated individuals, adjusted odds ratio [aOR] 1.02, 95% CI, 0.76–1.37). Furthermore, no association between COVID-19 vaccination and stillbirth was detected by vaccine manufacturer (Moderna: aOR 1.00, 95% CI, 0.62–1.62; Pfizer-BioNTech: aOR 1.00, 95% CI, 0.69–1.43), number of vaccine doses received during pregnancy (1 vs 0: aOR 1.17, 95% CI, 0.75–1.83; 2 vs 0: aOR 0.98, 95% CI, 0.81–1.17), or COVID-19 vaccination within the 6 weeks before stillbirth or index date compared with no vaccination (aOR 1.16, 95% CI, 0.74–1.83).

#### CONCLUSION:

No association was found between COVID-19 vaccination and stillbirth. These findings further support recommendations for COVID-19 vaccination in pregnancy. (Author)

Full URL: <https://doi.org/10.1097/AOG.0000000000005632>

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#### 2024-08771

**'No increased risk' of birth defects after Covid-19 infection or vaccine.** Ford S (2024), *Nursing Times* 19 July 2024, online

Neither being infected with Covid-19 nor being vaccinated against it during the first trimester of pregnancy is linked with increased risk of major birth defects, according to Scandinavian researchers. (Author)

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#### 2024-08579

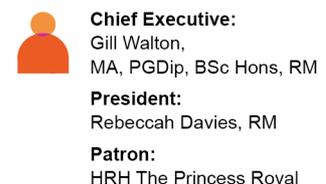
**Association of BNT162b2 SARS-CoV-2 vaccination during pregnancy with postnatal outcomes in premature infants.**

Tamir-Hostovsky L, Maayan-Metzger A, Gavri-Beker A, et al (2024), *Acta Paediatrica* vol 113, no 10, October 2024, pp 2275-2281

#### Aim

The effect of COVID-19 vaccine given during pregnancy on premature infants is unknown. This study aims to determine the association between maternal COVID-19 vaccine with postnatal outcome in premature infants.

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## Methods

This is a single-centre retrospective case–control study of infants born before 35 weeks gestation to mothers who received SARS-CoV-2 vaccine during pregnancy compared with infant born to non-vaccinated mothers.

## Results

A total of 78 infants in each group were included. Infants in the vaccinated group had less respiratory distress syndrome (RDS) ( $p = 0.02$ ) and less need for respiratory support ( $p = 0.002$ ), and maternal vaccine had a protective effect on RDS [adjustable OR 0.38 (0.17–0.85)]. Vaccination during the first compared to the second trimester was associated with earlier gestational age ( $32.3 \pm 2.1$  vs.  $33.3 \pm 1.1$  weeks,  $p = 0.03$ ).

## Conclusion

We demonstrated that maternal SARS-CoV-2 vaccine is not associated with postnatal adverse effect in premature infants and potentially has a protective effect on RDS. Earlier gestational age among the infants born to mothers who received COVID-19 vaccine during the first trimester did not translate to higher rate of postnatal complications. These findings might suggest that COVID-19 vaccine is safe in high-risk pregnancies, but timing of administration should be considered. Further studies are needed to confirm our findings and the biological mechanism. (Author)

## 2024-08515

### **The type of COVID–19 vaccination does not affect reproductive function and pregnancy outcomes in infertile couples.**

Wang S, Wang N, Yao G, et al (2024), *Frontiers in Endocrinology* 14 June 2024, online

**Introduction:** Studies on the effect of vaccine type and two other vaccines other than inactivated vaccines approved in China on in vitro fertilization (IVF) pregnancy outcomes are rare. To complement and confirm the existing findings, this research aimed to investigate whether there are adverse effects of different vaccine types in females and males on reproductive function and clinical pregnancy.

**Methods:** This retrospective study enrolled 6,455 fresh embryo transfer cycles at the First Affiliated Hospital of Zhengzhou University between May 1, 2021, and October 31, 2022. The primary outcome is the clinical pregnancy rate (CPR). At the same time, the secondary results are the number of oocytes retrieved, two pronuclei (2PN) rate, blastocyst formation rate, high-quality blastocyst rate, and semen parameters (volume, density, sperm count, forward motility rate, total motility rate, immobility rate, and DNA fragment index (DFI) rate).

**Results:** In the comparison of ovarian stimulation indicators, no statistically significant differences ( $P > 0.05$ ) were found in Gn days, endometrial thickness, 2PN rate, metaphase 2 (MII) rate, high-quality embryo rate, and blastocyst formation rate. No significant differences ( $P > 0.05$ ) were found in age, body mass index (BMI), education level, and semen parameters (volume, density, sperm count, forward motility rate, total motility rate, immobility rate, and DFI rate) in these four groups. The multivariate regression model showed that neither the types of vaccines nor the vaccination status of both infertile couples significantly affected clinical pregnancy.

**Discussion:** The type of vaccine does not appear to have an unfavorable effect on ovarian stimulation, embryo development, semen parameters, and clinical pregnancy. (Author)

**Full URL:** <https://doi.org/10.3389/fendo.2024.1356938>

## 2024-08235

### **Preservation of Anti-SARS-CoV-2 Neutralizing Antibodies in Breast Milk: Impact of Maternal COVID-19 Vaccination and Infection.** Suteerotrakool O, Mekangkul E, Maitreechit D, et al (2024), *Breastfeeding Medicine* vol 19, no 5, May 2024, pp 340–348

**Objectives:** To investigate specific immunoglobulin A (sIgA), specific immunoglobulin G (sIgG), and neutralizing antibodies (NAbs) against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in breast milk and compare

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immunity in mothers with hybrid immunity (infection and vaccination) versus those solely vaccinated (coronavirus disease [COVID]-naïve).

**Methods:** A longitudinal study was conducted among lactating mothers who received at least two doses of the coronavirus disease 2019 (COVID-19) vaccine or tested positive for SARS-CoV-2. Details of vaccination and infection were collected through questionnaires and interviews. Fifteen milliliters of breast milk samples, self-collected at 1, 3, and 6 months postvaccination or infection, were sent to analysis for sIgA, sIgG, and NAbs using enzyme-linked immunosorbent assay.

**Results:** In total, 119 lactating mothers (202 milk samples) were enrolled; 82 participants had hybrid immunity, and 32 were COVID-19-naïve. Two-thirds received a combination of different vaccines and booster shots. Breast milk retained sIgA, sIgG, and NAbs for up to 6 months post-COVID vaccination or infection. At 3 months, mothers with hybrid immunity had significantly higher sIgA and NAbs compared with COVID-naïve mothers (geometric mean [95% confidence interval (CI)] of sIgA 2.72 [1.94–3.8] vs. 1.44 [0.83–2.48]; NAbs 86.83 [84.9–88.8] vs. 81.28 [76.02–86.9]). No differences in sIgA, sIgG, and NAbs were observed between lactating mothers receiving two, three, or more than or equal to three doses, regardless of hybrid immunity or COVID-naïve status.

**Conclusion:** sIgA, sIgG, and NAbs against SARS-CoV-2 in breast milk sustained for up to 6 months postimmunization and infection. Higher immunity was found in mothers with hybrid immunity. These transferred immunities confirm in vitro protection, supporting the safety of breastfeeding during and after COVID-19 vaccination or infection. (Author)

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## 2024-07704

**What factors influence the uptake of vaccinations amongst pregnant women following the Covid-19 pandemic: A qualitative study.** Parsons J, Grimley C, Atherton H, et al (2024), *Midwifery* vol 134, July 2024, 104021

### Background

Pregnant women and their unborn babies are at increased risk from serious complications, hospitalisation and death from infectious diseases. Vaccinations for influenza (flu), pertussis (whooping cough) and Covid-19 are available for free for pregnant women in the UK, but uptake of these repeatedly remains low. This qualitative study aimed to explore how pregnant women feel about these vaccinations, and what factors influence the uptake of vaccinations amongst pregnant women since the onset of the Covid-19 pandemic.

### Methods

Pregnant women were recruited via two participating hospitals in one geographic area of the UK, and via one community group offering support to pregnant women from ethnic minorities. Semi-structured interviews were conducted remotely using telephone, were anonymised and transcribed, and analysed using thematic analysis.

### Findings

Interviews were conducted remotely with 43 pregnant women. The following themes were identified as influencing uptake of vaccinations amongst pregnant women: internal factors and beliefs, vaccination related factors, external influences and Covid-19 and changing perceptions of the pandemic.

### Discussion

Findings of this study increase awareness of some of the factors influencing vaccination decisions of pregnant women. It informs practice regarding healthcare professionals' discussions with pregnant women about vaccinations, and future vaccination campaigns and interventions that are targeting an increase in vaccination uptake amongst this population. (Author)

**Full URL:** <https://doi.org/10.1016/j.midw.2024.104021>

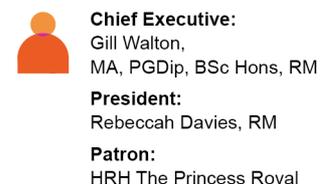
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## 2024-07360

**Obstetric Complications and Birth Outcomes After Antenatal Coronavirus Disease 2019 (COVID-19) Vaccination.** Vesco KK, Denoble AE, Lipkind HS, et al (2024), *Obstetrics & Gynecology* vol 143, no 6, June 2024, pp 794-802

### OBJECTIVE:

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To evaluate the association between antenatal messenger RNA (mRNA) coronavirus disease 2019 (COVID-19) vaccination and risk of adverse pregnancy outcomes.

#### METHODS:

This was a retrospective cohort study of individuals with singleton pregnancies with live deliveries between June 1, 2021, and January 31, 2022, with data available from eight integrated health care systems in the Vaccine Safety Datalink. Vaccine exposure was defined as receipt of one or two mRNA COVID-19 vaccine doses (primary series) during pregnancy. Outcomes were preterm birth (PTB) before 37 weeks of gestation, small-for-gestational age (SGA) neonates, gestational diabetes mellitus (GDM), gestational hypertension, and preeclampsia–eclampsia–HELLP (hemolysis, elevated liver enzymes, and low platelet count) syndrome. Outcomes in individuals vaccinated were compared with those in propensity-matched individuals with unexposed pregnancies. Adjusted hazard ratios (aHRs) and 95% CIs were estimated for PTB and SGA using a time-dependent covariate Cox model, and adjusted relative risks (aRRs) were estimated for GDM, gestational hypertension, and preeclampsia–eclampsia–HELLP syndrome using Poisson regression with robust variance.

#### RESULTS:

Among 55,591 individuals eligible for inclusion, 23,517 (42.3%) received one or two mRNA COVID-19 vaccine doses during pregnancy. Receipt of mRNA COVID-19 vaccination varied by maternal age, race, Hispanic ethnicity, and history of COVID-19. Compared with no vaccination, mRNA COVID-19 vaccination was associated with a decreased risk of PTB (rate: 6.4 [vaccinated] vs 7.7 [unvaccinated] per 100, aHR 0.89; 95% CI, 0.83–0.94). Messenger RNA COVID-19 vaccination was not associated with SGA (8.3 vs 7.4 per 100; aHR 1.06, 95% CI, 0.99–1.13), GDM (11.9 vs 10.6 per 100; aRR 1.00, 95% CI, 0.90–1.10), gestational hypertension (10.8 vs 9.9 per 100; aRR 1.08, 95% CI, 0.96–1.22), or preeclampsia–eclampsia–HELLP syndrome (8.9 vs 8.4 per 100; aRR 1.10, 95% CI, 0.97–1.24).

#### CONCLUSION:

Receipt of an mRNA COVID-19 vaccine during pregnancy was not associated with an increased risk of adverse pregnancy outcomes; this information will be helpful for patients and clinicians when considering COVID-19 vaccination in pregnancy. (Author)

Full URL: <https://doi.org/10.1097/AOG.0000000000005583>

#### 2024-07335

**Risk factors related to the SARS-CoV-2 vaccine additional doses hesitancy among pregnant and non-pregnant people of reproductive age and partners: A Brazilian cross-sectional study.** Charles CM, Noles M, Munezero A, et al (2024), International Journal of Gynecology & Obstetrics vol 166, no 3, September 2024, pp 1144-1160

#### Objective

The aim of this study was to assess the predictors of acceptance and hesitancy of additional doses of any SARS-CoV-2 (COVID-19) vaccine among pregnant or recently pregnant and non-pregnant people of reproductive age and partners in Brazil.

#### Methods

We conducted an online cross-sectional study from June 2022 to April 2023 and invited women and partners between 18 and 49 years old to participate. We employed a snowball strategy to reach all potential eligible participants. Our primary outcome was the acceptance rate of the COVID-19 booster vaccine. We estimated the frequency and percentage for the three groups and compared categorical variables using the Chi-square test. Moreover, bivariate, backward stepwise regression, and subgroup analyses were performed to evaluate risk factors and predictors of COVID-19 vaccine booster hesitancy. We reported the effect size as OR with a 95% CI.

#### Results

We included 1487 participants, and among them, 334 (22.5%) were pregnant or recently pregnant people, 905 (60.8%) were non-pregnant people, and 247 (16.6%) were male partners. Pregnant and recently pregnant people showed

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greater hesitancy for the COVID-19 vaccine booster than non-pregnant people (28% vs 15%,  $P < 0.001$ ) and male partners (28% vs 16%,  $P < 0.001$ ). Non-pregnant women accepted the COVID-19 vaccine more often than pregnant or recently pregnant people (OR 1.75; 95% CI: 1.13–2.70). The associated factors to the reduced COVID-19 vaccine booster acceptance were family income between US\$ 566–945.00 (54%), evangelic religion (65%), concern about vaccine safety (80%) and perceived common vaccine importance (93%).

#### Conclusion

Pregnant people were more hesitant than non-pregnant people to accept the COVID-19 booster vaccine. Family income, religious beliefs, vaccine safety concerns, and perceived common vaccine importance were significant barriers to accepting COVID-19 booster vaccines. The impact of these factors was more evident among pregnant or recently pregnant people, emphasizing the harmful effect of misinformation among this vulnerable population.

(Author)

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#### 2024-06417

##### **COVID-19 vaccination during pregnancy is not associated with an increased risk of severe postpartum hemorrhage.**

Magnus MC, Rasmussen TD, Örtqvist AK, et al (2024), American Journal of Obstetrics & Gynecology (AJOG) vol 231, no 3, September 2024, pp e99-e100

This article is a research letter detailing a study that examined 317,754 singleton term deliveries in Sweden, Denmark, and Norway to evaluate the risk of severe postpartum hemorrhage following vaccination against COVID-19 during pregnancy. (JM)

Full URL: <https://doi.org/10.1016/j.ajog.2024.04.028>

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#### 2024-05933

##### **Maternal COVID-19 vaccination status and association with neonatal congenital anomalies.** Santos J, Miller M, Branda ME, et al (2024), Frontiers in Pediatrics 19 April 2024, online

Introduction: Despite recommendations for COVID-19 vaccination in pregnant people, the effect of vaccination on neonatal outcomes remains unknown. We sought to determine the association between COVID-19 vaccination status in pregnancy and presence of neonatally diagnosed congenital anomalies.

Methods: A comprehensive vaccine registry was combined with a delivery database to create a cohort including all patients aged 16–55 years with a delivery event between December 10, 2020 and December 31, 2021 at a hospital within the Mayo Clinic Health System. Pregnancy and neonatal outcomes were analyzed in relation to vaccination status and timing, including a composite measure of congenital anomalies diagnosed in neonatal life. Comparisons between cohorts were conducted using chi-square test for categorical and Kruskal–Wallis test for continuous variables. A multivariable logistic regression was modeled to assess the association with congenital anomalies.

Results: 5,096 mother-infant pairs were analyzed. A total of 1,158 were vaccinated, with 314 vaccinated in the first trimester. COVID-19 vaccination status, including vaccination during the first trimester of pregnancy, was not associated with an increased risk of composite congenital anomalies. When further examining congenital anomalies by organ system, we did demonstrate a significant difference in eye, ear, face, neck anomalies between vaccinated and not vaccinated groups (Table 3, Not vaccinated = 2.3%, Vaccinated = 3.3%, p-value 0.04) however we did not demonstrate this difference between the 1st trimester and not vaccinated groups (Not vaccinated = 2.3%, 1st Trimester = 2.5%, p-value 0.77). No differences were found between not vaccinated, vaccinated, or 1st trimester vaccinated groups for any other organ systems. There were no differences in birthweight by gestational age, APGAR scores, incidence of NICU admission, or living status of the neonate by vaccination status.

Conclusion: We add additional information regarding the safety of COVID-19 vaccination status and timing as it pertains to neonatal composite congenital anomalies, with no association demonstrated. Our findings agree with prior literature that COVID-19 vaccination is not associated with adverse pregnancy outcomes or small for gestational age

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neonates. Further research is needed to elucidate the association between COVID-19 vaccination and eye, ear, face, neck, anomalies. (Author)

Full URL: <https://doi.org/10.3389/fped.2024.1355502>

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## 2024-05772

**Attitudes Toward COVID-19 Vaccines Among Pregnant and Recently Pregnant Individuals.** Williams JTB, Kurlandsky K, Breslin K, et al (2024), JAMA Network Open vol 7, no 4, April 2024, e245479

**Importance** Pregnant people and infants are at high risk of severe COVID-19 outcomes. Understanding changes in attitudes toward COVID-19 vaccines among pregnant and recently pregnant people is important for public health messaging.

**Objective** To assess attitudinal trends regarding COVID-19 vaccines by (1) vaccination status and (2) race, ethnicity, and language among samples of pregnant and recently pregnant Vaccine Safety Datalink (VSD) members from 2021 to 2023.

**Design, Setting, and Participants** This cross-sectional survey study included pregnant or recently pregnant members of the VSD, a collaboration of 13 health care systems and the US Centers for Disease Control and Prevention.

Unvaccinated, non-Hispanic Black, and Spanish-speaking members were oversampled. Wave 1 took place from October 2021 to February 2022, and wave 2 took place from November 2022 to February 2023. Data were analyzed from May 2022 to September 2023.

**Exposures** Self-reported or electronic health record (EHR)-derived race, ethnicity, and preferred language.

**Main Outcomes and Measures** Self-reported vaccination status and attitudes toward monovalent (wave 1) or bivalent Omicron booster (wave 2) COVID-19 vaccines. Sample- and response-weighted analyses assessed attitudes by vaccination status and 3 race, ethnicity, and language groupings of interest.

**Results** There were 1227 respondents; all identified as female, the mean (SD) age was 31.7 (5.6) years, 356 (29.0%) identified as Black race, 555 (45.2%) identified as Hispanic ethnicity, and 445 (36.3%) preferred the Spanish language. Response rates were 43.5% for wave 1 (652 of 1500 individuals sampled) and 39.5% for wave 2 (575 of 1456 individuals sampled). Respondents were more likely than nonrespondents to be White, non-Hispanic, and vaccinated per EHR. Overall, 76.8% (95% CI, 71.5%-82.2%) reported 1 or more COVID-19 vaccinations; Spanish-speaking Hispanic respondents had the highest weighted proportion of respondents with 1 or more vaccination. Weighted estimates of somewhat or strongly agreeing that COVID-19 vaccines are safe decreased from wave 1 to 2 for respondents who reported 1 or more vaccinations (76% vs 50%;  $\chi^2_1 = 7.8$ ;  $P < .001$ ), non-Hispanic White respondents (72% vs 43%;  $\chi^2_1 = 5.4$ ;  $P = .02$ ), and Spanish-speaking Hispanic respondents (76% vs 53%;  $\chi^2_1 = 22.8$ ;  $P = .002$ ).

**Conclusions and Relevance** Decreasing confidence in COVID-19 vaccine safety in a large, diverse pregnant and recently pregnant insured population is a public health concern. (Author)

Full URL: <https://doi.org/10.1001/jamanetworkopen.2024.5479>

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## 2024-05682

**Exploring Barriers and Facilitators to COVID-19 Vaccination in People Planning Pregnancy, Trying to Conceive, Pregnant and Post-Partum: A Mixed Methods Study.** Guarna G, Bauer-Maison N, Malik M, et al (2024), JOGC [Journal of Obstetrics and Gynaecology Canada] vol 46, no 7, July 2024, 102548

Pregnant people are at higher risk of morbidity from COVID-19 infection, yet vaccine hesitancy remains prevalent. Our mixed-methods study utilized surveys and interviews to understand decision making regarding COVID-19 vaccination surrounding pregnancy. The most trusted source of information was health care providers. Five themes relating to vaccination barriers and facilitators were identified: 1) COVID-19 vaccine-related policies; 2) pregnancy specific

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considerations; 3) barriers, facilitators, and influencers to vaccination; 4) vaccination decision based on personal health considerations; 5) attitudes towards COVID-19 and other vaccines. Our study underscores the importance of receiving high-quality information from a trusted source to increase vaccination. (Author)

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## 2024-05420

### **Influence of nutritional supplements on antibody levels in pregnant women vaccinated with inactivated SARS-CoV-2 vaccines.** Zhang X, Han X, Chen B, et al (2024), PLoS ONE vol 19, no 3, March 2024, e0289255

**Background:** Because of the significantly higher demand for nutrients during pregnancy, pregnant women are more likely to have nutrient deficiencies, which may adversely affect maternal and fetal health. The influence of nutritional supplements on the immune effects of inactivated SARS-CoV-2 vaccines during pregnancy is not clear.

**Methods:** In a multicenter cross-sectional study, we enrolled 873 pregnant women aged 18-45 y in Guangdong, China. The general demographic characteristics of pregnant women and their use of nutritional supplements were investigated, and the serum antibody levels induced by inactivated SARS-CoV-2 vaccines were measured. A logistic regression model was used to analyze the association between nutritional supplements and SARS-CoV-2 antibody levels.

**Results:** Of the 873 pregnant women enrolled, 825 (94.5%) took folic acid during pregnancy, 165 (18.9%) took iron supplements, and 197 (22.6%) took DHA. All pregnant women received at least one dose of inactivated SARS-CoV-2 vaccine, and the positive rates of serum SARS-CoV-2 neutralizing antibodies (NAbs) and immunoglobulin G (IgG) antibodies were 44.7% and 46.4%, respectively. After adjustment for confounding factors, whether pregnant women took folic acid, iron supplements, or DHA did not influence NAb positivity or IgG positivity ( $P > 0.05$ ). Compared with pregnant women who did not take folic acid, the odds ratios (ORs) for the presence of SARS-CoV-2 NAb and IgG antibody in pregnant women who took folic acid were 0.67 ( $P = 0.255$ ; 95% CI, 0.34-1.32) and 1.24 ( $P = 0.547$ ; 95% CI, 0.60-2.55), respectively. Compared with pregnant women who did not take iron supplements, the ORs for the presence of NAb and IgG antibody in pregnant women who took iron supplements were 1.16 ( $P = 0.465$ ; 95% CI, 0.77-1.76) and 0.98 ( $P = 0.931$ ; 95% CI, 0.64-1.49), respectively. Similarly, the ORs for NAb and IgG antibody were 0.71 ( $P = 0.085$ ; 95% CI, 0.49-1.04) and 0.95 ( $P = 0.801$ ; 95% CI, 0.65-1.38) in pregnant women who took DHA compared with those who did not.

**Conclusions:** Nutritional supplementation with folic acid, iron, or DHA during pregnancy was not associated with antibody levels in pregnant women who received inactivated SARS-CoV-2 vaccines.

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**Full URL:** <https://doi.org/10.1371/journal.pone.0289255>

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## 2024-04854

### **Is it safe and effective to administer COVID-19 vaccines during pregnancy? A systematic review and meta-analysis.**

Hameed I, Khan MO, Nusrat K, et al (2023), American Journal of Infection Control vol 51, no 5, May 2023, pp 582-593

#### **Objective**

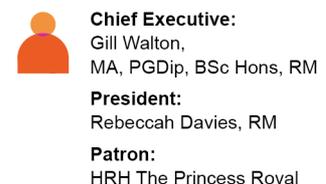
To evaluate the safety and efficacy of COVID-19 vaccines in pregnant women performing an updated meta-analysis.

#### **Methods**

We searched PubMed, Cochrane Central, and SCOPUS from inception to March 2022. Outcomes of interest were incidence of adverse maternal, fetal and neonatal consequences pertaining to safety of the vaccines. Secondly, we analyzed the number of SARS-CoV-2 infections, hospitalization for COVID-19, and admission to the I.C.U. for COVID-19 assessing the effectiveness of vaccines. Results were pooled using a random effects model.

#### **Results**

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Ten observational studies (n=326,499) analyzing pregnant women were included. Our results suggest that COVID-19 vaccination prevents infection (OR: 0.56, 95% CI: 0.47, 0.67; P = <0.00001) and related hospitalizations (OR: 0.50, 95% CI: 0.31, 0.82; P = 0.006) effectively. It was also observed that vaccination does not change adverse outcomes in pregnancy, namely preeclampsia or eclampsia, stroke (four weeks of delivery), meconium-stained amniotic fluid, spontaneous vaginal delivery, operative vaginal delivery, cesarean delivery, postpartum hemorrhage, and blood transfusions. Furthermore, the vaccine was observed to be protective against neonatal COVID-19 I.C.U. admissions (OR: 0.85; 95% CI: 0.81, 0.90; P = <0.00001).

#### Conclusion

Our pooled analysis suggests that the COVID-19 vaccination in pregnant women prevents infection effectively and has no adverse outcomes. Future large-scale trials in a randomized fashion are needed to confirm our results. (Author)

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## 2024-04670

**Maternal vaccination against COVID-19 and neonatal outcomes during Omicron: INTERCOVID-2022 study.** Barros FC, Gunier RB, Rego A, et al (2024), American Journal of Obstetrics & Gynecology (AJOG) vol 231, no 4, October 2024, pp 460.e1-460.e17

#### Background

In early 2023, when Omicron was the variant of concern, we showed that vaccinating pregnant women decreased the risk for severe COVID-19-related complications and maternal morbidity and mortality.

#### Objective

This study aimed to analyze the impact of COVID-19 during pregnancy on newborns and the effects of maternal COVID-19 vaccination on neonatal outcomes when Omicron was the variant of concern.

#### Study Design

INTERCOVID-2022 was a large, prospective, observational study, conducted in 40 hospitals across 18 countries, from November 27, 2021 (the day after the World Health Organization declared Omicron the variant of concern) to June 30, 2022, to assess the effect of COVID-19 in pregnancy on maternal and neonatal outcomes and to assess vaccine effectiveness. Women diagnosed with laboratory-confirmed COVID-19 during pregnancy were compared with 2 nondiagnosed, unmatched women recruited concomitantly and consecutively during pregnancy or at delivery. Mother-newborn dyads were followed until hospital discharge. The primary outcomes were a neonatal positive test for COVID-19, severe neonatal morbidity index, severe perinatal morbidity and mortality index, preterm birth, neonatal death, referral to neonatal intensive care unit, and diseases during the neonatal period. Vaccine effectiveness was estimated with adjustment for maternal risk profile.

#### Results

We enrolled 4707 neonates born to 1577 (33.5%) mothers diagnosed with COVID-19 and 3130 (66.5%) nondiagnosed mothers. Among the diagnosed mothers, 642 (40.7%) were not vaccinated, 147 (9.3%) were partially vaccinated, 551 (34.9%) were completely vaccinated, and 237 (15.0%) also had a booster vaccine. Neonates of booster-vaccinated mothers had less than half (relative risk, 0.46; 95% confidence interval, 0.23–0.91) the risk of being diagnosed with COVID-19 when compared with those of unvaccinated mothers; they also had the lowest rates of preterm birth, medically indicated preterm birth, respiratory distress syndrome, and number of days in the neonatal intensive care unit. Newborns of unvaccinated mothers had double the risk for neonatal death (relative risk, 2.06; 95% confidence interval, 1.06–4.00) when compared with those of nondiagnosed mothers. Vaccination was not associated with any congenital malformations. Although all vaccines provided protection against neonatal test positivity, newborns of booster-vaccinated mothers had the highest vaccine effectiveness (64%; 95% confidence interval, 10%–86%). Vaccine effectiveness was not as high for messenger RNA vaccines only. Vaccine effectiveness against moderate or severe neonatal outcomes was much lower, namely 13% in the booster-vaccinated group (all vaccines) and 25% and 28% in the completely and booster-vaccinated groups, respectively (messenger RNA vaccines only). Vaccines were fairly effective in protecting neonates when given to pregnant women  $\leq 100$  days (14 weeks) before birth; thereafter, the risk increased and was much higher after 200 days (29 weeks). Finally, none of the neonatal practices studied, including skin-to-skin contact and direct breastfeeding, increased the risk for infecting newborns.

#### Conclusion

When Omicron was the variant of concern, newborns of unvaccinated mothers had an increased risk for neonatal death. Neonates of vaccinated mothers had a decreased risk for preterm birth and adverse neonatal outcomes.

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Because the protective effect of COVID-19 vaccination decreases with time, to ensure that newborns are maximally protected against COVID-19, mothers should receive a vaccine or booster dose no more than 14 weeks before the expected date of delivery. (Author)

Full URL: <https://doi.org/10.1016/j.ajog.2024.02.008>

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## 2024-04443

**Lessons learned from COVID-19 vaccine acceptance among pregnant and lactating women from two districts in Kenya to inform demand generation efforts for future maternal RSV vaccines.** Limaye RJ, Singh P, Fesshaye B, et al (2024), BMC

Pregnancy and Childbirth vol 24, no 221, March 2024

### Background

Respiratory syncytial virus (RSV) is a leading cause of acute lower respiratory infections globally, with most RSV-related deaths occurring in infants < 6 months of age. The highest burden of RSV is in low-and-middle income countries, and in sub-Saharan Africa, RSV may be responsible for almost half of all hospital admissions with severe or very severe pneumonia among infants under 1 year. There is a maternal RSV vaccine on the horizon. Our study objective was to better understand how lessons learned from the COVID-19 vaccine experience rollout among pregnant and lactating people in Kenya could inform future maternal RSV vaccine rollout.

### Methods

This qualitative study interviewed 16 healthcare providers including doctors, nurses, midwives, community health workers, and vaccinators. Participants were recruited from two counties in Kenya and included healthcare providers that served diverse communities. A grounded theory approach was used to analyze the data.

### Results

As healthcare providers interviewed were instrumental in COVID-19 vaccine rollout among pregnant women in Kenya, they provided lessons learned from the COVID-19 vaccine experience to inform future maternal RSV vaccine rollout. Community sensitization emerged as the most critical lesson learned, including communication, mobilization, and education. Using communication to ensure community awareness of RSV, community awareness of RSV harms and benefits of RSV maternal vaccines, and providing up-to-date, clear information about maternal RSV vaccines emerged as lessons. Related to mobilization, participants identified the need for healthcare providers and community leaders to gain the trust of communities, and the importance of routinizing the vaccine. Finally, for education, participants outlined critical questions patients would have about a maternal RSV vaccine, including those related to vaccine safety concerns, duration of protection, and vaccine dosing.

### Conclusions

This is one of the first studies that has examined how lessons learned from the COVID-19 vaccine rollout for pregnant and lactating women can inform the rollout of future maternal vaccines, including an RSV maternal vaccine. As healthcare providers are directly involved in vaccine rollout, their perspectives are crucial for successful vaccine acceptance. (Author)

Full URL: <https://doi.org/10.1186/s12884-024-06425-y>

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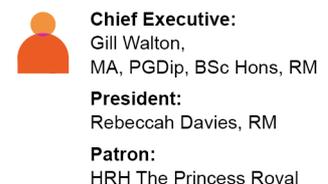
## 2024-04350

**Perinatal outcomes and sinopharm BBIBP-CorV vaccination during pregnancy.** Hatami D, Habibelahi A, Changizi N, et al (2024), BMC Pregnancy and Childbirth vol 24, no 190, March 2024

### Background

After the outbreak of COVID-19, a huge part of the health care services was dedicated to preventing and treating this disease. In case of COVID-19 infection, severe COVID-19 is reported more in pregnant individuals. Afterward, Vaccination against SARS-CoV-2 became a hot topic due to known effects in preventing severe COVID-19 during pregnancy.

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Vaccination of pregnant individuals started in August 2021 with the Sinopharm vaccine in Iran. The aim of current study was to determine the incidence of perinatal outcomes in women who were vaccinated during pregnancy.

#### Method

This retrospective cohort study included 129,488 singleton births from March 21, 2021, until March 21, 2022, in Tehran, Iran.

The data was obtained from the Iranian Maternal and Neonatal (IMaN) Network and the Maternal Vaccination Registry.

Adverse perinatal outcomes investigated in this study include preterm birth, extremely preterm birth, low birth weight, very low birth weight, intrauterine growth restriction, stillbirth, neonatal intensive care unit admission, congenital anomaly, neonatal death and low 5-minute Apgar score. The risk of all perinatal outcomes was evaluated using multiple logistic regression. The analysis was done using STATA version 14.

#### Results

Of all 129,488 singleton births included in this study, 17,485 (13.5%) were vaccinated against SARS-CoV-2 (all with Sinopharm (BBIBP-CorV)). The exposure to the Sinopharm vaccine during pregnancy caused a significant decrease in the incidence of preterm birth ( $P = 0.006$ ,  $OR = 0.91$  [95% CI, 0.85 to 0.97]), extremely preterm birth ( $P = < 0.001$ ,  $OR = 0.55$  [95% CI, 0.45 to 0.66]), and stillbirth ( $P = < 0.001$ ,  $OR = 0.60$  [95% CI, 0.47 to 0.76]). Exposure to vaccination during the first trimester was associated with an increased risk of preterm birth ( $P = 0.01$ ,  $OR = 1.27$  [95% CI, 1.04 to 1.55])

Maternal vaccination during pregnancy was not associated with an increased risk of other adverse perinatal outcomes included in this study.

#### Conclusion

The finding of this population-based study indicated no adverse pregnancy outcome due to vaccination with the Sinopharm vaccine during the second and third trimesters of pregnancy. Overall risk of adverse pregnancy outcomes were lower in the vaccinated individuals compared to the unvaccinated group. Also, vaccination during the first trimester was associated with an increased risk of preterm birth. (Author)

Full URL: <https://doi.org/10.1186/s12884-024-06389-z>

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#### 2024-04323

**Attitudes toward COVID-19 vaccines during pregnancy and breastfeeding.** Simsekoglu N, Akyuz E, Guven R, et al (2024), *Frontiers in Public Health* 1 March 2024, online

Background: Although vaccination is one of the most effective means of controlling the spread of COVID-19, public concerns and indecision about vaccination still continue. Because pregnant and breastfeeding individuals are at high risk for severe outcomes in case of infections, determining their level of hesitation and attitude toward COVID-19 vaccines will guide the management of the disease. This study aimed to determine pregnant and breastfeeding women's levels of hesitation and attitude toward COVID-19 vaccines as well as their related factors.

Methods: The sample of this descriptive research consisted of 103 pregnant or breastfeeding individuals who were seen at the obstetrics and gynecology outpatients clinic of a state hospital in Istanbul, Turkey. The data were collected using a 'demographic data form', the 'Vaccine Hesitancy Scale in Pandemic', and the 'Attitudes toward COVID-19 Vaccine Scale'. The research data were analyzed with appropriate statistical methods.

Results: The mean age of the participants was  $29.71 \pm 4.75$ , 51% were pregnant, and 74.8% had received the COVID-19 vaccine. The mean score of the 'Vaccination Hesitancy Scale in Pandemic' was  $30.83 \pm 6.91$ , and the mean score for the 'Attitude Scale toward the COVID-19 Vaccine' was  $25.50 \pm 5.20$ . A significant difference was found between the total score of the 'Vaccine Hesitancy Scale in the Pandemic' and the mean score of the 'Lack of Confidence' sub-dimension

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between the 'working status' and the 'influenza vaccination' status. In terms of the mean score of the 'Risk' sub-dimension, a significant difference was found between the 'period of vaccination' ( $p < 0.05$ ). According to the mean total score of the 'Attitude Towards COVID-19 Vaccine Scale', there was a significant difference between the 'smoking' status. There was a significant difference in the 'Positive Attitude' sub-dimension in terms of the 'flu vaccination' status. There was a significant difference in the 'Negative Attitude' sub-dimension in terms of the 'chronic disease' status. A positive correlation was found between the total scores of the scales.

**Conclusion:** It was concluded that although the participants had a high level of hesitation toward the COVID-19 vaccine, they had a positive attitude. The results obtained will be guided in determining the strategies to be developed for these specific groups in future pandemics. (Author)

**Full URL:** <https://doi.org/10.3389/fpubh.2024.1286891>

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## 2024-02532

**Transplacental transmission of the COVID-19 vaccine messenger RNA: evidence from placental, maternal, and cord blood analyses postvaccination.** Lin X, Botros B, Hanna M, et al (2024), American Journal of Obstetrics & Gynecology (AJOG) vol 230, no 6, June 2024, pp e113-e116

This report presents two cases of pregnant individuals vaccinated shortly before delivery. The aim of the study was to investigate the presence of COVID-19 vaccine mRNA in placenta and cord blood. (AS)

**Full URL:** <https://doi.org/10.1016/j.ajog.2024.01.022>

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## 2024-02525

**Investigation of Anti-SARS-CoV-2-specific IgG Levels in Breast Milk after Vaccination or COVID-19 Infection.** Temocin F, Çaycı YT, Seren C, et al (2023), American Journal of Perinatology 14 November 2023, online

**Objective** Newborns are vulnerable to all types of infections due to their developing immune system. To compensate for their immune immaturity, newborns rely on the passive transfer of antibodies through the placenta and own mother's breast milk (BM). In the present study, we investigated whether vaccination against SARS-CoV-2 leads to the presence of antibodies in BM. Furthermore, we compared the levels of SARS-CoV-2-specific anti-spike (anti-S) IgG antibodies in the BM of mothers who were vaccinated against Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or had coronavirus disease 2019 (COVID-19) infection naturally or were vaccinated after natural infection.

**Study Design** This was a prospective cohort study conducted in the Ondokuz Mayıs University Faculty of Medicine. Forty-six mothers who had at least two doses of the BNT162b2 messenger RNA-based vaccine and/or had a history of symptomatic COVID-19 infection were included in the study. BM samples were analyzed by the Abbott Architect SARS-CoV-2 IgG II Quant kit following the manufacturer's instructions.

**Results** Forty-six mothers with an average age of  $29.7 \pm 5.7$  years participated the study: 18 (39.1%) had COVID-19 infection + BNT162b2 vaccine, 17 (37.0%) had BNT162b2 vaccine, and 11 (23.9%) had natural infection. The highest SARS-CoV-2-specific anti-S IgG antibody titers in BM were found in mothers who were vaccinated following the infection (anti-SARS-CoV-2 IgG:  $32.48 \pm 57.1$  arbitrary units AU/mL). However, no significant difference in anti-SARS-CoV-2 antibody levels was observed between the three groups ( $p = 0.641$ ). No antibody was detected in 15.2% of BM samples.

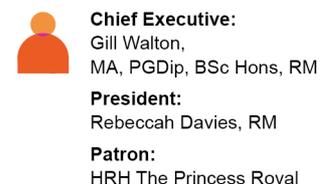
**Conclusion** Both vaccination and natural COVID-19 infection during pregnancy leads to the passive transfer of specific anti-SARS-CoV-2 IgG antibodies to BM. These results are important to overcome vaccine hesitancy and increase vaccination levels in expectant mothers. (Author)

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## 2024-02291

**COVID-19 Vaccine Acceptance in Pregnant Women in the United States: A Systematic Review and Meta-Analysis.** Patel

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**Purpose:** Pregnant women are vulnerable to Coronavirus Disease 2019 (COVID-19) complications, yet may hesitate to get vaccinated. It is important to identify racial/ethnic and other individual characteristics associated with COVID-19 vaccine acceptance in the United States during pregnancy.

**Methods:** We searched PubMed, Embase, and Web of Science for articles published through January 2023 for keywords/terms related to immunization, COVID-19, and pregnancy, and performed a systematic review and meta-analysis to examine characteristics associated with vaccine acceptance.

**Results:** Of 1,592 articles, 23 met inclusion criteria (focused on pregnant women in the United States, and their willingness or hesitation to vaccinate). Twenty-two of the studies examined receipt of  $\geq 1$  COVID-19 vaccine dose and/or intention to vaccinate, while one examined vaccine hesitancy. Vaccine acceptance rates ranged from 7% to 78.3%. Meta-analyses demonstrated that compared with Whites, Hispanics (odds ratios [OR] 0.72; 95% confidence interval [CI] 0.58–0.91) and Blacks (OR 0.44; 95% CI 0.30–0.63) had less COVID-19 vaccine acceptance, while Asians (OR 1.78; 95% CI 1.10–2.88) had greater vaccine acceptance. College graduation or more (OR 3.25; 95% CI 2.53–4.17), receipt or intention to receive the influenza vaccine (OR 3.46; 95% CI 2.22–5.41), and at least part-time employment (OR 2.12; 95% CI 1.66–2.72) were significantly associated with vaccine acceptance.

**Conclusions:** COVID-19 vaccine nonacceptance in pregnant women is associated with Hispanic ethnicity and Black race, while acceptance is associated with Asian race, college education or more, at least part-time employment, and acceptance of the influenza vaccine. Future COVID-19 vaccination campaigns can target identified subgroups of pregnant women who are less likely to accept vaccination. (Author)

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## 2024-02186

### **Association between social media use for medical information during pregnancy and likelihood of vaccination against COVID-19.** Jaswa EG, Lindquist KJ, Hariton E, et al (2023), AJOG Global Reports vol 3, no 4, November 2023, 100262

**OBJECTIVE:** Pregnant individuals are a high-risk group for COVID-19 because of an increased risk for adverse outcomes.<sup>1</sup> Vaccines are effective at preventing severe disease.<sup>2</sup> However, obstacles to universal vaccine uptake remain.<sup>3</sup>

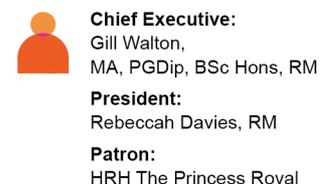
There are several factors that could impact vaccine acceptance during pregnancy, including the source of medical information upon which individuals rely. It is unknown whether the use of social media for medical information during pregnancy influences COVID-19 vaccination uptake.

We examined the Assessing the Safety of Pregnancy in the Coronavirus Pandemic (ASPIRE) cohort<sup>4</sup> to test the hypothesis that the use of social media for medical information during pregnancy would be associated with a reduced likelihood of COVID-19 vaccination.

**STUDY DESIGN:** Between April 2020 and December 2021, 7880 pregnant individuals aged  $\geq 18$  years at  $< 10$  weeks' gestation consented to an institutional review board–approved prospective cohort study of pregnancy and infant outcomes in relation to pandemic factors, including COVID-19 infection and vaccination (ASPIRE).<sup>4</sup> A total of 3018 participants from all 50 US states completed online questionnaires. The research team was based in San Francisco, California. At the end of the third trimester, participants were asked about the sources of medical information used during pregnancy, categorized as healthcare provider, friends and family, social media, and other pregnancy websites. Individuals were asked to indicate all sources and their primary resource.

To evaluate associations between the baseline characteristics and social media use as a source of medical information, bootstrapped (1000 reps) linear regression models and multinomial logistic regression models were used. A logistic regression was used to test for the association between social media use and vaccination with adjustment for other sources of medical information and covariates selected a priori, including age, race, ethnicity, education, household

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income, recruitment cohort, and healthcare worker status. Statistical analyses were performed in STATA v17.0 (StataCorp, College Station, TX).

**RESULTS:** The most common sources of medical information were healthcare provider (86%) and pregnancy websites (85%). A total of 52% of participants used social media and 54% reported friends or family as sources. Most participants reported multiple information sources. Of the 3018 participants, 2664 (88%) received COVID-19 vaccines (2121 during pregnancy).

Social media use was more common among Hispanic individuals, individuals who were employed full time, and who did not work in a healthcare field. (Author)

**Full URL:** <https://doi.org/10.1016/i.xagr.2023.100262>

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## 2024-02173

**Effectiveness of COVID-19 vaccination during pregnancy by circulating viral variant.** Zerbo O, Ray GT, Fireman B, et al (2023), *AJOG Global Reports* vol 3, no 4, November 2023, 100264

### BACKGROUND

SARS-CoV-2 infection in pregnancy can result in a spectrum of asymptomatic to critical COVID-19 outcomes, including hospitalization, admission to the intensive care unit, or death.

### OBJECTIVE

This study aimed to investigate the effectiveness of messenger RNA COVID-19 vaccination during pregnancy against both hospitalization and infection, stratified by different variant circulations and by time since the last vaccine dose.

### STUDY DESIGN

This was a retrospective cohort study among pregnant persons who were members of Kaiser Permanente Northern California and delivered between December 15, 2020, and September 30, 2022. Pregnant persons who received any vaccine dose before the pregnancy onset date were excluded. The primary outcome was hospitalization for COVID-19, and the secondary outcome was polymerase chain reaction–confirmed SARS-CoV-2 infection. Exposure was receipt of a messenger RNA vaccine during pregnancy. Poisson regression was used to estimate the risk ratio of hospitalization by comparing vaccinated pregnant persons with unvaccinated pregnant persons adjusted for sociodemographic factors and calendar time. Cox regression was used to estimate the hazard ratio of infection by comparing vaccinated pregnant persons with unvaccinated pregnant persons. Vaccine effectiveness was estimated as 1 minus the rate ratio or the hazard ratio multiplied by 100. Vaccine effectiveness was estimated overall and by variant periods (before Delta, Delta, Omicron, and subvariants).

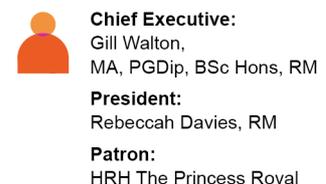
### RESULTS

Of 57,688 pregnant persons, 16,153 (28%) received at least 1 dose of a messenger RNA COVID-19 vaccine during pregnancy; moreover, 4404 pregnant persons tested positive for SARS-CoV-2 infection, and 108 pregnant persons were hospitalized during pregnancy. Overall, 2-dose vaccine effectiveness against hospitalization was 91% within <150 days of vaccination and 48% >150 days after vaccination. The 2-dose vaccine effectiveness within <150 days after vaccination was 100% during the original virus strain and Delta variant periods of the virus; vaccine effectiveness was 51% during the Omicron period. Of the hospitalization cases, 97% of pregnant persons were unvaccinated. During hospitalization, none of the vaccinated pregnant persons required ventilation or were admitted to the intensive care unit. Moreover, 2-dose vaccine effectiveness against infection was 54% within <150 days after vaccination and 26% ≥150 days after vaccination.

### CONCLUSION

Messenger RNA COVID-19 vaccination during pregnancy was effective against hospitalization for COVID-19 and SARS-CoV-2 infection. COVID-19 was mild among pregnant persons who were vaccinated compared with those who were unvaccinated. Thus, all pregnant persons should be strongly encouraged to receive messenger RNA COVID-19

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vaccines to prevent severe disease. (Author)

Full URL: <https://doi.org/10.1016/j.xagr.2023.100264>

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## 2024-02030

**Safety and efficacy of COVID-19 vaccine immunization during pregnancy in 1024 pregnant women infected with the SARS-CoV-2 Omicron virus in Shanghai, China.** Deng H, Jin Y, Sheng M, et al (2024), *Frontiers in Immunology* 16 January 2024, online

Background: Large sample of pregnant women vaccinated with COVID-19 vaccine has not been carried out in China. The objective of this study was to evaluate the safety and effectiveness of COVID-19 inactivated vaccine in pregnant women infected with the SARS-CoV-2 Omicron variant.

Methods: A total of 1,024 pregnant women and 120 newborns were enrolled in this study. 707 pregnant women received one to three doses of the inactivated COVID-19 vaccine, and 317 unvaccinated patients served as the control group. A comparison was made between their clinical and laboratory data at different stages of pregnancy.

Results: The incidence rate of patients infected with Omicron variant in the first, the second, and the third trimesters of pregnancy was 27.5%, 27.0%, and 45.5% in patients during, respectively. The corresponding length of hospital stay was  $8.7 \pm 3.3$  days,  $9.5 \pm 3.3$  days, and  $11 \pm 4.3$  days, respectively. The hospitalization time of pregnant women who received 3 doses of vaccine was ( $8.8 \pm 3.3$ ) days, which was significantly shorter than that of non-vaccinated women ( $11.0 \pm 3.9$ ) days. ( $P < 0.0001$ ). The positive rate of SARS-CoV-2 IgG in patients in the early stage of pregnancy was 28.8%, while that in patients in the late stage of pregnancy was 10.3%. However, three-doses of vaccination significantly increased the SARS-CoV-2 IgG positive rate to 49.5%. The hospitalization time of SARS-CoV-2 IgG-positive patients was shorter than that of negative patients ( $9.9 \pm 3.5$  days), which was  $7.4 \pm 2.0$  days. 12.2% of vaccinated women experienced mild adverse reactions, manifested as fatigue (10.6%) and loss of appetite (1.6%). The vaccination of mother did not affect her choice of future delivery mode and the Apgar score of their newborn. All newborns tested negative for SARS-CoV-2 nucleic acid, as well as for IgG and IgM antibodies.

Conclusions: Women in the third trimester of pregnancy are highly susceptible to infection with the Omicron strain. The vaccination of pregnant women with COVID-19 vaccine can accelerate the process of eliminating SARS-CoV-2 virus, and is considered safe for newborns. The recommended vaccination includes three doses. (Author)

Full URL: <https://doi.org/10.3389/fimmu.2023.1303058>

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## 2024-01962

**SARS-CoV-2 neutralizing antibody titers in maternal blood, umbilical cord blood, and breast milk.** Khalifeh M, Rubin LG, Dayya D, et al (2024), *Journal of Perinatology* vol 44, no 1, January 2024, pp 28–34

### Objective

We quantified neutralizing SARS-CoV-2 antibody against spike protein (nAb) levels after vaccination and SARS-CoV-2 infection in maternal serum, cord blood, and breast milk and determined whether they correlate with levels of spike protein binding antibody.

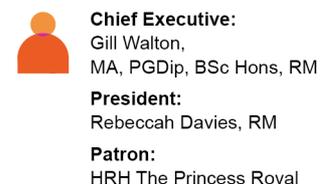
### Study design

Women ( $n = 100$ ) were enrolled on admission for delivery. Previous SARS-CoV-2 infection was defined by anti-nucleocapsid antibodies. Levels of nAb and binding antibodies against spike receptor binding domain were measured in maternal blood, cord blood, and milk.

### Results

Maternal nAb levels were higher after vaccine and infection than vaccine alone but waned rapidly. Levels of nAb in cord blood and milk correlated with maternal levels and were higher in cord blood than maternal. Spike protein binding antibody levels correlated with nAb.

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## Conclusion

SARS-CoV-2 vaccination near delivery may boost antibody-mediated immunity in the peripartum period. Neutralizing antibodies are passed transplacentally and into milk. Spike protein binding antibody may be a feasible proxy for nAb.

(Author)

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## 2024-01794

**Timing of Maternal COVID-19 Vaccine and Antibody Concentrations in Infants Born Preterm.** Kachikis A, Pike M, Eckert LO, et al (2024), JAMA Network Open vol 7, no 1, January 2024, e2352387

**Importance** COVID-19 vaccine-derived antibodies in pregnant people may protect infants from severe infection in the first 6 months of life via transplacental antibody transfer. Few data exist on maternally derived SARS-CoV-2 antibodies in preterm compared with full-term infants in association with vaccination timing.

**Objective** To compare SARS-CoV-2 anti-Spike (anti-S) antibody levels in preterm and full-term infants in the context of vaccine dose timing before delivery.

**Design, Setting, and Participants** This prospective cohort study enrolled pregnant individuals and collected paired maternal and cord blood samples at delivery at the University of Washington between February 1, 2021, and January 31, 2023. Participants who had received at least 2 doses of a messenger RNA COVID-19 vaccine before delivery and did not have a history of prior COVID-19 infection or detectable anti-SARS-CoV-2 nucleocapsid antibodies were included.

**Exposures** Timing of the last vaccine dose and preterm or full-term gestational age at delivery.

**Main Outcomes and Measures** Paired maternal and cord samples were tested for anti-S antibody, and linear regression was used to evaluate associations between preterm delivery and anti-S antibody levels. Covariates included timing of last dose, number of doses, insurance status, and immunosuppressing medications.

**Results** A total of 220 participants (median [IQR] age, 34 [32-37] years; 212 [96.4%] female) with 36 preterm and 184 full-term deliveries were studied. Before delivery, 121 persons received 2 vaccine doses and 99 persons received 3 or more vaccine doses. The geometric mean concentration of maternal anti-S antibodies was 674 (95% CI, 577-787) after 2 doses and 8159 (95% CI, 6636-10 032) after 3 or more doses ( $P < .001$ ). The cord anti-S antibody geometric mean concentration was 1000 (95% CI, 874-1144) after 2 doses and 9992 (95% CI, 8381-11 914) after 3 or more doses ( $P < .001$ ). After adjustment for vaccine timing and number of doses before delivery, no association was found between preterm delivery and cord anti-S antibody levels ( $\beta = 0.44$ ; 95% CI, -0.06 to 0.94).

**Conclusions and Relevance** In this prospective cohort study of pregnant individuals with preterm and full-term deliveries, receipt of 3 or more compared with 2 doses of COVID-19 vaccine before delivery resulted in 10-fold higher cord anti-S antibody levels. Maternal antibody concentration appeared more important than delivery gestational age in determining cord anti-S antibody levels. The number of doses and timing considerations for COVID-19 vaccine in pregnancy should include individuals at risk for preterm delivery. (Author)

**Full URL:** <https://doi.org/10.1001/jamanetworkopen.2023.52387>

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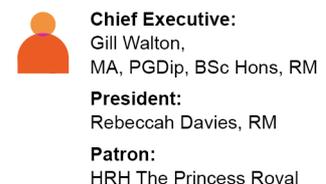
## 2024-01310

### **The Persistence of Specific Immunoglobulin A Against SARS-CoV-2 in Human Milk After Maternal COVID-19**

**Vaccination.** Suteerajtrakool O, Mekangkul E, Ananta P, et al (2023), Breastfeeding Medicine vol 18, no 12, December 2023, pp 943-950

**Objectives:** To investigate SARS-CoV-2 specific immunoglobulin A (IgA) in breast milk of Thai mothers post COVID-19 vaccination and/or SARS-CoV-2 infection, and to compare the IgA among lactating mothers with varying COVID-19 vaccination regimes.

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**Materials and Methods:** A longitudinal study was conducted in lactating mothers receiving  $\geq 2$  doses of COVID-19 vaccine or confirming SARS-CoV-2–positive test as a part of an infant feeding survey. Vaccination and infection details were collected through questionnaires and interviews. Self-collected breast milk samples (15 mL) at 1, 3, and 6 months postvaccination or infection were analyzed for sIgA through enzyme-linked immunosorbent assay (ELISA).

**Results:** Eighty-eight lactating mothers (152 milk samples), average age of  $30.7 \pm 6.2$  years, were recruited. Fifty-five percent of milk samples were from lactating mothers with both SARS-CoV-2 infection and vaccination (hybrid immunity); 40% were from those with vaccination alone (COVID naïve). Sixty percent of lactating mothers received mixed types of vaccines. Median sIgA ratio in breast milk was 2.67 (0.82–7.85). Breast milk sIgA at 1, 3, and 6 months were higher in mothers with hybrid immunity than in COVID naïve (geometric mean [95% confidence interval]: 3.30 [2.06–5.29] versus 1.04 [0.52–2.04], 3.39 [2.24–5.13] versus 1.26 [0.77–2.06], 4.29 [3.04–6.06] versus 1.33 [0.74–2.42], respectively). No significant differences were observed among various vaccination regimes.

**Conclusion:** sIgA against SARS-CoV-2 was detected in breast milk for up to 6 months after immunization together with infection at a greater level than after immunization or infection alone. This immunity could be transferred and protective against SARS-CoV-2 infection. Discontinuation of breastfeeding among mothers who received COVID vaccination or experienced infection should be discouraged. Clinical Trial Registration number: TCTR20220215012.

(Author) [Erratum: Breastfeeding Medicine, vol 19, no 1, January 2024, p 69.

<https://doi.org/10.1089/bfm.2023.0210.correx>

## 2024-00745

**Miscarriage after SARS-CoV-2 vaccination: A population-based cohort study.** Velez MP, Fell DB, Shellenberger JP, et al (2024), BJOG: An International Journal of Obstetrics and Gynaecology vol 131, no 4, March 2024, pp 415-422

### Objective

To evaluate the risk of miscarriage following SARS-CoV-2 vaccination, while accounting for the competing risk of induced abortion.

### Design

Population-based cohort study.

### Setting

Ontario, Canada.

### Participants

Women aged 15–50 years with a confirmed pregnancy at  $\leq 19$  completed weeks' gestation.

### Methods

Exposure to first SARS-CoV-2 vaccination, handled in a time-varying manner, was defined as (i) unvaccinated, (ii) remotely vaccinated  $> 28$  days before the estimated conception date or (iii) recently vaccinated  $\leq 28$  days before conception and up to 120 days after conception.

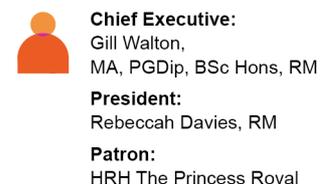
### Main outcome measures

The outcome was miscarriage, occurring between the estimated date of conception and up to 19 completed weeks of pregnancy. Fine-Grey hazard models, accounting for the competing risk of induced abortion, generated hazard ratios (aHR), adjusted for socio-demographic factors, comorbidities, and biweekly periods.

### Results

Included were 246 259 pregnant women, of whom 34% received a first SARS-CoV-2 vaccination. Miscarriage occurred at a rate of 3.6 per 10 000 person-days among remotely vaccinated women and 3.2 per 10 000 person-days among those

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recently vaccinated, in contrast to a rate of 1.9 per 10 000 person-days among unvaccinated women, with corresponding aHR of 0.98 (95% confidence interval [CI] 0.91–1.07) and 1.00 (95% CI 0.93–1.08).

#### Conclusions

SARS-CoV-2 vaccination was not associated with miscarriage while accounting for the competing risk of induced abortion. This study reiterates the importance of including pregnant women in new vaccine clinical trials and registries, and the rapid dissemination of vaccine safety data. (Author)

Full URL: <https://doi.org/10.1111/1471-0528.17721>

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#### 2024-00410

**Human Milk SARS-CoV-2 Antibodies up to 6 Months After Vaccination.** Perez SE, Centeno LDL, Cheng WA, et al (2022), *Pediatrics* vol 149, no 2, February 2022, e2021054260

#### BACKGROUND

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)-specific antibodies have been detected in human milk up to 6 weeks post-coronavirus disease 2019 (COVID-19) vaccination. We evaluated SARS-CoV-2-specific antibodies, neutralization activity, effect of pasteurization, and persistence through 6 months after vaccination.

#### METHODS

This prospective longitudinal study enrolled 30 pregnant or lactating women. SARS-CoV-2 antibodies and neutralization capacity were analyzed using an enzyme-linked immunosorbent assay compared at prevaccination and 1, 3, and 6 months postvaccination, and through Holder pasteurization.

#### RESULTS

Human milk SARS-CoV-2-specific IgG levels peaked at 1 month postvaccination and persisted above prevaccination levels for at least 6 months ( $P = .005$ ). SARS-CoV-2-specific IgA was detected at 1 and 3 months (both  $P < .001$ ) but waned by 6 months compared with baseline ( $P = .07$ ). Milk SARS-CoV-2-specific IgG and IgA correlated with serum IgG at the same time point ( $R_2 = 0.37$ ,  $P < .001$  and  $R_2 = 0.19$ ,  $P < .001$ ). Neutralization activity was seen in 83.3%, 70.4%, and 25.0% of milk samples at 1, 3, and 6 months postvaccination. Neutralization most strongly correlated with SARS-CoV-2-specific IgG ( $R_2 = 0.57$ ,  $P < .001$ ). Pre- and postpasteurization samples showed similar IgG (0.84 vs 1.07,  $P = .36$ ) and neutralizing activity (57.7% vs 58.7% inhibition,  $P = .27$ ), but lower IgM and IgA levels postpasteurization (0.09 vs 0.06,  $P = .004$  and 0.21 vs 0.18,  $P = .043$ ).

#### CONCLUSIONS

The data suggest that human milk SARS-CoV-2-specific antibodies may be available to milk-fed infants for up to 6 months. In addition, donor milk from vaccinated mothers retain IgG and neutralizing activity. (Author)

Full URL: <https://doi.org/10.1542/peds.2021-054260>

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#### 2024-00014

**A Population-Based Test-Negative Matched Case-Control Analysis of SARS-CoV-2 Vaccine Effectiveness Among Pregnant People in Ontario, Canada.** Lapinsky SC, Baxter NN, Sutradhar R, et al (2024), *JOGC [Journal of Obstetrics and Gynaecology Canada]* vol 46, no 2, February 2024, 102239

#### Objective

Pregnancy is a risk factor for severe SARS-CoV-2 infection, which can result in adverse pregnancy outcomes, thus making understanding vaccine effectiveness (VE) in this population important. This study aimed to assess the VE of mRNA COVID-19 vaccines against symptomatic SARS-CoV-2 infection and COVID-19-related hospitalization in pregnant people.

#### Methods

Population-based matched test-negative case-control study of pregnant people aged 18–49 years, of 12 or more weeks gestation in Ontario, Canada, symptomatic with possible SARS-CoV-2 infection, and having at least 1 positive ( $n = 1842$ )

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or negative (n = 8524) real-time polymerase chain reaction (RT-PCR) SARS-CoV-2 test between December 14, 2020, and December 31, 2021. The exposure was receipt of  $\geq 1$  dose of mRNA COVID-19 vaccine versus no vaccination. Exposure was further stratified by number and recency of doses. The primary outcome was a positive SARS-CoV-2 RT-PCR test. As a secondary outcome, VE for COVID-19-related hospitalization was assessed.

#### Results

In the primary outcome analysis, there were 1821 positive cases, matched to 1821 negative controls. The mean (SD) maternal age was 31 (5) years. When compared to those unvaccinated, receipt of  $\geq 1$  dose was associated with an estimated VE of 39% (95% CI 29%–48%) for symptomatic infection, and 85% (95% CI 72%–92%) for COVID-19 hospitalization. VE estimates demonstrated waning with increased time since last vaccination.

#### Conclusions

mRNA COVID-19 vaccines provide protection against symptomatic COVID-19 illness and are highly effective at preventing severe illness in pregnant people. The observed effect of vaccine waning highlights the importance of booster doses to provide optimal protection for pregnant people. (Author)

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### 2024-00003

#### Impact of COVID-19 and Vaccination During Pregnancy on Placenta-Mediated Complications (COVIGRO Study).

Ghesquiere L, Boivin G, Demuth B, et al (2024), JOGC [Journal of Obstetrics and Gynaecology Canada] vol 46, no 4, April 2024, 102291

#### Objectives

COVID-19 has been associated with preterm birth (PTB) and placental-mediated complications, including fetal growth restriction and preeclampsia (PE). This study aimed to estimate the impact of COVID-19 and vaccination on adverse pregnancy outcomes and markers of placental function.

#### Methods

We performed a study on a prospective cohort of women recruited in the first trimester of pregnancy during the early COVID-19 pandemic period (December 2020 to December 2021). At each trimester of pregnancy, the assessment included a questionnaire on COVID-19 and vaccination status; serological tests for COVID-19 (for asymptomatic infection); measurement of placental growth factor (PlGF) and soluble fms-like tyrosine kinase 1 (sFlt-1) in maternal blood; measurement of mean uterine artery pulsatility index (UtA-PI); and pregnancy outcomes (PTB, PE, birth weight below the fifth and the tenth percentile).

#### Results

Among 788 patients with complete data, we observed 101 (13%) cases of symptomatic infection and 74 (9%) cases of asymptomatic infection with SARS-CoV-2. Most cases (73%) of infection were among women with previous vaccination or COVID-19 infection before pregnancy. COVID-19 infection was not associated with adverse pregnancy outcomes, abnormal fetal growth, sFlt-1/PlGF ratio, or mean UtA-PI. Vaccination during pregnancy did not influence these outcomes either. We observed no case of severe COVID-19 infection requiring respiratory support.

#### Conclusion

Mild symptomatic or asymptomatic COVID-19 during pregnancy did not influence the risk of adverse pregnancy outcomes and the markers of placental function in predominantly vaccinated women. Fetal growth monitoring is unlikely to be mandatory in women with mild symptoms of COVID-19. (Author)

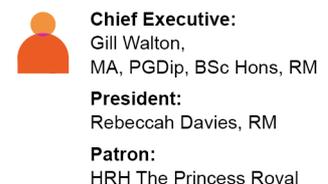
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### 2023-13233

**Doubts about the COVID-19 vaccine against pregnancy: public trust and government issues in Indonesia.** Saputra R, Lidyawati Y, Suhardita K, et al (2023), Journal of Public Health vol 45, no 4, December 2023, pp e832–e833

In response to an article on the topic of administering vaccines to children in the Philippines. The topic of this vaccine has also been discussed in Indonesia, but now we will discuss it related to pregnancy. The controversy surrounding the coronavirus disease 2019 (COVID-19) vaccine is whether to believe in it or be forced by the government to take it. Some people are hesitant to take vaccines, as shown by a survey conducted by Populi Center in December 2020, which found that 40% of Indonesians do not want to receive vaccines from the government. However, Amnesty International Indonesia researcher, Ari Pramuditya stated that everyone has the right to give consent without coercion in the

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vaccination program, and the government must strive for a voluntary vaccination process. This effort is very interesting because it talks about a person's psychology. In this case, the psychological factor is closely related to the health of pregnant women. The COVID-19 pandemic continues to affect the worldwide community, and efforts in vaccination are very important in curbing its spread. However, still, there are several doubts about vaccines among pregnant people, because of worries about potency effects and bad results in pregnancy and the development of the fetus. To overcome the problem, it is important to note that the American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine recommend that individuals pregnant and breastfeeding offer COVID-19 vaccination. (Author)

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## 2023-13135

**mRNA SARS-CoV-2 Vaccination Before vs During Pregnancy and Omicron Infection Among Infants.** Goh O, Pang D, Tan J, et al (2023), JAMA Network Open vol 6, no 11, November 2023, e2342475

**Importance** Infants younger than 6 months are at risk of severe SARS-CoV-2 infection. Data are lacking on the optimum timing for maternal vaccination and estimated effectiveness against Omicron variants, including XBB, for infants.

**Objective** To investigate maternal vaccination against Omicron variants, including XBB, and the association of vaccination timing during pregnancy vs prior to pregnancy and risks of SARS-CoV-2 infection among infants aged 6 months or younger.

**Design, Setting, and Participants** This population-based cohort study was conducted between January 1, 2022, and March 31, 2023. Singapore's national dataset was used to study infants born at greater than 32 weeks' gestation between January 1, 2022, and September 30, 2022. The study included infants whose parents had a confirmed SARS-CoV-2 infection from the date of birth up to 6 months of age. Of 21 609 infants born during this period, 7292 (33.7%) had at least 1 parent infected with SARS-CoV-2 before the age of 7 months. Statistical analysis was performed from April to July 2023.

**Exposure** Infants' mothers were unvaccinated, vaccinated prior to pregnancy, or vaccinated with a messenger RNA (mRNA) SARS-CoV-2 vaccine during pregnancy.

**Main Outcome and Measure** Infants were considered infected if they had a positive polymerase chain reaction test.

**Results** Among 7292 infants included in this study, 4522 (62.0%) had mothers who were Chinese, 527 (7.2%) had mothers who were Indian, 2007 (27.5%) had mothers who were Malay, and 236 (3.2%) had mothers who were other ethnicity; 6809 infants (93.4%) were born at full term, and 1272 infants (17.4%) were infected during the study period. There were 7120 infants (97.6%) born to mothers who had been fully vaccinated or boosted as of 14 days prior to delivery. The crude incidence rate was 174.3 per 100 000 person-days among infants born to mothers who were unvaccinated, 122.2 per 100 000 person-days among infants born to mothers who were vaccinated before pregnancy, and 128.5 per 100 000 person-days among infants born to mothers who were vaccinated during pregnancy. The estimated vaccine effectiveness (VE) was 41.5% (95% CI, 22.8% to 55.7%) among infants born to mothers vaccinated during pregnancy. Infants of mothers who received vaccination prior to pregnancy did not have a lower risk for infection (estimated VE, 15.4% [95% CI, -17.6% to 39.1%]). A lower risk for Omicron XBB infection was only observed among mothers vaccinated with the third (booster) dose antenatally (estimated VE, 76.7% [95% CI, 12.8% to 93.8%]).

**Conclusions and Relevance** In this population-based cohort study, maternal mRNA vaccination was associated with a lower risk of Omicron SARS-CoV-2 infection among infants up to 6 months of age only if the vaccine was given during the antenatal period. These findings suggest that mRNA vaccination during pregnancy may be needed for lower risk of SARS-CoV-2 infection among newborns. (Author)

**Full URL:** <https://doi.org/10.1001/jamanetworkopen.2023.42475>

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2023-13067

**Comparison of Anti-SARS-CoV-2-Specific Antibody Signatures in Maternal and Infant Blood after COVID-19 Infection versus COVID-19 Vaccination during Pregnancy.** Sabharwal V, Taglauer E, Demos R, et al (2023), American Journal of

Perinatology 31 October 2023, online

**Objective** The Advisory Committee on Immunization Practices and The American College of Obstetricians and Gynecologists recommend coronavirus disease 2019 (COVID-19) vaccine for pregnant persons to prevent severe illness and death. The objective was to examine levels of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) IgG, IgM, and IgA against spike protein receptor binding domain (RBD) and nucleocapsid protein (NCP) in maternal and infant/cord blood at delivery after COVID 19 vaccination compared with SARS-CoV-2 infection at in mother–infant dyads at specified time points.

**Study Design** Mothers with SARS-CoV-2 infection (n = 31) or COVID-19 vaccination (n = 25) during pregnancy were enrolled between July 2020 and November 2021. Samples were collected at delivery and IgG, IgM, and IgA to RBD of spike and NCPs compared in the infected and vaccinated groups. Timing of infection/vaccination prior to delivery and correlation with antibody levels was performed.

**Results** The majority of participants received vaccination within 90 days of delivery and over half received the Pfizer BioNTech vaccine. There were no significant correlations between antibody levels and timing of infection or vaccination. Infant IgG levels to the RBD domain of spike protein were higher in the vaccinated group (n = 25) as compared with the infants born to mothers with infection (n = 31). Vaccination against COVID-19 during pregnancy was associated with detectable maternal and infant anti-RBD IgG levels at delivery irrespective of the timing of vaccination.

**Conclusion** Timing of vaccination had no correlation to the antibody levels suggesting that the timing of maternal vaccination in the cohort did not matter. There was no IgM detected in infants from vaccinated mothers. Infants from vaccinated mothers had robust IgG titers to RBD, which have a lasting protective effect in infants. (Author)

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2023-11769

**"Trauma, abandonment and isolation": experiences of pregnancy and maternity services in Scotland during COVID-19.** Engender, Health and Social Care Alliance Scotland (2023), September 2023

The report, "Trauma, abandonment and isolation": Experiences of pregnancy and maternity services in Scotland during Covid-19, draws on survey responses from over 200 women across Scotland. It documents the profound and negative impact that public health restrictions had on access to vital healthcare across all aspects of these services from antenatal care, fertility treatment, to miscarriage and baby loss, birth and the postnatal period. (Author)

**Full URL:** <https://www.engender.org.uk/content/publications/MATFinalNEW.pdf>

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2023-11738

**Pregnancy outcomes following natural conception and assisted reproduction treatment in women who received COVID-19 vaccination prior to conception: a population-based cohort study in China.** Yang Y, Dong Y, Li G, et al (2023),

Frontiers in Medicine 11 October 2023, online

**Introduction:** The coronavirus disease-2019 (COVID-19) pandemic has swept across the world and continues to exert serious adverse effects on vulnerable populations, including pregnant women and neonates. The vaccines available at present were designed to prevent infection from COVID-19 strains and control viral spread. Although the incidence of pregnancy cycle outcomes are not likely to increase patients vaccinated prior to pregnancy compared with unvaccinated patients based on our knowledge of vaccination safety, there is no specific evidence to support this hypothesis. Therefore, the current study aimed to investigate the association between maternal vaccination prior to conception and pregnancy outcomes.

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**Methods:** We retrospectively analyzed 2,614 women who received prenatal care and delivered in the Obstetrical Department of The First Affiliated Hospital of Anhui Medical University between February 2022 and November 2022. Of the 1,380 eligible pregnant women, 899 women who had received preconception vaccination were assigned to a vaccine group and 481 women who were not vaccinated were control group. Of the enrolled patients, 291 women received fertility treatment (141 vaccinated women, 150 unvaccinated women). The primary outcomes were pregnancy complications (hypothyroidism, gestational diabetes mellitus, pregnancy-induced hypertension, polyhydramnios, oligohydramnios, premature rupture of membranes and postpartum hemorrhage), obstetric outcomes (preterm birth rate, cesarean section rate) and neonatal outcomes (birth-weight, body length, low-birth-weight rate, rate of congenital defects, neonatal mortality and admission to the neonatal intensive care unit).

**Results:** There was no significant difference in the incidence of complications during pregnancy and delivery when compared between the vaccine group and control group in either univariate- or multivariate-models. The type of vaccine was not associated with the odds of adverse pregnancy outcome. Among the women with infertility treatment, the vaccinated group and the unvaccinated group had similar pregnancy outcomes.

**Conclusion:** Women who received COVID-19 vaccination prior to conception had similar maternal and neonatal outcomes as women who were unvaccinated. Our findings indicate that COVID-19 vaccinations can be safely administered prior to pregnancy in women who are planning pregnancy or assisted reproductive treatment. During new waves of COVID-19 infection, women who are planning pregnancy should be vaccinated as soon as possible to avoid subsequent infections. (Author)

**Full URL:** <https://doi.org/10.3389/fmed.2023.1250165>

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#### 2023-11443

**Vaccination Hesitancy Increasing Among Pregnant Women.** Harris E (2023), JAMA (Journal of the American Medical Association) vol 330, no 17, November 2023, pp 1611-1612

More pregnant women in the US were hesitant to receive common vaccinations in 2022 to 2023 compared with 2021 to 2022, researchers reported in the Morbidity and Mortality Weekly Report. (Author, edited)

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#### 2023-11424

**Covid-19: Confusion around vaccination during pregnancy likely to have contributed to deaths of 27 women in the UK.**

Limb M (2023), British Medical Journal vol 383, no 8403, October 2023, p 2388

Pregnant women are being urged to get the covid vaccine after an expert group found that “confused messaging and vaccine hesitancy” may have contributed to the deaths of 27 women during the pandemic in the UK. (Author, edited)

**Full URL:** <https://doi.org/10.1136/bmj.p2388>

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#### 2023-11266

**COVID-19 Vaccine Safety Surveillance in Early Pregnancy in the United States: Design Factors Affecting the Association Between Vaccine and Spontaneous Abortion.** Vazquez-Benitez G, Haapala JL, Lipkind HS, et al (2023), American Journal of Epidemiology vol 192, no 8, August 2023, pp 1386-1395

In the Vaccine Safety Datalink (VSD), we previously reported no association between coronavirus disease 2019 (COVID-19) vaccination in early pregnancy and spontaneous abortion (SAB). The present study aims to understand how time since vaccine rollout or other methodological factors could affect results. Using a case-control design and generalized estimating equations, we estimated the odds ratios (ORs) of COVID-19 vaccination in the 28 days before a SAB or last date of the surveillance period (index date) in ongoing pregnancies and occurrence of SAB, across cumulative 4-week periods from December 2020 through June 2021. Using data from a single site, we evaluated alternative methodological approaches: increasing the exposure window to 42 days, modifying the index date from the last day to the midpoint of the surveillance period, and constructing a cohort design with a time-dependent exposure model. A protective effect (OR = 0.78, 95% confidence interval: 0.69, 0.89), observed with 3-cumulative

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periods ending March 8, 2021, was attenuated when surveillance extended to June 28, 2021 (OR = 1.02, 95% confidence interval: 0.96, 1.08). We observed a lower OR for a 42-day window compared with a 28-day window. The time-dependent model showed no association. Timing of the surveillance appears to be an important factor affecting the observed vaccine-SAB association. (Author)

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### 2023-10996

**JCVI statement on the COVID-19 vaccination programme for autumn 2023, 26 May 2023.** Department of Health and Social Care (2023), 5 October 2023

The Joint Committee on Vaccination and Immunisation (JCVI) met on 18 April 2023, 2 May 2023, and 9 May 2023 to develop advice for COVID-19 vaccination ahead of winter 2023 to 2024. This statement provides advice on the eligibility for COVID-19 vaccination in autumn 2023, including persons aged 6 months to 64 years in a clinical risk group, women in all stages of pregnancy, and frontline health and social care workers. Further advice on the choice of vaccine products for use in autumn 2023 will be provided in due course. (Author, edited)

**Full URL:** <https://www.gov.uk/government/publications/covid-19-autumn-2023-vaccination-programme-jcvi-advice-26-may-2023/jcvi-statement-on-the-covid-19-vaccination-programme-for-autumn-2023-26-may-2023>

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### 2023-10768

**Reduced maternal immunity and vertical transfer of immunity against SARS-CoV-2 variants of concern with COVID-19 exposure or initial vaccination in pregnancy.** Boelig RC, Chaudhury S, Gromowski GD, et al (2023), *Frontiers in Immunology* 11 September 2023, online

**Introduction:** As the SARS-CoV-2 pandemic continues to evolve, we face new variants of concern with a concurrent decline in vaccine booster uptake. We aimed to evaluate the difference in immunity gained from the original SARS-CoV-2 mRNA vaccine series in pregnancy versus SARS-CoV-2 exposure during pregnancy against recent variants of concern.

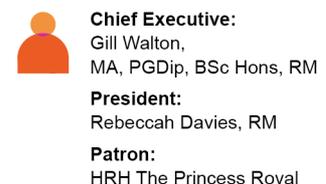
**Study Design:** This is a retrospective analysis of previously collected samples from 192 patients who delivered between February 2021 and August 2021. Participants were categorized as 1) COVID vaccine: mRNA vaccine in pregnancy, 2) COVID-exposed, and 3) controls. The primary outcome was neutralizing capacity against wild-type, Delta, and Omicron-B1 between cohorts. Secondary outcomes include a comparison of cord-blood ID50 as well as the efficiency of vertical transfer, measured by cord-blood:maternal blood ID50 for each variant.

**Results:** Pregnant women with COVID-19 vaccination had a greater spike in IgG titers compared to both those with COVID-19 disease exposure and controls. Both COVID exposure and vaccination resulted in immunity against Delta, but only COVID vaccination resulted in significantly greater Omicron ID-50 versus controls. The neutralizing capacity of serum from newborns was lower than that of their mothers, with COVID-vaccination demonstrating higher cord-blood ID50 vs wildtype and Delta variants compared to control or COVID-exposed, but neither COVID-exposure nor vaccination demonstrated significantly higher Omicron ID50 in cord-blood compared to controls. There was a 0.20 (0.07-0.33,  $p=0.004$ ) and 0.12 (0.0-0.24,  $p=0.05$ ) increase in cord-blood:maternal blood ID50 with COVID vaccination compared to COVID-19 exposure for wild-type and Delta respectively. In pair-wise comparison, vertical transfer of neutralization capacity (cord-blood:maternal blood ID50) was greatest for wild-type and progressively reduced for Delta and Omicron ID50.

**Conclusion:** Pregnant patients with either an initial mRNA vaccination series or COVID-exposure demonstrated reduced immunity against newer variants compared to wild-type as has been reported for non-pregnant individuals; however, the COVID-vaccination series afforded greater cross-variant immunity to pregnant women, specifically against Omicron, than COVID-disease. Vertical transfer of immunity is greater in those with COVID vaccination vs COVID disease exposure but is reduced with progressive variants. Our results reinforce the importance of bivalent booster vaccination in pregnancy for both maternal and infant protection and also provide a rationale for receiving updated vaccines as they become available. (Author)

**Full URL:** <https://doi.org/10.3389/fimmu.2023.1216410>

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## 2023-10545

**Vaccination effects on reducing COVID-19 complications in pregnancy: A large-scale report from Iran.** Changizi N, Eshtrati B, Salehi M, et al (2023), International Journal of Gynecology & Obstetrics vol 163, no 3, December 2023, pp 1012-1017

### Objective

The objective of this study was to evaluate the effects of maternal coronavirus disease 2019 (COVID-19) vaccination on preventing severe complications of COVID-19 in pregnant women.

### Methods

A retrospective study was conducted in pregnant women infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) during pregnancy and/or for up to 6 weeks postpartum between September 1, 2021, to January 30, 2022. The data was retrieved from a national database. The pregnant women were divided into two groups of vaccinated and unvaccinated. The proposed outcomes (the need for hospitalization, intensive care unit admission, and mechanical ventilation and products of conception complications) were compared between the two groups.

### Results

Approximately 90 000 pregnant women infected with COVID-19 were included in the study. The data of the vaccinated (19 922) and unvaccinated (70 147) groups were analyzed and compared. Pregnant patients in the vaccinated group had a significantly lower rate of hospitalization (21.2% vs 29.4%) (odds ratio [OR], 0.648 [95% confidence interval (CI), 0.625–0.673],  $P = 0.0001$ ) and intensive care unit admission (3.7% vs 7.8%) (OR, 0.453 [95% CI, 0.382–0.535],  $P = 0.0001$ ). The need for mechanical ventilation was also lower, although not statistically significant, in the vaccinated group than in the unvaccinated group (30 of 155 [19.4%] vs 418 of 1597 [26.2%]) (OR, 0.677 [95% CI, 0.448–1.024],  $P = 0.063$ ). Cesarean section (54.3% vs 58.1%) (OR, 0.856 [95% CI, 0.751–0.977],  $P = 0.021$ ) and stillbirth (0.4% vs 3.6%) (OR, 0.097 [95% CI, 0.026–0.252],  $P = 0.0001$ ) were also significantly lower in the vaccinated patients. Most pregnant women in the vaccinated group (18 484–96.14%) received Sinopharm BIBP COVID-19 inactivated vaccine. No significant differences were seen in the effect of different types of COVID-19 vaccines on reducing COVID-19 complications in infected pregnant patients.

### Conclusion

Maternal COVID-19 immunization is effective in reducing COVID-19 complications in infected pregnant women.

(Author)

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## 2023-10532

**Outcome findings of COVID-19 vaccine among 31 977 pregnant women in Indonesia.** Wiweco B, Januarto AK, Saleh N, et al (2023), International Journal of Gynecology & Obstetrics vol 163, no 3, December 2023, pp 1018-1023

### Objective

We provide an overview of the safety of messenger RNA and inactivated coronavirus disease 2019 (COVID-19) vaccine and monitoring of pregnant women after COVID-19 vaccination. The vaccine safety outcome profile is beneficial for further recommendations of COVID-19 vaccination in pregnancy.

### Methods

This research was conducted as descriptive research. Sampling was performed using an online questionnaire to be filled out voluntarily and distributed to all pregnant women in Indonesia who received the COVID-19 vaccination. Data collection was performed and descriptive statistics were obtained.

### Results

Among 31 977 pregnant women, 24 212 (75.7%) received the first dose, 7619 (23.8%) received the second dose, and 146 (4.5%) received the third dose of the COVID-19 vaccine. Sinovac vaccine is the most administered vaccine to pregnant women (27 122 [84%]). Most pregnant women (78.7%) who were vaccinated had no adverse effects after

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immunization, while the most reported adverse effects were mild symptoms.

#### Conclusion

The current study contributed evidence that COVID-19 vaccination during pregnancy has minimal adverse effects. These findings may help pregnant women and healthcare providers to make informed decisions regarding vaccination.

(Author)

Full URL: <https://doi.org/10.1002/ijgo.15073>

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#### 2023-10398

**Using the COM-B framework to elucidate facilitators and barriers to COVID-19 vaccine uptake in pregnant women: a qualitative study.** Patterson L, Berry E, Parsons C, et al (2023), BMC Pregnancy and Childbirth vol 23, no 640, September 2023

Since April 2021, COVID-19 vaccines have been recommended for pregnant women. Despite this, COVID-19 vaccine uptake in this group is low compared to the non-pregnant population of childbearing age. Our aim was to understand barriers and facilitators to COVID-19 vaccine uptake among pregnant women in Northern Ireland using the COM-B framework, and so to make recommendations for public health interventions. The COM-B proposes that human behaviour is influenced by the extent to which a person has the capability, opportunity, and motivation to enact that behaviour. Understanding the factors underpinning behaviour through this lens helps discern what needs to change to change behaviour, therefore supporting the development of targeted interventions.

This study consisted of eight semi-structured interviews with new/expectant mothers who did not receive a COVID-19 vaccine dose while pregnant since April 2021, and a focus group with five participants who received at least one COVID-19 vaccine dose while pregnant. Interview and focus group data were analysed using semi-deductive reflexive thematic analysis framed by a subtle realist approach. The COM-B was used to categorise codes and subthemes were developed within each COM-B construct.

Within Psychological Capability, subthemes captured the need for consistent and reliable COVID-19 vaccine information and access to balanced and jargon-free, risk–benefit information that is tailored to the pregnant individual. The behaviour/opinions of family, friends, and local healthcare providers had a powerful influence on COVID-19 vaccine decisions (Social Opportunity). Integrating the COVID-19 vaccine as part of routine antenatal pathways was believed to support access and sense of familiarity (Physical Opportunity). Participants valued health autonomy, however experienced internal conflict driven by concerns about long-term side effects for their baby (Reflective Motivation). Feelings of fear, lack of empathy from healthcare providers, and anticipated guilt commonly underpinned indecision as to whether to get the vaccine (Automatic Motivation).

Our study highlighted that the choice to accept a vaccine during pregnancy generates internal conflict and worry. Several participants cited their concern was primarily around the safety for their baby. Healthcare professionals (HCPs) play a significant part when it comes to decision making about COVID-19 vaccines among pregnant women. HCPs and pregnant women should be involved in the development of interventions to improve the delivery and communication of information. (Author)

Full URL: <https://doi.org/10.1186/s12884-023-05958-y>

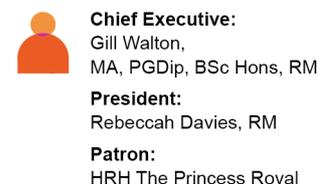
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#### 2023-09627

**Maternal and Cord Anti-SARS-CoV-2-Spike IgG following COVID-19 Vaccination versus Infection during Pregnancy: A Prospective Study, Israel October 2021–March 2022.** Abu Shqara R, Frank Wolf M, Mikhail Mustafa S, et al (2023), American Journal of Perinatology 19 June 2023, online

**Objective** Defining how pregnant women respond to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection and vaccination is critical to optimize vaccination strategies that protect mother and infant at the epidemic. This study aimed to compare anti-SARS-CoV-2-spike immunoglobulin G (IgG) of vaccinated versus infected women and to determine the optimal timing of maternal vaccination during pregnancy at the time of epidemic.

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**Study Design** We collected maternal/cord blood at delivery (October 2021–March 2022) and measured anti-SARS-CoV-2-spike IgG geometric mean concentrations (IgG-GMCs) using a quantitative immunoassay. We compared groups according to timing and number of doses and correlated maternal and fetal IgG levels. We described the proportion of women with IgG levels above the 150 AU/mL positivity threshold according to the timing of infection/vaccination and performed a subanalysis for maternal IgG-GMC levels pre- and during the Omicron wave.

**Results** We included 238 vaccinated women, 125 who received two doses and 113 three doses, and 48 unvaccinated infected women. All groups infected/vaccinated in the second or third trimester had an IgG-GMC above the positivity threshold. Third-trimester vaccination (second/third dose) resulted in higher maternal and cord-blood IgG-GMC compared to the second trimester (maternal-IgG: 102,32 vs. 4,325 AU/mL,  $p < 0.001$ ; cord-IgG: 12,113 vs. 8,112 AU/mL,  $p < 0.001$ ). Compared with infected-only women, a higher proportion of vaccinated women with  $\geq 2$  doses and their newborns had IgG levels above the positivity threshold at all time points. In vaccinated women, there were higher maternal IgG-GMC levels during the Omicron wave than pre-Omicron.

**Conclusion** At the time of epidemic, receiving an additional COVID-19 vaccine dose in the third trimester resulted in a higher IgG-GMC compared to the second trimester. Relatively higher levels of maternal and cord IgG-GMC were achieved following vaccination than infection. Women infected during or before the first trimester might benefit from an additional third-trimester dose to prevent peripartum infection and to passively immunize their newborn. The higher levels of maternal IgG-GMC in the Omicron period are suggestive of hybrid immunity. (Author)

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### 2023-09582

**Sustained and Boosted Antibody Responses in Breast Milk After Maternal SARS-CoV-2 Vaccination.** Ware J, McElhinney K, Latham T, et al (2023), Breastfeeding Medicine vol 18, no 8, August 2023

**Background:** Pregnant and lactating women were not included in the initial large vaccine clinical trials for SARS-CoV-2 (COVID) infection. Delineating the antibody titers in serum and breast milk of lactating women is important to determine the safety and benefits of vaccination in this special population.

**Objective:** To investigate COVID vaccinations in breastfeeding dyads and effects on lactation, the Antibody Detection of Vaccine-Induced Secretory Effects trial (ADVISE) prospectively evaluated anti-COVID antibodies in serum and breast milk after initial paired and booster vaccines.

**Methods:** This is a prospective longitudinal surveillance cohort study of lactating women. Eligibility criteria included  $\geq 18$  years of age, currently lactating, and at enrollment either received COVID vaccination within the past 60 days or planning vaccination within 60 days.

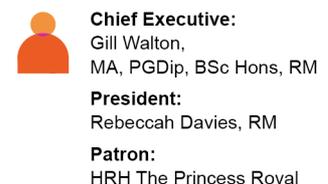
**Results:** Among 63 lactating mothers, COVID vaccination led to breast milk secretory IgA (sIgA) and IgG antibodies with consistent viral neutralizing activity. Milk sIgA titers increased further after second vaccination and were prolonged after a third booster dose, including women with extended breastfeeding beyond 12 months. Milk IgG antibody titers were higher and more sustained than sIgA. Antibody titers were not associated with individual dyad characteristics or vaccine manufacturer. Vaccine-induced antibodies from milk were not detected in infant circulation.

**Conclusions and Relevance:** Maternal COVID vaccination during lactation is well tolerated and generates sustained and boosted antibody responses in breast milk. COVID-specific sIgA and IgG antibodies with neutralizing activity are found in breast milk, including boosted mothers who continue breastfeeding beyond 12 months. These data support universal COVID vaccinations for all lactating mothers, including booster immunizations during extended breastfeeding (NCT04895475). (Author)

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### 2023-09350

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## Factors influencing uptake of the COVID-19 vaccination among pregnant women in Australia: A cross-sectional survey.

Javid N, Phipps H, Homer C, et al (2023), Birth vol 50, no 4, December 2023, pp 877-889

### Background

Mounting evidence shows the risk of COVID-19 on perinatal outcomes, as well as the safety and efficacy of vaccination during pregnancy. However, little is known about vaccine uptake among pregnant women in Australia, including women who are culturally and linguistically diverse (CALD), and about sources of information pregnant women use when making decisions about vaccines. We aimed to determine the proportion of pregnant women who had been vaccinated and to identify factors associated with vaccine uptake or decline during pregnancy.

### Method

A cross-sectional, anonymous, online survey was conducted from October 2021 to January 2022 in two metropolitan hospitals in New South Wales, Australia.

### Results

Of 914 pregnant women, 406 (44%) did not speak English at home. Overall, 101 (11%) received a vaccine pre-pregnancy and 699 (76%) during pregnancy. In the nonvaccinated cohort, 87 (76%) declined vaccination during pregnancy. The uptake was more than 87% among women during pregnancy who received information from government or health professional websites but 37% when received from personal blogs. The main reasons for vaccine uptake were (1) hearing that COVID-19 affects pregnant women, (2) being concerned about the COVID-19 outbreak, and (3) receiving vaccine recommendation from a general practitioner. In a multivariable logistic regression, three main factors associated with declining or feeling unsure about vaccination were (1) concerns about the safety of the COVID-19 vaccine, (2) lack of trust and being unsatisfied with the information received about COVID-19 vaccination during pregnancy, and (3) doubting the importance of COVID-19 vaccine.

### Conclusion

Clinicians play a critical role in counseling women to alleviate vaccine fear, support vaccine acceptance, and direct women to use reliable information sources, such as government and professional healthcare organizations, for information about vaccines. (Author)

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## 2023-09256

### Coronavirus Disease 2019 (COVID-19) Vaccination and Assisted Reproduction Outcomes: A Systematic Review and Meta-analysis.

Chamani IJ, Taylor LL, Dadoun SE, et al (2024), Obstetrics & Gynecology vol 143, no 2, February 2024, pp 210-218

#### OBJECTIVE:

To assess the association between coronavirus disease 2019 (COVID-19) vaccination and female assisted reproduction outcomes through a systematic review and meta-analysis.

#### DATA SOURCES:

We searched Medline (OVID), EMBASE, Web of Science, Cochrane Library, and ClinicalTrials.gov on January 11, 2023, for original articles on assisted reproduction outcomes after COVID-19 vaccination. The primary outcome was rates of clinical pregnancy; secondary outcomes included number of oocytes retrieved, number of mature oocytes retrieved, fertilization rate, implantation rate, ongoing pregnancy rate, and live-birth rate.

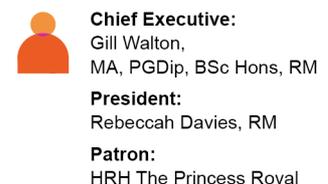
#### METHODS OF STUDY SELECTION:

Two reviewers independently screened citations for relevance, extracted pertinent data, and rated study quality. Only peer-reviewed published studies were included.

#### TABULATION, INTEGRATION, AND RESULTS:

Our query retrieved 216 citations, of which 25 were studies with original, relevant data. Nineteen studies reported embryo transfer outcomes, with a total of 4,899 vaccinated and 13,491 unvaccinated patients. Eighteen studies reported data on ovarian stimulation outcomes, with a total of 1,878 vaccinated and 3,174 unvaccinated patients. There

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were no statistically significant results among our pooled data for any of the primary or secondary outcomes: clinical pregnancy rate (odds ratio [OR] 0.94, 95% CI 0.88–1.01, P=.10), number of oocytes retrieved (mean difference –0.26, 95% CI –0.68 to 0.15, P=.21), number of mature oocytes retrieved (mean difference 0.31, 95% CI –0.14 to 0.75, P=.18), fertilization rate (OR 0.99, 95% CI 0.87–1.11, P=.83), implantation rate (OR 0.92, 95% CI 0.84–1.00, P=.06), ongoing pregnancy rate (OR 0.95, 95% CI 0.86–1.06, P=.40), or live-birth rate (OR 0.95, 95% CI 0.78–1.17, P=.63). A subanalysis based on country of origin and vaccine type was also performed for the primary and secondary outcomes and did not change the study results.

#### CONCLUSION:

Vaccination against COVID-19 is not associated with different fertility outcomes in patients undergoing assisted reproductive technologies. (Author)

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#### 2023-09029

**Impact of maternal SARS-CoV-2 booster vaccination on blood and breastmilk antibodies.** Rick AM, Lentscher A, Xu L, et al (2023), PLoS ONE vol 18, no 6, 13 June 2023, e0287103

Maternal COVID-19 vaccination could protect infants who are ineligible for vaccine through antibody transfer during pregnancy and lactation. We measured the quantity and durability of SARS-CoV-2 antibodies in human milk and infant blood before and after maternal booster vaccination. Prospective cohort of lactating women immunized with primary and booster COVID-19 vaccines during pregnancy or lactation and their infants. Milk and blood samples from October 2021 to April 2022 were included. Anti-nucleoprotein (NP) and anti-receptor binding domain (RBD) IgG and IgA in maternal milk and maternal and infant blood were measured and compared longitudinally after maternal booster vaccine. Forty-five lactating women and their infants provided samples. 58% of women were anti-NP negative and 42% were positive on their first blood sample prior to booster vaccine. Anti-RBD IgG and IgA in milk remained significantly increased through 120-170 days after booster vaccine and did not differ by maternal NP status. Anti-RBD IgG and IgA did not increase in infant blood after maternal booster. Of infants born to women vaccinated in pregnancy, 74% still had positive serum anti-RBD IgG measured on average 5 months after delivery. Infant to maternal IgG ratio was highest for infants exposed to maternal primary vaccine during the second trimester compared to third trimester (0.85 versus 0.29;  $p < 0.001$ ). Maternal COVID-19 primary and booster vaccine resulted in robust and long-lasting transplacental and milk antibodies. These antibodies may provide important protection against SARS-CoV-2 during the first six months of life.

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#### Conflict of interest statement

I have read the journal's policy and the authors of this manuscript have the following competing interests: JWV serves on the Scientific Advisory Board for Quidel and a Data Safety Monitoring Board for GlaxoSmithKline, neither related to the present work. This does not alter our adherence to PLOS ONE policies on sharing data and materials (Author)

Full URL: <https://doi.org/10.1371/journal.pone.0287103>

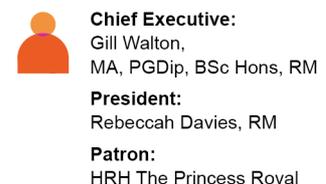
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#### 2023-08822

**A narrative review of COVID-19 vaccination in pregnancy and breastfeeding.** Devera JL, Gonzalez Y, Sabharwal V (2024), Journal of Perinatology vol 44, no 1, January 2024, pp 12–19

The Coronavirus pandemic has affected millions of people due to the spread of the Severe acute respiratory syndrome Coronavirus-2 (SARS-CoV-2) virus. Pregnant individuals and infants are most vulnerable given the increased risk of developing severe complications from SARS-CoV-2 infection. Recently, COVID-19 vaccination is recommended for pregnant women and infants starting at 6 months of age to prevent disease contraction and minimize disease severity. We conducted a review of the literature on COVID-19 vaccination to discuss vaccine safety and efficacy,

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immunity after maternal vaccination, transplacental transfer and persistence of antibodies, and public health implications. Current evidence supports the safety and efficacy of vaccination during pregnancy. Maternal vaccination provides greater antibody persistence in infants compared to immunity from natural infection. Furthermore, vaccination has demonstrated an increased rate of passive antibody transfer through the placenta and breast milk. Public health interventions are important in achieving herd immunity and ultimately ending the pandemic. (Author)

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#### 2023-08610

**Reduction in preterm birth among COVID-19 vaccinated pregnant individuals in the United States.** Darwin KC, Kohn JR, Shippey E, et al (2023), American Journal of Obstetrics & Gynecology MFM vol 5, no 10, October 2023, 101114

##### Background

Most studies investigating preterm birth and COVID-19 vaccination have suggested no difference in preterm birth rates between vaccinated and unvaccinated pregnant individuals, however one recent study suggested a protective effect of COVID-19 vaccination on preterm birth (PTB) rates in Australia.

##### Objective

We sought to determine whether a similar association and protective effect of COVID-19 vaccination on PTB would be found in our multi-state, U.S. cohort.

##### Study design

We performed a cohort study using the Vizient® clinical database, which included data from 192 hospitals in 38 states. We included pregnant individuals who delivered between January 2021-April 2022. Propensity score matching was used to match a 'treated' group of pregnant individuals with any COVID-19 vaccination (incomplete or complete vaccination) to a group that had not received any COVID-19 vaccination (the 'untreated' group). We considered a complete vaccination series > two doses of the Moderna or Pfizer vaccines or at least one dose of the Johnson & Johnson vaccine. An incomplete series was receipt of one dose of the Pfizer or Moderna vaccines. We examined the association between COVID-19 vaccination status and PTB at < 28, < 34, and < 37 weeks. Multivariable logistic regression models were used to adjust for potential confounders, with adjusted odds ratios (aOR) as the measure of treatment effect.

##### Results

Matching with replacement was conducted for 5,749 treated participants. After propensity score matching, there was no difference in maternal demographics of age, race, insurance status, parity, or comorbid conditions. Vaccinated individuals were 26% less likely to deliver at < 37 weeks (aOR 0.74, 95% CI 0.73-0.75,  $p < 0.001$ ), 37% less likely to deliver at < 34 weeks (aOR 0.63, 95% CI 0.61-0.64,  $p < 0.001$ ), and 43% less likely to deliver at < 28 weeks (aOR 0.57, 95% CI 0.55-0.60,  $p < 0.001$ ) compared to unvaccinated individuals.

##### Conclusion

Vaccination against COVID-19 may be protective against preterm birth. (Author)

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#### 2023-08481

**COVID-19 vaccine acceptance among pregnant women: a hospital-based cross-sectional study in Sudan.** Omar SM, Osman OS, Khalil R, et al (2023), Frontiers in Public Health 17 July 2023, online

**Introduction:** Pregnancy increases the risk of developing a severe illness due to COVID-19 infection. To the best of our knowledge, no previous study has been conducted on COVID-19 vaccine acceptance among pregnant women in Sudan. Hence, this study aimed to determine COVID-19 vaccination acceptance and its predictors among pregnant women.

**Methods:** A cross-sectional study was conducted among 623 pregnant women attending Gadarif maternity hospital in eastern Sudan through a structured questionnaire. Data were obtained on sociodemographic characteristics, obstetric and health-related characteristics, COVID-19 infection, and vaccination-related information, as well as beliefs about and acceptance of COVID-19 vaccination.

**Results:** COVID-19 vaccine acceptance among the pregnant women was 2.7%. The vaccine acceptance was higher if

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their husband's education was secondary school or higher [adjusted odds ratio [AOR] 4.30, 95% confidence interval (CI) 1.11–16.65,  $p = 0.035$ ] and discussion of COVID-19 vaccine with the pregnant women by a health care professional in the hospital (AOR 5.46, 95% CI 1.94–15.35,  $p < 0.001$ ). The most common reasons for resistance to the vaccine were concerns about the side effects of the vaccine for the mother and her baby.

Conclusion: Acceptance of the COVID-19 vaccination among the pregnant women was very low. Discussions with pregnant women and their husbands by health care professionals regarding the safety of COVID-19 vaccine for the mother and her baby are highly recommended. (Author)

Full URL: <https://doi.org/10.3389/fpubh.2023.1221788>

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## 2023-08445

### COVID-19 vaccine registry for pregnant women: policy to control complications of vaccination in pregnant women in

2021–2022. Asadi F, Shakiba R, Rabiei R, et al (2023), BMC Pregnancy and Childbirth vol 23, no 542, July 2023

#### Background

Data management related to COVID-19 vaccination in pregnant women is vital to improve the treatment process and to establish preventive programs. Implementing a registry to manage data is an essential part of this process. This study aims to design a national model of the COVID-19 vaccination registry for pregnant women in Iran.

#### Methods

The present study is an applied descriptive study conducted in 2021 and 2022 in two stages. In the first stage, the coordinates of the National Registry of COVID-19 vaccination of pregnant women from related references and articles, as well as the comparative study of the National Registry of COVID-19 vaccination of pregnant women in the United States, Canada, and the United Kingdom was done. In the second stage, the preliminary model was designed. The model was validated using the Delphi technique and questionnaire tools and analyzing the data.

#### Results

The presented national COVID-19 vaccination registry model of pregnant women's main components consist of objectives, data sources, structure, minimum data set, standards, and registry processes, all of which received 100% expert consensus.

#### Conclusion

The vaccination registry of pregnant women has a major role in managing COVID-19 vaccination data of pregnant women and can be one of the Ministry of Health and Medical Education priorities. (Author)

Full URL: <https://doi.org/10.1186/s12884-023-05856-3>

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## 2023-08364

**Strategies to Address COVID-19 Vaccine and Pregnancy Myths.** Berkowitz HE, Jacobson Vann JC (2023), MCN - American Journal of Maternal/Child Nursing vol 48, no 4, July/August 2023, pp 215-223

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) poses risks to pregnant women and their infants. The spread of misinformation about COVID-19 vaccination is a barrier to optimizing vaccination rates among women of childbearing age. We conducted an environmental scan to identify misinformation about COVID-19 vaccination, pregnancy, and fertility, and a review to identify evidence to refute misinformation and strategies to correct and prevent the spread of misinformation. Seven identified themes of misinformation are: the vaccine causes female infertility; can cause miscarriage; and can decrease male fertility; mRNA vaccines attack the placenta; pregnant and breastfeeding persons should not get the vaccine; the vaccine can change menstrual cycles; and vaccinated people can spread infertility symptoms to unvaccinated people. Strategies that can be implemented by social media platforms to help prevent misinformation spread and correct existing health misinformation include improving information regulation by modifying community standards, implementing surveillance algorithms, and applying warning labels to potentially misleading posts. Health services organizations and clinicians can implement health misinformation

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policies, directly recommend vaccinations, provide credible explanations and resources to debunk misinformation, educate patients and populations on spotting misinformation, and apply effective communication strategies. More research is needed to assess longer-term effects of vaccination among women of childbearing age to strengthen the defense against misinformation and to evaluate strategies that aim to prevent and correct misinformation spread about COVID-19 vaccinations. (Author)

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## 2023-08288

**Vaccination during pregnancy: A golden opportunity to embrace.** Amaral E, Money D, Jamieson D, et al (2023), International Journal of Gynecology & Obstetrics vol 163, no 2, November 2023, pp 476-483

Immunization strategies are part of routine pregnancy care to prevent infectious diseases in the mother, the fetus, and the newborn. Maternal immunization recommendations followed the recognition of the consequences of infectious diseases in pregnancy, including vertical transmission and perinatal consequences. The recent COVID-19 pandemic highlighted the issue of vaccination among pregnant individuals. Recommendations vary globally; however, Tdap, influenza, and, recently, COVID-19 vaccines are routinely recommended during pregnancy. There are several new maternal immunization products in the pipeline, including those directed against malaria, cytomegalovirus, Group B Streptococcus, herpes simplex virus, and respiratory syncytial virus. Important challenges must be addressed in all countries to guarantee that pregnant individuals and their babies receive the best care possible, including uptake of recommended immunizations by their entire target population groups. These challenges include disseminating appropriate data for vaccine recommendations and many others, such as ensuring stakeholder endorsement, achieving in-country distribution and administration, adequate vaccine supply, and a well-organized healthcare system, ideally offering the immunization free of charge. More recently, the hesitancy of pregnant women to receive immunizations highlights the relevance of cultural aspects and other contextual factors affecting vaccine uptake among pregnant individuals. (Author)

Full URL: <https://doi.org/10.1002/ijgo.14981>

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## 2023-07997

**COVID-19 vaccine induced poor neutralization titers for SARS-CoV-2 omicron variants in maternal and cord blood.**

Govindaraj S, Cheedarla N, Cheedarla S, et al (2023), Frontiers in Immunology 3 July 2023, online

Introduction: Maternally derived antibodies are crucial for neonatal immunity. Understanding the binding and cross-neutralization capacity of maternal and cord antibody responses to SARS-CoV-2 variants following COVID-19 vaccination in pregnancy can inform neonatal immunity.

Methods: Here we characterized the binding and neutralizing antibody profile at delivery in 24 pregnant individuals following two doses of Moderna mRNA-1273 or Pfizer BNT162b2 vaccination. We analyzed for SARS-CoV-2 multivalent cross-neutralizing antibody levels for wildtype Wuhan, Delta, Omicron BA1, BA2, and BA4/BA5 variants. In addition, we evaluated the transplacental antibody transfer by profiling maternal and umbilical cord blood.

Results: Our results reveal that the current COVID-19 vaccination induced significantly higher RBD-specific binding IgG titers in cord blood compared to maternal blood for both the Wuhan and Omicron BA1 strain. Interestingly, the binding IgG antibody levels for the Omicron BA1 strain were significantly lower when compared to the Wuhan strain in both maternal and cord blood. In contrast to the binding, the Omicron BA1, BA2, and BA4/5 specific neutralizing antibody levels were significantly lower compared to the Wuhan and Delta variants. It is interesting to note that the BA4/5 neutralizing capacity was not detected in either maternal or cord blood.

Discussion: Our data suggest that the initial series of COVID-19 mRNA vaccines were immunogenic in pregnant women, and vaccine-elicited binding antibodies were detectable in cord blood at significantly higher levels for the Wuhan and Delta variants but not for the Omicron variants. Interestingly, the vaccination did not induce neutralizing antibodies for Omicron variants. These results provide novel insight into the impact of vaccination on maternal humoral immune response and transplacental antibody transfer for SARS-CoV-2 variants and support the need for

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bivalent boosters as new variants emerge. (Author)

Full URL: <https://doi.org/10.3389/fimmu.2023.1211558>

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## 2023-07892

**Assessment of Adverse Reactions, Antibody Patterns, and 12-month Outcomes in the Mother-Infant Dyad After COVID-19 mRNA Vaccination in Pregnancy.** Cassidy AG, Li L, Golan Y (2023), JAMA Network Open vol 6, no 7, July 2023, e2323405

**Importance** Longitudinal data on COVID-19 messenger RNA (mRNA) vaccine reactogenicity and immunogenicity in pregnancy and for the mother-infant dyad are needed.

**Objective** To examine COVID-19 mRNA vaccine reactogenicity and immunogenicity in pregnancy and observe longitudinal maternal and infant outcomes.

**Design, Setting, and Participants** This prospective cohort study of pregnant individuals enrolled in the COVID-19 Vaccination in Pregnancy and Lactation study from December 1, 2020, through December 31, 2021, with follow-up through March 31, 2022, was conducted at a large academic medical center in an urban metropolitan area in California. Pregnant individuals receiving COVID-19 mRNA vaccines (mRNA-1273 [Moderna] and BNT162b2 [Pfizer-BioNTech]) were eligible. Of 81 participants enrolled, 5 were excluded after enrollment: 1 terminated pregnancy, 1 received the third vaccine dose prior to delivery, and 3 delivered prior to completing the initial vaccine series.

**Exposure** COVID-19 mRNA vaccination at any time during pregnancy.

**Main Outcomes and Measures** The primary outcomes were vaccine response as measured by blood Immunoglobulin G (IgG) titers after each vaccine dose and self-reported postvaccination symptoms. Patients' IgG titers were measured in cord blood and in infant blood at intervals up to 1 year of life; IgG and IgA titers were measured in maternal milk. Clinical outcomes were collected from medical records.

**Results** Of 76 pregnant individuals included in final analyses (median [IQR] maternal age, 35 [29-41] years; 51 [67.1%] White; 28 [36.8%] primigravid; 37 [48.7%] nulliparous), 42 (55.3%) received BNT162b2 and 34 (44.7%) received mRNA-1237. There were no significant differences in maternal characteristics between the 2 vaccine groups. Systemic symptoms were more common after receipt of the second vaccine dose than after the first dose (42 of 59 [71.2%] vs 26 of 59 [44.1%];  $P = .007$ ) and after mRNA-1237 than after BNT162b2 (25 of 27 [92.6%] vs 17 of 32 [53.1%];  $P = .001$ ). Systemic symptoms were associated with 65.6% higher median IgG titers than no symptoms after the second vaccine dose (median [IQR], 2596 [1840-4455] vs 1568 [1114-4518] RFU;  $P = .007$ ); mean cord titers in individuals with local or systemic symptoms were 6.3-fold higher than in individuals without symptoms. Vaccination in all trimesters elicited a robust maternal IgG response. The IgG transfer ratio was highest among individuals vaccinated in the second trimester. Anti-SARS-CoV-2 IgG was detectable in cord blood regardless of vaccination trimester. In milk, IgG and IgA titers remained above the positive cutoff for at least 5-6 months after birth, and infants of mothers vaccinated in the second and third trimesters had positive IgG titers for at least 5 to 6 months of life. There were no vaccine-attributable adverse perinatal outcomes.

**Conclusions and Relevance** The findings of this cohort study suggest that mRNA COVID-19 vaccination in pregnancy provokes a robust IgG response for the mother-infant dyad for approximately 6 months after birth. Postvaccination symptoms may indicate a more robust immune response, without adverse maternal, fetal, or neonatal outcomes.

(Author)

Full URL: <https://doi.org/10.1001/jamanetworkopen.2023.23405>

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## 2023-07683

**Comparatively low rates of COVID-19 in women admitted in labor and their newborns prior to routine vaccination of**

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**pregnant women: insights from Denmark.** Nielsen SY, Murra M, Pedersen LH, et al (2023), Journal of Maternal-Fetal and Neonatal Medicine vol 36, no 2, 2023, 2229933

**Background:** In a country with a high-test frequency, societal lockdown, and pregnancy leave granted from 28 gestational weeks, we investigated SARS-CoV-2 infection in women admitted in labor and their newborn in the pre-vaccine period.

**Material and methods:** A total of 1042 women admitted for delivery in two Danish hospitals agreed to a plasma sample and nasopharyngeal, vaginal, and rectal swabs and to sampling of umbilical cord blood and a nasopharyngeal swab from their newborn at delivery. Plasma samples from women were examined for SARS-CoV-2 antibodies. If antibodies were detected, or the woman had a positive nasopharyngeal swab upon admission or had a household contact with symptoms consistent with COVID-19, SARS-CoV-2 PCR was performed on plasma and swab samples from mother and child.

**Results:** Seventeen women (1.6%) were seropositive. Half the newborn (n = 9 (53%)) of seropositive mothers were also seropositive. None of the seropositive women or newborns had clinical signs of COVID-19 and all had SARS-CoV-2 PCR negative plasma and swab samples.

**Conclusion:** Adherence to specific national guidelines pertaining to testing, self-imposed isolation, and cautious behaviors among pregnant women likely contributed to the exceptionally low prevalence of both prior and current COVID-19 infections detected at the time of childbirth preceding the routine vaccination of pregnant women in Denmark. (Author)

**Full URL:** <https://doi.org/10.1080/14767058.2023.2229933>

## 2023-07546

**The relationship between COVID-19 vaccination status in pregnancy and birth weight.** Gaur P, Darwin KC, Kohn JR, et al (2023), American Journal of Obstetrics & Gynecology MFM vol 5, no 9, September 2023, 101057

### Background

Despite findings that maternal COVID-19 infection in pregnancy is associated with low birth weight (LBW; weight < 2,500 grams), previous studies demonstrate no difference in LBW risk between COVID-19 vaccinated and unvaccinated pregnant persons. Few studies, however, have examined the association of unvaccinated, incomplete, and complete vaccination on LBW, and they have been limited by small sample sizes and lack of adjustment for covariates.

### Objective

We sought to address key limitations of prior work and evaluate this association between unvaccinated, incomplete, and complete COVID-19 vaccination status in pregnancy and LBW. We predicted a protective association of vaccination on LBW that varies by number of doses received.

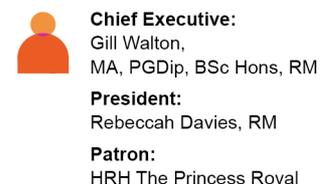
### Study design

We performed a population-based retrospective study using the Vizient® clinical database, which included data from 192 hospitals in the United States. Our sample included pregnant persons who delivered between January 2021 and April 2022 at hospitals that reported maternal vaccination data and birth weight at delivery. Pregnant persons were categorized into three groups: unvaccinated; incompletely vaccinated (one dose of Pfizer or Moderna); or completely vaccinated (one dose of Johnson & Johnson or ≥ two doses of Moderna or Pfizer). Demographics and outcomes were analyzed using standard statistical tests. We performed multivariable logistic regression to account for potential confounders between vaccination status and LBW in the original cohort. Propensity score matching was used to reduce bias related to likelihood of vaccination, and the multivariable logistic regression model was then applied to the propensity score matched cohort. Stratification analysis was performed for gestational age and race/ethnicity.

### Results

Of the 377,995 participants, 31,155 (8.2%) had LBW, and these participants were more likely to be unvaccinated than those without LBW (98.8% versus 98.5%,  $p < 0.001$ ). Incompletely vaccinated pregnant persons were 13% less likely to have LBW neonates compared to unvaccinated persons (odds ratio 0.87, 95% confidence interval 0.73-1.04), and completely vaccinated persons were 21% less likely to have LBW neonates (odds ratio 0.79, 95% confidence interval

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0.79-0.89). After controlling for maternal age, race/ethnicity, hypertension, diabetes, lupus, tobacco use, multifetal gestation, obesity, use of assisted reproductive technology, and maternal/neonatal COVID-19 infections in the original cohort, these associations remained significant for only complete vaccination (adjusted odds ratio 0.80, 95% confidence interval 0.70-0.91) and not incomplete vaccination (adjusted odds ratio 0.87, 95% confidence interval 0.71-1.04). In the propensity score matched cohort, pregnant persons who were completely vaccinated against COVID-19 were 22% less likely to have LBW neonates compared to unvaccinated and incompletely vaccinated individuals (aOR 0.78, 95% CI 0.76-0.79).

#### Conclusion

Pregnant persons who were completely vaccinated against COVID-19 were less likely to have LBW neonates compared to unvaccinated and incompletely vaccinated individuals. This novel association was observed among a large population after adjusting for confounders of LBW and factors influencing the likelihood of receiving the COVID-19 vaccine. (Author)

Full URL: <https://doi.org/10.1016/j.ajogmf.2023.101057>

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#### 2023-07050

**A critical review of COVID-19 course and vaccination in dermatology patients on immunomodulatory/biologic therapy: recommendations should not differ between non-pregnant and pregnant individuals.** Messas T, Lim RK, Burns L, et al (2023), *Frontiers in Medicine* 2 June 2023, online

COVID-19 can have detrimental effects on immunosuppressed patients. Here, we evaluate the evidence regarding continuing immunomodulatory/biologic (IMBI) therapy in pregnant dermatology patients during the COVID-19 pandemic. Also, we discuss the risks of COVID-19 vaccination in pregnant dermatology patients on IMBI therapy. As indicated in this review, regarding continuing IMBI therapy in pregnant dermatology patients during the pandemic, there is no compelling reason for treating them differently than non-pregnant. The body of evidence indicates that mRNA COVID-19 vaccines are safe during pregnancy. Studies on rheumatology patients, a group that overlaps significantly with the dermatology group, provided essential findings. IMBI in a non-pregnant rheumatology patient was not associated with COVID-19 mortality (except for rituximab), and vaccination of the rheumatology patient during pregnancy improved the obstetric outcomes compared to the unvaccinated patient. Based on this data, it can be stated that after weighing the benefit–risk profile of the available COVID-19 vaccines, the recommendation for the pregnant dermatology patient speaks in favor of the COVID-19 vaccination. COVID-19 vaccine recommendations in pregnant dermatology patients on IMBI should not differ from those for their non-pregnant counterparts. (Author)

Full URL: <https://doi.org/10.3389/fmed.2023.1121025>

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#### 2023-06508

**Impact of timing between tetanus, diphtheria, and pertussis and SARS-CoV-2 messenger RNA vaccinations during pregnancy on SARS-CoV-2 antibody levels at delivery.** Yang YJ, Prabhu M, Murphy EA, et al (2023), *American Journal of Obstetrics & Gynecology* MFM vol 5, no 6, June 2023, 100934

This is a research letter detailing original research. This research sought to study if the timing between both the tetanus, diphtheria, and acellular pertussis (Tdap) and the SARS-CoV-2 vaccines interferes with the maternal SARS-CoV-2 antibody response. (JM)

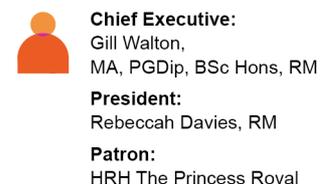
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#### 2023-06415

**Medically Attended Acute Adverse Events in Pregnant People After Coronavirus Disease 2019 (COVID-19) Booster Vaccination.** DeSilva MB, Haapala J, Vazquez-Benitez G, et al (2023), *Obstetrics & Gynecology* vol 142, no 1, July 2023, pp 125-129

In this multisite, observational, matched cohort study of more than 80,000 pregnant people, receipt of an mRNA monovalent coronavirus disease 2019 (COVID-19) booster vaccination in pregnancy was not associated with increased risk for thrombocytopenia, myocarditis, venous thromboembolism, ischemic stroke, or other serious adverse events within 21 or 42 days after booster vaccination. The mRNA monovalent COVID-19 booster in pregnancy was associated with an increased risk for medically attended malaise or fatigue within 7 days of vaccination (adjusted rate ratio [aRR] 3.64, 95% CI 2.42–5.48) and lymphadenopathy or lymphadenitis within 21 days (aRR 3.25, 95% CI 1.67–6.30) or 42 days

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(aRR 2.18, 95% CI 1.33–3.58) of vaccination. Our findings are consistent with prior evaluations of the primary COVID-19 vaccine series and are reassuring with respect to COVID-19 booster vaccination in pregnancy. (Author)

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### 2023-06407

**Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Antibody Titer Levels in Pregnant Individuals After Infection, Vaccination, or Both.** Marshall CL, Kaplowitz E, Ibroci E, et al (2023), *Obstetrics & Gynecology* vol 141, no 6, June 2023, pp. 1199-1202

We examined differences in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) antibody responses in pregnant individuals with natural, vaccine-induced, or combined immunity. Participants had live or nonlive births between 2020 and 2022, were seropositive (SARS-CoV-2 spike protein, anti-S), and had available mRNA vaccination and infection information (n=260). We compared titer levels among three immunity profiles: 1) natural immunity (n=191), 2) vaccine-induced immunity (n=37), and 3) combined immunity (ie, natural and vaccine-induced immunity; n=32). We applied linear regression to compare anti-S titers between the groups, controlling for age, race and ethnicity, and time between vaccination or infection (whichever came last) and sample collection. Anti-S titers were 57.3% and 94.4% lower among those with vaccine-induced and natural immunity, respectively, compared with those with combined immunity (P<.001, P=.005). (Author)

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### 2023-06179

**COVID-19 vaccine hesitancy among pregnant women attending tertiary care centre: A cross-sectional study.** Gupta N, Sharma S, Nigam A, et al (2023), *International Journal of Gynecology & Obstetrics* vol 162, no 1, July 2023, pp 70-77

#### Objective

To evaluate the knowledge and attitude towards coronavirus disease 2019 (COVID-19) vaccination during pregnancy and to discover factors that lead to non-acceptance of vaccine.

#### Methods

A cross-sectional study was performed in the Department of Obstetrics and Gynecology, Hamdard Institute of Medical Science & Research, New Delhi over a period of 3 months through a web-based questionnaire via Google form. The questionnaire was assessed using Cronbach  $\alpha$  for internal consistency, which was 0.795.

#### Results

News (74%) was the major source of knowledge among pregnant women. Around 60% women were not willing to receive the vaccine, mainly because of their fear of a harmful effect on pregnancy. The anticipated vaccine acceptance rate was 41% but actual vaccine acceptance rate in pregnancy was 7.3%.

#### Conclusion

Efforts should be made to reduce the gap of knowledge regarding vaccine among pregnant women. (Author)

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### 2023-06163

**Strategies to reduce COVID-19 vaccine hesitancy among pregnant individuals: Data from a prospective survey of unvaccinated pregnant women.** Binger K, Cui Y, Kelly JA, et al (2023), *International Journal of Gynecology & Obstetrics* vol 162, no 1, July 2023, pp 95-104

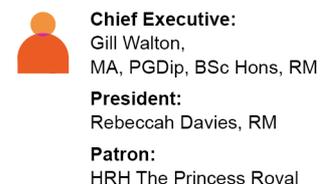
#### Objective

To explore strategies that could reduce coronavirus disease 2019 (COVID-19) vaccine hesitancy in pregnancy.

#### Methods

In 2021, the authors conducted a survey of pregnant women assessing attitudes and beliefs regarding COVID-19 vaccination. The present analysis reviewed trusted sources of information about COVID-19 vaccination that could reduce vaccine hesitancy among pregnant respondents.

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## Results

A total of 295 surveys were analyzed. Using 10-point Likert scales, intentions to accept COVID-19 vaccine were split between individuals with low (n = 126, 43%) and high (n = 141, 48%) intentions to receive the vaccine, with only a small percentage of women having midrange vaccination intentions (n = 28, 10%). When asked what would reduce their COVID-19 vaccine concerns, published data was the leading answer in both low (46.2%) and medium (35.7%) intention groups followed by personally knowing someone who got vaccinated during pregnancy (21.0% and 28.6% for low and medium groups, respectively). In contrast, an obstetrician's recommendation was the most common answer in the group with high intention to vaccinate (37.2%). Knowing someone who received the vaccine in pregnancy was the leading response for reducing concerns of COVID-19 vaccination among Black respondents.

## Conclusion

The survey identified several innovative and culturally specific approaches to address vaccine confidence and complacency and improve vaccine uptake in pregnant people. (Author)

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## 2023-06073

**Trends in Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection and vaccine antibody prevalence in a multi-ethnic inner-city antenatal population: A cross-sectional surveillance study.** Andreeva D, Gill C, Brockbank A, et al (2023), BJOG: An International Journal of Obstetrics and Gynaecology vol 130, no 9, August 2023, pp 1135-1144

### Objective

To determine severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) seroprevalence in pregnancy in an inner-city setting and assess associations with demographic factors and vaccination timing.

### Design

Repeated cross-sectional surveillance study.

### Setting

London maternity centre.

### Sample

A total of 906 pregnant women attending nuchal scans, July 2020–January 2022.

### Methods

Blood samples were tested for IgG antibodies against SARS-CoV-2 nucleocapsid (N) and spike (S) proteins. Self-reported vaccination status and coronavirus disease 2019 (COVID-19) infection were recorded. Multivariable regression models determined demographic factors associated with seroprevalence and antibody titres.

### Main outcome measures

Immunoglobulin G N- and S-protein antibody titres.

### Results

Of the 960 women, 196 (20.4%) were SARS-CoV-2 seropositive from previous infection. Of these, 70 (35.7%) self-reported previous infection. Among unvaccinated women, women of black ethnic backgrounds were most likely to be SARS-CoV-2 seropositive (versus white adjusted risk ratio [aRR] 1.88, 95% CI 1.35–2.61,  $p < 0.001$ ). Women from black and mixed ethnic backgrounds were least likely to have a history of vaccination with seropositivity to S-protein (versus white aRR 0.58, 95% CI 0.40–0.84,  $p = 0.004$ ; aRR 0.56, 95% CI 0.34–0.92,  $p = 0.021$ , respectively). Double vaccinated, previously infected women had higher IgG S-protein antibody titres than unvaccinated, previously infected women (mean difference 4.76 fold-change, 95% CI 2.65–6.86,  $p < 0.001$ ). Vaccination timing before versus during pregnancy did not affect IgG S-antibody titres (mean difference –0.28 fold-change, 95% CI –2.61 to 2.04,  $p = 0.785$ ).

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## Conclusions

This cross-sectional study demonstrates high rates of asymptomatic SARS-CoV-2 infection with women of black ethnic backgrounds having higher infection risk and lower vaccine uptake. SARS-CoV-2 antibody titres were highest among double-vaccinated, infected women. (Author)

**Full URL:** <https://doi.org/10.1111/1471-0528.17508>

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## 2023-06051

**Social media and COVID-19 vaccination hesitancy during pregnancy: a mixed methods analysis.** Golder S, McRobbie-Johnson ACE, Klein A, et al (2023), BJOG: An International Journal of Obstetrics and Gynaecology vol 130, no 7, June 2023, pp. 750-758

### Objective

To evaluate the reasons for COVID-19 vaccine hesitancy during pregnancy.

### Design

We used regular expressions to identify publicly available social media posts from pregnant people expressing at least one reason for their decision not to accept COVID-19 vaccine.

### Setting

Two social media platforms – WhatToExpect and Twitter.

### Sample

A total of 945 pregnant people in WhatToExpect (1017 posts) and 345 pregnant people in Twitter (435 tweets).

### Methods

Two annotators manually coded posts according to the Scientific Advisory Group for Emergencies (SAGE) working group's 3Cs vaccine hesitancy model (confidence, complacency and convenience barriers). Within each 3Cs we created subthemes that emerged from the data.

### Main Outcome Measures

Subthemes were derived according to the people's posting own words.

### Results

Safety concerns were most common and largely linked to the perceived speed at which the vaccine was created and the lack of data about its safety in pregnancy. This led to a preference to wait until after the baby was born or to take other precautions instead. Complacency surrounded a belief that they are young and healthy or already had COVID-19. Misinformation led to false safety and efficacy allegations, or even conspiracy theories, and fed into creating confidence and complacency barriers. Convenience barriers (such as availability) were uncommon.

### Conclusion

The information in this study can be used to highlight the questions, fears and hesitations pregnant people have about the COVID-19 vaccine. Highlighting these hesitations can help public health campaigns and improve communication between healthcare professionals and patients. (Author)

**Full URL:** <https://doi.org/10.1111/1471-0528.17481>

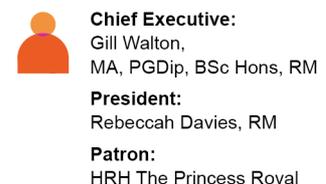
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## 2023-06023

**COVID-19 Booster Vaccination in Early Pregnancy and Surveillance for Spontaneous Abortion.** Kharbanda EO, Haapala J, Lipkind HS, et al (2023), JAMA Network Open vol 6, no 5, May 2023, e2314350

**Importance** Adherence to COVID-19 booster vaccine recommendations has lagged in pregnant and nonpregnant adult populations. One barrier to booster vaccination is uncertainty regarding the safety of booster doses among pregnant people.

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**Objective** To evaluate whether there is an association between COVID-19 booster vaccination during pregnancy and spontaneous abortion.

**Design, Setting, and Participants** This observational, case-control, surveillance study evaluated people aged 16 to 49 years with pregnancies at 6 to 19 weeks' gestation at 8 health systems in the Vaccine Safety Datalink from November 1, 2021, to June 12, 2022. Spontaneous abortion cases and ongoing pregnancy controls were evaluated during consecutive surveillance periods, defined by calendar time.

**Exposure** Primary exposure was receipt of a third messenger RNA (mRNA) COVID-19 vaccine dose within 28 days before spontaneous abortion or index date (midpoint of surveillance period in ongoing pregnancy controls). Secondary exposures were third mRNA vaccine doses in a 42-day window or any COVID-19 booster in 28- and 42-day windows.

**Main Outcomes and Measures** Spontaneous abortion cases and ongoing pregnancy controls were identified from electronic health data using a validated algorithm. Cases were assigned to a single surveillance period based on pregnancy outcome date. Eligible ongoing pregnancy time was assigned to 1 or more surveillance periods as an ongoing pregnancy-period control. Generalized estimating equations were used to estimate adjusted odds ratios (AOR) with gestational age, maternal age, antenatal visits, race and ethnicity, site, and surveillance period as covariates and robust variance estimates to account for inclusion of multiple pregnancy periods per unique pregnancy.

**Results** Among 112 718 unique pregnancies included in the study, the mean (SD) maternal age was 30.6 (5.5) years. Pregnant individuals were Asian, non-Hispanic (15.1%); Black, non-Hispanic (7.5%); Hispanic (35.6%); White, non-Hispanic (31.2%); and of other or unknown (10.6%); and 100% were female. Across eight 28-day surveillance periods, among 270 853 ongoing pregnancy-period controls, 11 095 (4.1%) had received a third mRNA COVID-19 vaccine in a 28-day window; among 14 226 cases, 553 (3.9%) had received a third mRNA COVID-19 vaccine within 28 days of the spontaneous abortion. Receipt of a third mRNA COVID-19 vaccine was not associated with spontaneous abortion in a 28-day window (AOR, 0.94; 95% CI, 0.86-1.03). Results were consistent when using a 42-day window (AOR, 0.97; 95% CI, 0.90-1.05) and for any COVID-19 booster in a 28-day (AOR, 0.94; 95% CI, 0.86-1.02) or 42-day (AOR, 0.96; 95% CI, 0.89-1.04) exposure window.

**Conclusions and Relevance** In this case-control surveillance study, COVID-19 booster vaccination in pregnancy was not associated with spontaneous abortion. These findings support the safety of recommendations for COVID-19 booster vaccination, including in pregnant populations. (Author)

**Full URL:** <https://doi.org/10.1001/jamanetworkopen.2023.14350>

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## 2023-05974

**Vaccine intention and hesitancy among Australian women who are currently pregnant or have recently given birth: the Birth in the Time of COVID-19 (BITOC) national online survey.** Dahlen HG, Homer C, Boyle J, et al (2023), *BMJ Open* vol 13, no 4, April 2023

**Objective** To examine the prevalence of COVID-19 vaccination, and factors associated with vaccination intention and hesitancy in pregnant and postnatal women in Australia.

**Design and setting** A national online survey was conducted over 6 months between 31 August 2021 and 1 March 2022 and responses to vaccination status were categorised as: 'vaccinated', 'vaccine intended' and 'vaccine hesitant'. The data were weighted to reflect the proportion of women of reproductive age. Potential confounding variables were examined using multinomial logistic regression analyses, and all comparisons were made against vaccinated pregnant and postnatal women.

**Participants** 2140 women responded to the survey (838 pregnant; 1302 recently post partum).

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Results Amongst pregnant women, 586 (69.9%) were vaccinated, 166 (19.8%) indicated intention and 86 (10.3%) were hesitant. In postnatal women, this was 1060 (81.4%), 143 (11.0%) and 99 (7.6%), respectively. Only 52 (6.2%) of pregnant women stated never wanting a COVID-19 vaccine. Vaccine hesitancy increased over time, and for pregnant women was associated with: living in a state other than New South Wales (NSW) (Adjusted Relative Risk (ARR) 2.77, 95%CI: 1.68-4.56 for vaccine intention and ARR=3.31, 95%CI: 1.52-7.20 for vaccine hesitancy), younger age <30 years, not having a university education, income <80K AUD, gestation <28 weeks, having no pregnancy risk factors, and being less satisfied with life (ARR=2.20, 95%CI: 1.04-4.65 for vaccine intention and ARR=2.53, 95%CI: 1.02-6.25 for vaccine hesitancy) . For postnatal women: living in a state other than NSW or Victoria, income <80K AUD and having private obstetric care (ARR=2.06, 95%CI: 1.23-3.46) were significantly associated with vaccine hesitancy.

Conclusions Around 1 in 10 pregnant women and just over 1 in 13 postnatal women reported vaccine hesitancy in this Australian survey, and hesitancy was higher in the latter 3-month period. Tailored messages to younger mothers and those from lower-middle socioeconomic groups, alongside advice from midwives and obstetricians, could help to reduce hesitancy among pregnant and postnatal women. Financial incentives may help to facilitate COVID-19 vaccine uptake. A real-time surveillance system and additional pregnancy fields added to the Australian immunisation register would support the safety monitoring of multiple vaccines in pregnancy and may build confidence. (Author)

Full URL: <http://dx.doi.org/10.1136/bmjopen-2022-063632>

## 2023-05965

**Factors associated with having COVID-19 among unvaccinated pregnant and non-pregnant women in Metro Manila, Philippines: a multicentre longitudinal cohort study.** Llamas-Clark EF, Heralde FM, Lumandas MU, et al (2023), BMJ Open vol 13, no 4, April 2023

Objective To determine the potential risk factors associated with having COVID-19 among unvaccinated pregnant and non-pregnant women.

Design A multicentre prospective cohort study among eligible women in Metro Manila, Philippines, from 2020 to 2022.

Setting Five national and local hospital research sites altogether recruited and screened 500 consenting eligible individuals.

Participants Pregnant and non-pregnant participants meeting the eligibility criteria were admitted for a reverse-transcription PCR determination of SARS-CoV-2, pregnancy testing and ultrasound, and an interview with an administered questionnaire.

Exposures Primary exposure was pregnancy; secondary exposures involve sociodemographic, lifestyle and obstetric-gynaecologic factors.

Outcome measure Outcome being measured was COVID-19 status.

Results The significant COVID-19 risk factors were: pregnancy (PR=1.184, 95% CI 1.096, 1.279), having a white-collar job (PR=1.123, 95% CI 1.02, 1.235), travelling abroad (PR=1.369, 95% CI 1.083, 1.173) and being infected by at least one vaccine-preventable disease (VPD) (PR=1.208, 95% CI 1.113, 1.310). Protective factors included having graduate-level education (PR=0.787, 95% CI 0.649, 0.954), immunisation against a VPD (PR=0.795, 95% CI 0.733, 0.862) and practising contraception (PR=0.889, 95% CI 0.824, 0.960).

Conclusion This study is the first in the country to determine the risks influencing COVID-19 infection among unvaccinated pregnant and non-pregnant women. Pregnancy is a significant risk for COVID-19 among women in Metro Manila. Educational attainment and positive health behaviours seem to confer protection. Occupations and activities that increase the frequency of interactions, as well as history of communicable diseases may predispose women to

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COVID-19. Further studies are needed to elucidate the development of the disease in pregnant women, including the maternal and neonatal effects of COVID-19 via potential vertical mechanisms of transmission. (Author)

**Full URL:** <http://dx.doi.org/10.1136/bmjopen-2022-070688>

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## 2023-05724

**COVID-19 mRNA vaccination status and concerns among pregnant women in Japan: a multicenter questionnaire survey.** Takahashi K, Samura O, Hasegawa A, et al (2023), BMC Pregnancy and Childbirth vol 23, no 332, May 2023

### Background

mRNA vaccination is an effective, safe, and widespread strategy for protecting pregnant women against infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. However, information on factors such as perinatal outcomes, safety, and coverage of mRNA vaccinations among pregnant women is limited in Japan.

Therefore, this study aimed to investigate the perinatal outcomes, coverage, adverse effects, and short-term safety of mRNA vaccination as well as vaccine hesitancy among pregnant women.

### Methods

We conducted a multicenter online survey of postpartum women who delivered their offspring at 15 institutions around Tokyo from October 2021 to March 2022. Postpartum women were divided into vaccinated and unvaccinated groups. Perinatal outcomes, COVID-19 prevalence, and disease severity were compared between the two groups. Adverse reactions in the vaccinated group and the reasons for being unvaccinated were also investigated retrospectively.

### Results

A total of 1,051 eligible postpartum women were included. Of these, 834 (79.4%) had received an mRNA vaccine, while 217 (20.6%) had not, mainly due to concerns about the effect of vaccination on the fetus. Vaccination did not increase the incidence of adverse perinatal outcomes, including fetal morphological abnormalities. The vaccinated group demonstrated low COVID-19 morbidity and severity. In the vaccinated group, the preterm birth rate, cesarean section rate, and COVID-19 incidence were 7.2%, 33.2%, and 3.3%, respectively, compared with the 13.7%, 42.2%, and 7.8% in the unvaccinated group, respectively. Almost no serious adverse reactions were associated with vaccination.

### Conclusions

mRNA vaccines did not demonstrate any adverse effects pertaining to short-term perinatal outcomes and might have prevented SARS-CoV-2 infection or reduced COVID-19 severity. Concerns regarding the safety of the vaccine in relation to the fetus and the mother were the main reasons that prevented pregnant women from being vaccinated. To resolve concerns, it is necessary to conduct further research to confirm not only the short-term safety but also the long-term safety of mRNA vaccines. (Author)

**Full URL:** <https://doi.org/10.1186/s12884-023-05669-4>

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## 2023-05375

**Reductions in stillbirths and preterm birth in COVID-19–vaccinated women: a multicenter cohort study of vaccination uptake and perinatal outcomes.** Hui L, Marzan MB, Rolnik DL, et al (2023), American Journal of Obstetrics & Gynecology (AJOG) vol 228, no 5, May 2023, pp. 585.E1-585.E16

### Background

COVID-19 infection in pregnancy is associated with a higher risk of progression to severe disease, but vaccine uptake by pregnant women is hindered by persistent safety concerns. COVID-19 vaccination in pregnancy has been shown to reduce stillbirth, but its relationship with preterm birth is uncertain.

### Objective

This study aimed to measure the rate of COVID-19 vaccine uptake among women giving birth in Melbourne, Australia, and to compare perinatal outcomes by vaccination status.

### Study Design

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This was a retrospective multicenter cohort study conducted after the June 2021 government recommendations for messenger RNA COVID-19 vaccination during pregnancy. Routinely collected data from all 12 public maternity hospitals in Melbourne were extracted on births at  $\geq 20$  weeks' gestation from July 1, 2021 to March 31, 2022. Maternal sociodemographic characteristics were analyzed from the total birth cohort. Perinatal outcomes were compared between vaccinated and unvaccinated women for whom weeks 20 to 43 of gestation fell entirely within the 9-month data collection period. The primary outcomes were the rates of stillbirth and preterm birth (spontaneous and iatrogenic) in singleton pregnancies of at least 24 weeks' gestation, after exclusion of congenital anomalies. Secondary perinatal outcomes included the rate of congenital anomalies among infants born at  $\geq 20$  weeks' gestation and birthweight  $\leq$  third centile and newborn intensive care unit admissions among infants born without congenital anomalies at  $\geq 24$  weeks' gestation. We calculated the adjusted odds ratio of perinatal outcomes among vaccinated vs unvaccinated women using inverse propensity score-weighting regression adjustment with multiple covariates;  $P < .05$  was considered statistically significant.

#### Results

Births from 32,536 women were analyzed: 17,365 (53.4%) were vaccinated and 15,171 (47.6%) were unvaccinated. Vaccinated women were more likely to be older, nulliparous, nonsmoking, not requiring an interpreter, of higher socioeconomic status, and vaccinated against pertussis and influenza. Vaccination status also varied by region of birth. Vaccinated women had a significantly lower rate of stillbirth compared with unvaccinated women (0.2% vs 0.8%; adjusted odds ratio, 0.18; 95% confidence interval, 0.09–0.37;  $P < .001$ ). Vaccination was associated with a significant reduction in total preterm births at  $< 37$  weeks (5.1% vs 9.2%; adjusted odds ratio, 0.60; 95% confidence interval, 0.51–0.71;  $P < .001$ ), spontaneous preterm birth (2.4% vs 4.0%; adjusted odds ratio, 0.73; 95% confidence interval, 0.56–0.96;  $P = .02$ ), and iatrogenic preterm birth (2.7% vs 5.2%; adjusted odds ratio, 0.52; 95% confidence interval, 0.41–0.65;  $P < .001$ ). Infants born to vaccinated mothers also had lower rates of admission to the neonatal intensive care unit. There was no significant increase in the rate of congenital anomalies or birthweight  $\leq 3$ rd centile in vaccinated women. Vaccinated women were significantly less likely to have an infant with a major congenital anomaly compared with the unvaccinated group (2.4% vs 3.0%; adjusted odds ratio, 0.72; 95% confidence interval, 0.56–0.94;  $P = .02$ ). This finding remained significant even when the analysis was restricted to women vaccinated before 20 weeks' gestation.

#### Conclusion

COVID-19 vaccination during pregnancy was associated with a reduction in stillbirth and preterm birth, and not associated with any adverse impact on fetal growth or development. Vaccine coverage was substantially influenced by known social determinants of health. (Author)

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#### 2023-05118

**Intention to take COVID-19 vaccine and associated factors among pregnant women attending antenatal care at public health facilities in Bahir Dar city, Northwest Ethiopia.** Mekuriaw BY, Nigatu D, Dessie AM, et al (2023), BMC Women's Health vol 23, no 175, April 2023

#### Background

Pregnant mothers are a risky population group for COVID-19 and pregnant mothers with COVID-19 are at increased risk of hospitalization, intensive-care unit admission, invasive ventilation support, and maternal mortality. Vaccination is an essential tool in stopping the effect of the pandemic on maternal and child health. However, there are only limited studies in Ethiopia on the intention to take the COVID-19 vaccine among pregnant women. Thus, this study aimed to assess intention to take the COVID-19 vaccine and associated factors among pregnant women in Bahir Dar city, Northwest Ethiopia.

#### Methods

Facility based cross-sectional study was conducted among 590 pregnant women from 23 May to 07 July 2022. The study participants were selected using a systematic sampling technique. Interviewer administrative questionnaire with epicollect5 application was used to collect the data. Both bi-variable and multivariable binary logistic regression analysis was performed. Statistical significance was defined at a 95% CI with a p-value  $< 0.05$ .

#### Result

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Overall, 19.8% (95% CI: 16.60–23.06%) of pregnant women intend to take the COVID-19 vaccine. Being urban residence (AOR = 3.40, 95% CI: 1.71–6.78), third trimester of gestational age (AOR = 3.11, 95% CI: 1.61–6.03), multipara (AOR = 2.30, 95% CI: 1.33–3.97), knowledge of COVID-19 vaccine (AOR = 2.33, 95% CI: 1.44–3.77) and having good attitude towards COVID-19 vaccine (AOR = 2.68, 95% CI: 1.65–4.33) were significantly associated with intention to take COVID-19 vaccine.

#### Conclusion

In conclusion, the pregnant women's intention to take the COVID-19 vaccine in this study area was very low. It was significantly associated with residency, gestational age, parity, knowledge, and attitude toward the vaccine. Therefore, strengthening interventions that improve knowledge and attitude about the COVID-19 vaccine, predominantly among those primipara mothers and mothers from rural residences, may raise the intention to take it.

(Author)

Full URL: <https://doi.org/10.1186/s12905-023-02331-1>

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#### 2023-05039

**Vaccination and treatment options for SARS-CoV2 infection affecting lactation and breastfeeding.** Chen MJ, Cheema R, Hoyt-Austin A, et al (2023), *Seminars in Fetal and Neonatal Medicine* vol 28, no 1, February 2023, 101425

The COVID-19 pandemic has posed considerable challenges to the health of lactating individuals. Vaccination remains one of the most important strategies for prevention of moderate to severe COVID-19 infection and is associated with protective benefits for lactating individuals and their breastfed infants with overall mild side effects. The current recommendations for COVID-19 treatment in lactating individuals includes remdesivir and dexamethasone for hospitalized patients and Paxlovid® (nirmatrelvir + ritonavir) as outpatient treatment in those with mild disease. As the pandemic continues to evolve with new COVID-19 variants, alternative therapeutic options are potentially needed, and it is critical to include lactating individuals in research to evaluate the safety and efficacy of COVID-19 treatment options in this population. (Author)

Full URL: <https://doi.org/10.1016/j.siny.2023.101425>

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#### 2023-04762

**COVID-19 vaccine hesitancy among pregnant and postpartum Kenyan women.** Marwa MM, Kinuthia J, Larsen A, et al (2023), *International Journal of Gynecology & Obstetrics* vol 162, no 1, July 2023, pp 147-153

#### Objective

The authors evaluated factors contributing to coronavirus disease 2019 (COVID-19) vaccine hesitancy among pregnant and postpartum women to inform vaccine scale-up strategies.

#### Methods

This observational study utilized data from pregnant and postpartum women attending four public maternal child health (MCH) clinics in Western Kenya. From October 2020 to July 2022, nurses assessed COVID-19 vaccine hesitancy, defined as reporting “unlikely” or “very unlikely” to the question, “If a vaccine for COVID-19 were available today, what is the likelihood that you would get vaccinated?”

#### Results

Among 1023 women (235 pregnant, 788 postpartum), 20% reported worsened MCH care during the pandemic and most (92%) perceived themselves or family members to be at risk for COVID-19, yet 54% of women reported COVID-19 vaccine hesitancy. Vaccine hesitancy was more frequent among women reporting worsened MCH care ( $P < 0.001$ ) since the pandemic and those who did not trust the government as a source of COVID-19 information ( $P = 0.016$ ). Over the 2-year period, willingness to receive the vaccine almost doubled (38% to 71%,  $P < 0.001$ ).

#### Conclusions

Our findings suggest that sustaining access to quality MCH services may decrease COVID-19 vaccine hesitancy.

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Willingness to receive the vaccine doubled over the 2-year period in our cohort, suggesting increased trust for use and acceptance in the unique context of the pregnancy/postpartum period. (Author)

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## 2023-04657

**Vaccination Beliefs and Attitudes of Lactating People During the SARS-CoV-2 Pandemic.** Mark EG, Demirci JR, Megli C, et al (2023), vol 39, no 3, August 2023, pp 415–425

### Background:

Pregnant and recently pregnant people have lower vaccination rates against SARS-CoV-2 than the general population, despite increased risk of adverse outcomes from infection. Little is known about vaccine hesitancy in this population.

### Research Aim:

To characterize SARS-CoV-2 and other vaccine attitudes of lactating people who accepted the SARS-CoV-2 vaccine, describing their vaccine experiences to further contextualize their beliefs.

### Methods:

A prospective cross-sectional online survey design was used. We administered the survey to 100 lactating people in Pennsylvania from April to August 2021, upon enrollment into a longitudinal study investigating SARS-CoV-2 vaccine antibodies in human milk. This survey assessed SARS-CoV-2 vaccine attitudes, vaccine counseling from providers, and vaccine decision making. Associations between vaccination timing and beliefs were analyzed by Pearson chi-square.

### Results:

Of 100 respondents, all received  $\geq 1$  SARS-CoV-2 vaccine before or shortly after enrollment, with 44% ( $n = 44$ ) vaccinated in pregnancy and 56% ( $n = 56$ ) while lactating. Participants reported vaccination counseling by obstetric ( $n = 48$ ; 70%) and pediatric ( $n = 25$ ; 36%) providers. Thirty-two percent ( $n = 32$ ) received no advice on SARS-CoV-2 vaccination from healthcare providers, while 69% ( $n = 69$ ) were counseled that vaccination was safe and beneficial. While 6% ( $n = 6$ ) and 5% ( $n = 5$ ) reported concerns about the safety of maternal vaccines for lactating people or their infants, respectively, 12% ( $n = 12$ ) and 9% ( $n = 9$ ) expressed concerns about the safety of maternal SARS-CoV-2 vaccination in particular.

### Conclusions:

Despite high uptake of SARS-CoV-2 vaccine among participants, safety concerns persisted, with many reporting a lack of direct counseling from providers. Future research should investigate how variability in provider counseling affects SARS-CoV-2 vaccine uptake in perinatal populations. (Author)

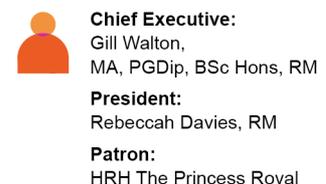
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## 2023-04065

**Strategies to Address COVID-19 Vaccine and Pregnancy Myths.** Berkowitz HE, Jacobson Vann JC (2023), MCN - American Journal of Maternal/Child Nursing vol 48, no 4, July/August 2023, pp 215-223

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) poses risks to pregnant women and their infants. The spread of misinformation about COVID-19 vaccination is a barrier to optimizing vaccination rates among women of childbearing age. We conducted an environmental scan to identify misinformation about COVID-19 vaccination, pregnancy, and fertility, and a review to identify evidence to refute misinformation and strategies to correct and prevent the spread of misinformation. Seven identified themes of misinformation are: the vaccine causes female infertility, can cause miscarriage, and can decrease male fertility; mRNA vaccines attack the placenta; pregnant and breastfeeding persons should not get the vaccine; the vaccine can change menstrual cycles; and vaccinated people can spread infertility symptoms to unvaccinated people. Strategies that can be implemented by social media platforms to help prevent misinformation spread and correct existing health misinformation include improving information regulation by modifying community standards, implementing surveillance algorithms, and applying warning labels to potentially misleading posts. Health services organizations and clinicians can implement health misinformation policies, directly recommend vaccinations, provide credible explanations and resources to debunk misinformation, educate patients and populations on spotting misinformation, and apply effective communication strategies. More research is needed to assess longer-term effects of vaccination among women of childbearing age to strengthen the defense against misinformation and to evaluate strategies that aim to prevent and correct misinformation spread about COVID-19 vaccinations. (Author)

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2023-03956

**Safety of COVID-19 vaccination in pregnant women and their neonatal outcome: a narrative Review.** Askary E, Moradi Alamdarloo S, Keshavarz Hesam Abadi A (2023), Journal of Maternal-Fetal and Neonatal Medicine vol 36, no 1, 2023, 2183750

#### Background

Even through the fact that pregnant women are more and more severely infected with COVID-19 disease, there are still doubts about vaccinating these people due to the lack of sufficient evidence base information. So in this systematic review, we decided to study vaccinated and unvaccinated pregnant women regarding maternal, fetal and neonatal complications and outcomes.

#### The strategy of searching

Between 30 December 2019 and 15 October 2021, electronic searches were performed on the databases of PubMed, Scopus, Google Scholar, and Cochrane library by searching in English and free full text. Keywords searched included these: maternal outcome, neonatal outcome, pregnancy, and COVID-19 vaccination. Among 451 articles, finally, seven studies were included to study pregnancy outcomes in vaccinated women compared to unvaccinated for systematic review purposes

#### Results

In this study 30257 vaccinated women in their third trimester compared to 132339 unvaccinated women in terms of age, the root of delivery, neonatal adverse outcomes. There were no significant differences between two groups in terms of: IUFD, and 1 min Apgar score, C/S rate, and NICU admission between the two groups, however, the rate of SGA, IUFD, and also neonatal jaundice, asphyxia, and hypoglycemia was more significant in the unvaccinated group comparing to the vaccinated group as a result. Among them, the chance of preterm labor pain was reported more among vaccinated patients. Emphasizing that, except 7.3% of the case population, everyone in the second and third trimesters had been vaccinated with mRNA COVID-19 vaccines

#### Conclusion

COVID-19 vaccination during the second and third trimesters appears to be the right choice due to the immediate impact of COVID-19 antibodies on the developing fetus and formation of neonatal prophylaxis, as well as the absence of adverse outcomes for both the fetus and mothers. (Author)

Full URL: <https://doi.org/10.1080/14767058.2023.2183750>

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2023-03908

**Acceptance of vaccination against pertussis, COVID-19 and influenza during pregnancy: a cross-sectional study.**

Widdershoven V, Reijis RP, Eskes A, et al (2023), BMC Pregnancy and Childbirth vol 23, no 219, March 2023

#### Background

This study aims to assess the uptake of maternal pertussis and COVID-19 vaccination and the intention towards accepting the maternal influenza vaccination. Insights into different socio-demographic factors related to maternal vaccination coverage might help to address vaccine acceptance and improve maternal vaccine uptake in the future.

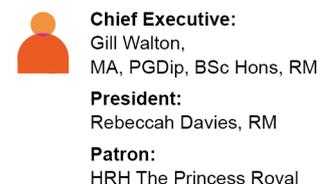
#### Methods

We conducted a cross-sectional survey among pregnant women and recent mothers, up to 6 months post-partum. The primary outcome measures of this study were behaviour for maternal pertussis and COVID-19 vaccination, and maternal influenza vaccination intention. Associations between socio-demographic factors and maternal pertussis vaccination and maternal COVID-19 vaccination behaviour; and socio-demographic factors and maternal influenza vaccination intention were assessed using binary logistic regression analyses.

#### Results

In total 1361 respondents filled out the questionnaire. Almost all women (95%) were vaccinated against pertussis

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during pregnancy, while almost two-third were vaccinated against COVID-19 during pregnancy (58%) and almost one-third (28%) had a positive intention towards receiving the maternal influenza vaccination. Results show that young maternal age and low education level were associated with lower maternal vaccination acceptance.

#### Conclusion

Vaccination campaigns focusing on the severity of diseases that are prevented, are needed to increase maternal vaccine acceptance in younger and low-educated pregnant women. We expect that differences in vaccination coverage between the three maternal vaccinations might partly be explained by existing recommendations, campaigns and whether the vaccination is part of the national immunisation program. (Author)

Full URL: <https://doi.org/10.1186/s12884-023-05505-9>

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#### 2023-03529

**Pregnant Women's Concerns Regarding COVID-19 and Their Willingness to Be Vaccinated.** Mitchell SL, Strassberg E, Rhoades C, et al (2023), *Journal of Women's Health* vol 32, no 5, May 2023, pp 513–520

Objectives: We investigated coronavirus disease 2019 (COVID-19) opinions, experiences, and willingness to accept COVID-19 vaccination during pregnancy at two prenatal clinics in early 2021 and early 2022.

Materials and Methods: Paper questionnaires were distributed to pregnant women at prenatal care facilities in Virginia and Florida between January and April 2021 and January and April 2022. Questions regarding acceptance and opinions of the influenza vaccine served as a baseline to assess COVID-19 vaccine opinions. Associations between demographic parameters and vaccine opinions and acceptance were examined using Chi-square. A COVID-19 concern score was constructed by principal component analysis with differences between groups assessed by analysis of variance (ANOVA) and analysis of covariance (ANCOVA).

Results: Many participants (40.6%) reported that the COVID pandemic had affected their pregnancy. Main themes were problems with social networks, increased stress/anxiety, and being more cautious. In 2021, 19.5% reported they would accept a COVID-19 vaccination during their pregnancy, which increased to 45.8% in 2022. Vaccine hesitancy did not vary by race or between sites, but educational attainment was significant ( $p < 0.001$ ). Women with a higher concern score were more likely to report they would accept a COVID-19 vaccine. Women who would accept COVID vaccination had a positive opinion regarding the influenza vaccine. Main themes for refusing COVID-19 vaccination were concerns about side effects, lack of research/data, and mistrust of vaccines.

Conclusions: The proportion of women willing to accept COVID-19 vaccination increased but remained below 50%. Willingness to accept vaccination during pregnancy was associated with higher education, higher concern about COVID-19, and a positive opinion of the influenza vaccine. (Author)

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#### 2023-03457

**Individual-level determinants of COVID-19 vaccination in pregnant people in East Tennessee.** Ehrlich SF, Maples J, Burnette S, et al (2023), *International Journal of Gynecology & Obstetrics* vol 162, no 1, July 2023, pp 6-12

#### Objective

Coronavirus disease 2019 (COVID-19) infection during pregnancy increases the risk of severe illness and death. This study describes individual-level determinants of COVID-19 vaccination among pregnant people in East Tennessee.

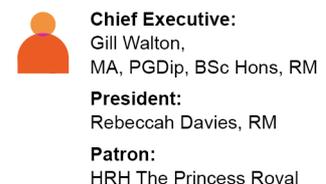
#### Methods

Advertisements for the online Moms and Vaccines survey were placed in prenatal clinics in Knoxville, Tennessee. Determinants were compared between unvaccinated individuals and those partially or fully vaccinated for COVID-19.

#### Results

Wave 1 of the Moms and Vaccines study included 99 pregnant people: 21 (21.2%) were unvaccinated and 78 (78.8%)

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were partially or fully vaccinated. Compared with the unvaccinated individuals, the partially or fully vaccinated patients more often obtained information about COVID-19 from their prenatal care provider (8 [38.1%] vs. 55 [70.5%],  $P = 0.006$ ) and indicated higher levels of trust in that information (4 [19.1] vs. 69 [88.5%],  $P < 0.0001$ ). Misinformation was higher in the unvaccinated group overall, although there was no difference in concern for the severity of COVID-19 infection during pregnancy by vaccination status (1 [5.0%] of the unvaccinated vs. 16 [20.8%] of the partially or fully vaccinated,  $P = 0.183$ ).

#### Conclusion

Strategies to counter misinformation are of the utmost importance, particularly pregnancy- and reproductive health-related misinformation, because of the increased risk of severe disease faced by unvaccinated pregnant individuals. (Author)

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#### 2023-03417

**Examination of cord blood at birth in women with SARS-CoV-2 exposure and/or vaccination during pregnancy and relationship to fetal complete blood count, cortisol, ferritin, vitamin D, and CRP.** Mendenhall E, Hogan MB, Nudelman M, et al (2023), *Frontiers in Pediatrics* 16 March 2023, online

Background: SARS-CoV-2 is known to manifest a robust innate immune response. However, little is known about inflammatory influences from maternal SARS-CoV-2 infection or maternal mRNA vaccination upon the fetus. In addition, it is unknown if Vitamin D deficiency influences fetal homeostasis or if an anti-inflammatory mechanism to the development of possible innate cytokines or acute phase reactants by the maternal/fetal dyad, in the form of cortisol elevations, occur. In addition, effects on Complete Blood Count (CBC) are not known.

Objective: To evaluate the neonatal acute phase reactants and anti-inflammatory responses after maternal SARS-CoV-2 disease or mRNA vaccination.

Methods: Samples and medical records reviews from mother/baby dyads ( $n = 97$ ) were collected consecutively, and were categorized into 4 groups; no SARS-CoV-2 or vaccination exposure (Control), Vaccinated mothers, maternal SARS-CoV-2 disease positive/IgG titer positive fetal blood, and maternal SARS-CoV-2 positive/IgG titer negative fetal blood. SARS-CoV-2 IgG/IgM/IgA titers, CBC, CRP, ferritin, cortisol, and Vitamin D were obtained to examine the possible development of an innate immune response and possible anti-inflammatory response. Student's t-test, Wilcoxon rank-sum, and Chi-squared with Bonferroni corrections were used to compare groups. Multiple imputations were performed for missing data.

Results: Cortisol was higher in babies of both mothers who were vaccinated ( $p = 0.001$ ) and SARS-CoV-2 positive/IgG positive ( $p = 0.009$ ) as compared to the control group suggesting an attempt to maintain homeostasis in these groups. Measurements of ferritin, CRP, and vitamin D did not reach statistical significance. CBC showed no variation, except for the mean platelet volume (MPV), which was elevated in babies whose mothers were vaccinated ( $p = 0.003$ ) and SARS-CoV-2 positive/IgG positive ( $p = 0.007$ ) as compared to the control group.

Conclusion: Acute phase reactant elevations were not noted in our neonates. Vitamin D levels were unchanged from homeostatic levels. Cord blood at birth, showed Cortisol and MPV higher in vaccinated and SARS-CoV-2 IgG positive mother/baby dyads as compared to the Control group, indicating that possible anti-inflammatory response was generated. The implication of possible inflammatory events and subsequent cortisol and/or MPV elevation effects upon the fetus after SARS-CoV-2 disease or vaccination is unknown and merits further investigation. (Author)

Full URL: <https://doi.org/10.3389/fped.2023.1092561>

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#### 2023-03383

**COVID-19 Vaccination During Pregnancy Protected Infants.** Harris E (2023), *JAMA (Journal of the American Medical Association)* vol 329, no 10, March 2023, p. 789

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Two doses of COVID-19 vaccine administered to mothers during pregnancy were 95% effective against infection with the SARS-CoV-2 Delta variant and 97% effective against related hospitalizations among infants younger than 6 months, according to a study of 8809 infants in The BMJ. Protection was lower against infection with the Omicron variant and corresponding hospitalizations, although a third dose boosted the effectiveness to 73% against infection and 80% against hospital admission.

The ideal timing for COVID-19 vaccination during pregnancy is unclear, according to the authors of a corresponding editorial. The researchers showed that protection was highest for infants when mothers received a second vaccine dose in the third trimester. That benefit, however, "should be balanced against the potential harm to the mother and fetus associated with maternal covid-19 occurring before receipt of the vaccine," the editorial's authors wrote.

(Author)

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## 2023-03002

### **Prenatal Vaccination Patterns among Birthing Individuals with History of Preterm Birth in the Pre- and Post-COVID**

**Era.** Ramey-Collier KL, Okunbor JI, Lunn SR, et al (2024), American Journal of Perinatology vol 41, no 5, April 2024, pp 548-553

**Objective** This study aims to explore vaccination acceptance among individuals with a history of preterm birth between March and June during the pre-COVID (2019), early-COVID (2020), and late-COVID (2021) periods.

**Study Design** This is a cross-sectional, retrospective cohort study of pregnant individuals with a history of preterm birth (<37 weeks' gestation) who initiated care of a subsequent pregnancy during pre-COVID (March–June 2019), early-COVID (March–June 2020), or late-COVID (March–June 2021). The primary outcome of interest was vaccination status for influenza, Tdap, and COVID-19 vaccines. Fisher's exact and chi-square tests were used to investigate association between vaccination status and time periods, race/ethnicity, and insurance.

**Results** Among 293 pregnancies, influenza vaccination rate was highest in early-COVID ( $p < 0.05$ ). There was no statistically significant difference in Tdap or COVID-19 vaccination between time periods. COVID-19 vaccination was highest in individuals with private insurance ( $p < 0.05$ ). There was no statistically significant difference in vaccination status by race/ethnicity.

**Conclusion** In this study on high-risk pregnant individuals, the majority of our cohort remained unvaccinated against COVID-19 into the late-COVID period. Additionally, their influenza vaccination rates were greater than the national average in early-COVID and substantially lower than the national average in late-COVID. This shift in influenza vaccination acceptance may have been sparked by COVID-19 vaccine distribution beginning in January 2021 leading to overall vaccination hesitancy. Standardized guidelines and counseling concerning prenatal safety in recommended immunizations may serve as important tools of reassurance and health promotion. (Author)

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## 2023-02875

### **Influence of the COVID-19 pandemic and social media on the behaviour of pregnant and lactating women towards vaccination: a scoping review.** De Brabandere L, Hendrickx G, Poels K, et al (2023), BMJ Open vol 13, no 2, February 2023, 066367

**Background** Pregnant women, fetuses and infants are at risk of infectious disease-related complications. Maternal vaccination is a strategy developed to better protect pregnant women and their offspring against infectious disease-related morbidity and mortality. Vaccines against influenza, pertussis and recently also COVID-19 are widely recommended for pregnant women. Yet, there is still a significant amount of hesitation towards maternal vaccination policies. Furthermore, contradictory messages circulating social media impact vaccine confidence.

**Objectives** This scoping review aims to reveal how COVID-19 and COVID-19 vaccination impacted vaccine confidence in pregnant and lactating women. Additionally, this review studied the role social media plays in creating opinions towards vaccination in these target groups.

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Eligibility criteria Articles published between 23 November 2018 and 18 July 2022 that are linked to the objectives of this review were included. Reviews, articles not focusing on the target group, abstracts, articles describing outcomes of COVID-19 infection/COVID-19 vaccination were excluded.

Sources of evidence The PubMed database was searched to select articles. Search terms used were linked to pregnancy, lactation, vaccination, vaccine hesitancy, COVID-19 and social media.

Charting methods Included articles were abstracted and synthesised by one reviewer. Verification was done by a second reviewer. Disagreements were addressed through discussion between reviewers and other researchers.

Results Pregnant and lactating women are generally less likely to accept a COVID-19 vaccine compared with non-pregnant and non-nursing women. The main reason to refuse maternal vaccination is safety concerns. A positive link was detected between COVID-19 vaccine willingness and acceptance of other vaccines during pregnancy. The internet and social media are identified as important information sources for maternal vaccination.

Discussion and conclusion Vaccine hesitancy in pregnant and lactating women remains an important issue, expressing the need for effective interventions to increase vaccine confidence and coverage. The role social media plays in vaccine uptake remains unclear. (Author)

Full URL: <http://dx.doi.org/10.1136/bmjopen-2022-066367>

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## 2023-02640

**Antibody response, neutralizing potency, and transplacental antibody transfer following SARS-CoV-2 infection versus mRNA-1273, BNT162b2 COVID-19 vaccination in pregnancy.** Dude CM, Joseph NT, Forrest AD, et al (2023), International Journal of Gynecology & Obstetrics vol 162, no 1, July 2023, pp 154-162

### Objective

To improve our understanding of the immune response, including the neutralization antibody response, following COVID-19 vaccination in pregnancy.

### Methods

This was a prospective cohort study comprising patients with PCR-confirmed SARS-CoV-2 infection and patients who received both doses of mRNA COVID-19 vaccine (mRNA-1273, BNT162b2) in pregnancy recruited from two hospitals in Atlanta, GA, USA. Maternal blood and cord blood at delivery were assayed for anti-receptor binding domain (RBD) IgG, IgA and IgM, and neutralizing antibody. The detection of antibodies, titers, and maternal to fetal transfer ratios were compared.

### Results

Nearly all patients had detectable RBD-binding IgG in maternal and cord samples. The vaccinated versus infected cohort had a significantly greater proportion of cord samples with detectable neutralizing antibody (94% vs. 28%,  $P < 0.001$ ) and significantly higher transfer ratios for RBD-specific IgG and neutralizing antibodies with a transfer efficiency of 105% (vs. 80%,  $P < 0.001$ ) and 110% (vs. 90%,  $P < 0.001$ ), respectively. There was a significant linear decline in maternal and cord blood RBD-specific IgG and neutralizing antibody titers as time from vaccination to delivery increased.

### Conclusions

Those who receive the mRNA COVID-19 vaccine mount an immune response that is equivalent to—if not greater than—those naturally infected by SARS-CoV-2 during pregnancy. (Author)

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## 2023-02632

**COVID-19 vaccination in pregnancy: Need for global pharmaco-vigilance.** Sarwal Y, Sarwal R (2023), International Journal of

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Coronavirus infectious disease has been around for more than 2 years as a pandemic, but now appears to have taken the form of an endemic. COVID-19 vaccination in pregnant women is presently being recommended and followed in most countries. However, robust scientific evidence on safety of the vaccine in the medium or long term, or regarding any adverse effects, is lacking. We searched the PubMed and gray literature for evidence on medium- or long-term effects of COVID-19 vaccination during pregnancy on the mother or her fetus/newborn and found limited data on this subject. Moreover, available evidence comes almost exclusively from the Western world. Any adverse effects of COVID-19 vaccination during or after pregnancy may take time to manifest. Therefore, there is a need to keep the cohort of vaccinated women and their children under scrutiny for any possible adverse effects. This is also needed to build confidence in the long term in the vaccines. A global pharmaco-vigilance or post-marketing surveillance network covering pregnant recipients of COVID-19 vaccines can identify and help to address any medium- or long-term adverse effects of the COVID-19 vaccines on pregnancy and the newborn. (Author)

## 2023-02628

**Factors associated with COVID-19 vaccination likelihood during pregnancy.** Wainstock T, Sergienko R, Orenshtein S, et al (2023), International Journal of Gynecology & Obstetrics vol 161, no 2, May 2023, pp 478-484

### Objective

To identify maternal background, medical and gynecological characteristics associated with COVID-19 vaccination likelihood, in the context where COVID-19 vaccination rates among pregnant women are significantly lower than the general population.

### Methods

In a retrospective cohort study, including all women who delivered between January and September 2021, background and medical history, including current and previous pregnancies diagnoses, were compared between vaccinated and unvaccinated women. Multivariable logistic models were used to identify factors associated with vaccination for the entire population, and for the two distinctive populations included in the study (Bedouin Arabs and Jewish women).

### Results

The study population included 7017 women, of whom 1925 (27.4%) were vaccinated during pregnancy. According to the multivariable analysis, unvaccinated mothers were younger with lower socioeconomic score. They were more likely to be Bedouin Arabs, have a poor obstetrical history or recurrent pregnancy loss, and insufficient prenatal care. Additional risk factors were inconsistent between the two ethnicities included in the study.

### Conclusions

Ethnicity, insufficient prenatal care, and having a poor obstetric history were consistently associated with lower vaccination among pregnant women. These factors should be considered in future plans aimed at increasing vaccination among pregnant women. (Author)

**Full URL:** <https://doi.org/10.1002/ijgo.14680>

## 2023-02624

**Preliminary results of COVID-19 vaccination among Taiwanese pregnant women: A single-center, prospective, case-control study.** Law KS, Hsu Y-T, Chen H-P (2023), International Journal of Gynecology & Obstetrics vol 162, no 1, July 2023, pp 133-138

### Objective

To evaluate the impacts of messenger RNA coronavirus disease 2019 (COVID-19) vaccines in Taiwanese pregnant women in terms of obstetrical and neonatal outcomes.

### Methods

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The authors prospectively followed up 450 pregnant women receiving vaccination at a single center. Patients recorded prespecified adverse reactions via a mobile application up to 30 days after the first and second doses. Obstetrical and neonatal outcomes were compared with those of pregnant women, during the same period, who did not undergo vaccination.

## Results

Among the 387 women who received the first dose and were followed up for 30 days, injection site pain, fatigue, injection site swelling, muscle ache, and headache were the most prevalent side effects. There were 4.7-, 5.7-, 7.1-, and 9.3-fold increases in fatigue, injection site swelling, muscle ache, and headache, respectively, among the 231 women who received the second dose. Most of the side effects resolved by 14 days and all resolved by 30 days after each doses. There were no significant differences ( $P > 0.05$ ) in obstetrical and neonatal morbidity or mortality between the vaccinated and unvaccinated cohorts.

## Conclusion

No serious adverse reactions were noted among pregnant women receiving messenger RNA vaccinations with comparable obstetrical and neonatal outcomes to unvaccinated pregnant women. (Author)

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## 2023-02623

**Analysis of changing United States Practice Advisory guidelines on COVID-19 vaccine uptake in pregnancy.** Rodriguez GF, Vilarino V, Agasse E, et al (2023), International Journal of Gynecology & Obstetrics vol 162, no 1, July 2023, pp 185-187

The rate of COVID-19 vaccine uptake in pregnant individuals approximately doubled following the release of a US Practice Advisory recommending COVID-19 immunization in pregnancy. (Author)

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## 2023-02599

**Safety and Efficacy of Coronavirus Disease 2019 (COVID-19) mRNA Vaccines During Lactation.** Shook LL, Edlow AG (2023), Obstetrics & Gynecology vol 141, no 3, March 2023, pp. 483-491

In this review, we summarize the data on the safety and side-effect profile of coronavirus disease 2019 (COVID-19) vaccines during lactation to date, review what is known about mRNA vaccine components in breast milk, and discuss the efficacy of COVID-19 vaccines in providing immune protection for the breastfeeding infant. The Centers for Disease Control and Prevention and the American College of Obstetricians and Gynecologists recommend that lactating individuals receive COVID-19 mRNA vaccines and stay up to date on booster doses, including the bivalent COVID-19 booster. The lack of serious side effects in mothers or infants across numerous large studies and registries of COVID-19 vaccination in pregnancy and lactation is reassuring. Although small quantities of mRNA may be transiently detectable in breast milk after maternal vaccination, there are no data demonstrating that vaccine mRNA can survive the infant gastrointestinal tract and no evidence that breast milk from lactating individuals who have received a COVID-19 mRNA vaccine can cause harm to breastfeeding infants. In contrast, numerous studies demonstrate that the breast milk of vaccinated individuals contains severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)-specific functional antibodies and T cells, which benefit the breastfeeding infant's developing immune system. Transfer of SARS-CoV-2-specific antibodies from mother to infant is highest when vaccination occurs during pregnancy compared with lactation, because the breastfeeding infant receives both long-lasting antibodies through the placenta and breast-milk antibodies through breast milk. With clear data demonstrating efficacy and safety and no data demonstrating harm to mother or infant after COVID-19 vaccine administration during lactation, any recommendations to avoid vaccination while breastfeeding or to withhold breast milk from the infant for any period of time after vaccination are not supported by available evidence. (Author)

Full URL: <https://doi.org/10.1097/AOG.0000000000005093>

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## 2023-02597

**Coronavirus Disease 2019 (COVID-19) Vaccination in Pregnancy.** Prabhu M, Riley LE (2023), Obstetrics & Gynecology vol 141, no 3, March 2023, pp. 473-482

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Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection in pregnancy is associated with significant maternal morbidity and mortality, and its risks can be mitigated with coronavirus disease 2019 (COVID-19) vaccination. Vaccination against COVID-19 in pregnancy results in protection against both maternal and neonatal SARS-CoV-2 infection, as well as maternal critical illness. Vaccination during pregnancy is safe, with no documented risks of pregnancy loss, preterm delivery, congenital anomalies, or other adverse perinatal outcomes. For these reasons, COVID-19 vaccination is recommended in pregnancy by the Centers for Disease Control and Prevention, the American College of Obstetricians and Gynecologists, and the Society for Maternal-Fetal Medicine, as well as other national and international professional organizations. In this review, we will summarize the published literature demonstrating the benefit and safety of these vaccines.

The rapid development of coronavirus disease 2019 (COVID-19) vaccines and the limited prospective data on COVID-19 vaccination in pregnancy has resulted in individuals, including pregnant individuals, being fearful of potential risks. The uptake of vaccination has been lower among pregnant individuals as compared with reproductive-aged nonpregnant individuals, with notable disparities by race and ethnicity.<sup>1,2</sup> The most recent data from the Centers for Disease Control and Prevention (CDC) (as of December 31, 2022) show that 72% of pregnant individuals are fully vaccinated with the primary vaccine series.<sup>3</sup> These findings are despite unequivocal data demonstrating increased risks of maternal adverse outcomes (intensive care unit [ICU] admission, mechanical ventilation, death) and fetal or neonatal adverse outcomes (preterm delivery, stillbirth) with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection during pregnancy.<sup>4</sup>

The primary goal of coronavirus disease 2019 (COVID-19) vaccination is to prevent severe disease, hospitalization, and death due to COVID-19. Initial randomized controlled trial data for the Pfizer-BioNTech (BNT162b2) and Moderna (mRNA-1273) mRNA vaccines demonstrated 91% and 93% efficacy, respectively, against laboratory-confirmed SARS-CoV-2 infection, with some decline in vaccine efficacy with time elapsed since the last dose.<sup>5,6</sup> These initial studies were completed before the development of novel SARS-CoV-2 variants. Over the past 2 years, real-world experience and subsequent data have demonstrated lower vaccine efficacy against infection; thus, a bivalent booster targeting the native SARS-CoV-2 strain as well as the Omicron strain was developed.

In this narrative review, we provide evidence-based answers to common questions faced by clinicians caring for pregnant individuals. We discuss the efficacy of COVID-19 vaccines by summarizing the published literature on the maternal antibody response to vaccination and on the decreased risks of SARS-CoV-2 infection during pregnancy with vaccination, present the neonatal benefit of maternal vaccination, and highlight the documented safety profile of vaccination during pregnancy. We will focus primarily on mRNA-based vaccines, because these are the most available vaccines in the United States. (Author)

**Full URL:** <https://doi.org/10.1097/AOG.0000000000005100>

## 2023-02593

**Pregnancy Outcomes in Patients After Completion of the mRNA Coronavirus Disease 2019 (COVID-19) Vaccination Series Compared With Unvaccinated Patients.** Morgan JA, Biggio Jr JR, Martin JK, et al (2023), *Obstetrics & Gynecology* vol 141, no 3, March 2023, pp. 555-562

### OBJECTIVE:

To compare frequency of perinatal death between pregnant patients who completed the mRNA coronavirus disease 2019 (COVID-19) vaccination series and unvaccinated patients.

### METHODS:

This retrospective cohort study included 15,865 pregnant patients who delivered 16,132 newborns after 20 weeks of gestation within a large regional health system between January 1, 2021, and December 31, 2021. Patients who received two doses of mRNA vaccine (Pfizer–BioNTech [BNT162b2] or Moderna [mRNA-1273]) were included in the vaccinated group and were compared with unvaccinated patients. Exclusions included partial vaccination, viral-vector vaccine, major congenital anomalies, and higher-order multiple gestation. Our primary outcome was perinatal death,

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including stillbirth and neonatal death, which was evaluated by logistic regression. Unadjusted odds ratios and adjusted odds ratios (aORs) were reported, controlling for age, body mass index (BMI), diabetes, hypertension, smoking, twin gestation, and insurance status. Propensity score matching was also performed.

#### RESULTS:

A total of 15,865 patients were included in the final analysis: 2,069 in the vaccination group and 13,796 in the control group. Only 13.0% of the cohort was included in the vaccination group; however, the vaccination rate increased over the course of the study period as the vaccine became more widely available and accepted. Vaccinated patients were older, with higher rates of people of non-Black racial non-Hispanic ethnic backgrounds, people with private insurance, and those with higher BMIs. Vaccination was associated with a lower incidence of perinatal death (0.5% vaccinated group vs 0.8% unvaccinated group, aOR 0.20 0.05–0.88). Vaccination against COVID-19 was also associated with lower rates of preterm delivery (aOR 0.63, 0.48–0.82), neonates with very low birth weight (aOR 0.35, 0.15–0.84), and neonatal intensive care unit (NICU) admission (aOR 0.66, 0.52–0.85). The association between vaccination and lower rates of perinatal death was no longer significant after propensity score matching.

#### CONCLUSION:

In a large retrospective cohort study, receipt of the primary mRNA COVID-19 vaccination series was associated with a lower rate of several adverse pregnancy outcomes, including perinatal death, preterm delivery, neonates with very low birth weight, and NICU admission. Although the decreased rates of perinatal death did not remain significant after propensity score matching, there was evidence of directional benefit for vaccinated patients. (Author)

Full URL: <https://doi.org/10.1097/AOG.0000000000005072>

#### 2023-02530

**COVID-19 vaccination during pregnancy: a systematic review and meta-analysis.** Shafiee A, Kohandel Gargari O, Teymouri Athar MM, et al (2023), BMC Pregnancy and Childbirth vol 23, no 45, January 2023

#### Background

SARS-CoV-2 exposure during pregnancy is related to adverse effects for both the mother and the infant. SARS-CoV-2 vaccination has lowered the risk of symptomatic disease substantially. Recently published studies have evaluated the outcomes of women who received the COVID-19 vaccine during pregnancy; systematic evidence regarding vaccination safety is crucial to ensure that COVID-19 vaccination is not associated with adverse pregnancy and neonatal outcomes.

#### Methods

Pubmed/MEDLINE, EMBASE, Scopus, Web of Science, and Clinicaltrials.gov were searched from each database's inception through April 7, 2022. All interventional and observational studies comparing neonatal or pregnancy outcomes between pregnant women who received COVID-19 vaccines during their pregnancy and unvaccinated pregnant women were included. The random-effects model was used in the meta-analyses.

#### Results

A total of 11 studies comprising 756,098 pregnant mothers were included. The rate of neonates with 5-min Apgar score  $\leq 7$  (log RR -0.08 (95% CI: -0.15 to -0.00), (P = 0.03)) and pregnant mothers with preterm birth (log RR -0.11 (95% CI: -0.21 to -0.01), (P = 0.02)) was significantly lower among vaccinated group. No significant difference was observed in adverse neonatal outcomes (log RR -0.07 (95% CI: -0.17 to 0.03)), small for gestational age (log RR -0.06 (95% CI: -0.14 to 0.02)), caesarean delivery (log RR 0.05 (95% CI: -0.05 to 0.15)), postpartum hemorrhage (log RR -0.05 (95% CI: -0.13 to 0.02)), stillbirth (log RR -0.05 (95% CI: -0.54 to 0.45)).

#### Conclusions and relevance

In this systematic review and meta-analysis, no evident differences were observed when comparing vaccinated pregnant mothers with those who had not received COVID-19 vaccines. Based on low certainty of evidence, vaccination during pregnancy was accompanied by a favorable Apgar score in neonates and fewer preterm births.

(Author)

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## 2023-02422

### **Detection of SARS-CoV-2 IgA and IgG in human milk and breastfeeding infant stool 6 months after maternal COVID-19**

**vaccination.** Stafford LS, Valcarce V, Henry M, et al (2023), Journal of Perinatology vol 43, no 6, June 2023, pp 775–781

#### Objective

Assess presence, durability, and neutralization capacity of SARS-CoV-2-specific antibodies in breastfeeding infants' stool, mother's plasma and milk following maternal vaccination.

#### Design

Thirty-seven mothers and 25 infants were enrolled between December 2020 and November 2021 for this prospective observational study. All mothers were vaccinated during lactation except three, which were vaccinated during pregnancy. Milk, maternal plasma, and infants' stool was collected pre-vaccination and at periods up to 6 months following COVID-19 vaccine series initiation/completion. SARS-CoV-2 antibody levels and their neutralization capacities were assessed.

#### Results

SARS-CoV-2-specific IgA and IgG levels were higher in infant stool post-maternal vaccination amongst milk-fed compared to controls. Maternal SARS-CoV-2-specific IgA and IgG concentrations decreased over 6 months post-vaccination but remained higher than pre-vaccination levels. We observed improved neutralization capacity in milk and plasma after COVID-19 vaccination.

#### Conclusions

The presence of SARS-CoV-2-specific antibodies in infant stool following maternal vaccination offers further evidence of the lasting transfer of these antibodies through breastfeeding. (Author)

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## 2023-02338

### **Current Evidence to Guide Practice, Policy, and Research: COVID-19 Vaccination During Pregnancy.** Hawkins SS (2023),

JOGNN: Journal of Obstetric, Gynecologic and Neonatal Nursing vol 52, no 2, March 2023, pp 159-167

Pregnant and lactating women continue to have some of the lowest levels of vaccine uptake despite COVID-19 vaccine recommendations. It is important to consider why COVID-19 vaccine uptake has lagged counter to robust evidence on vaccine benefits, including concerns about vaccine safety and effectiveness. In this column, I present a summary of research findings, limitations, future directions, and a compilation of guidelines and recommendations from professional and governmental organizations. (Author)

Full URL: <https://doi.org/10.1016/j.jogn.2023.01.001>

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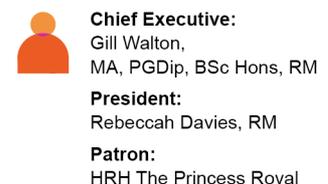
## 2023-02329

### **Associations of COVID-19 vaccination during pregnancy with adverse neonatal and maternal outcomes: A systematic review and meta-analysis.** Ding C, Liu Y, Pang W, et al (2023), Frontiers in Public Health 30 January 2023, online

**Objectives:** The low COVID-19 vaccine uptake rate among pregnant women is mainly due to safety concerns about COVID-19 vaccines due to limited safety evidence. Our goal was to evaluate the safety of COVID-19 vaccination during pregnancy with up-to-date evidence.

**Methods:** A comprehensive search of MEDLINE, EMBASE, the Cochrane Library, and clinicaltrials.gov was performed on April 5th, 2022, and updated on May 25th, 2022. Studies evaluating the association of COVID-19 vaccination during pregnancy with adverse maternal and neonatal outcomes were included. Two reviewers independently performed the risk of bias assessment and data extraction. Inverse variance random effect meta-analyses were performed to pool outcome data.

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Results: Forty-three observational studies were included. COVID-19 vaccination [96,384 (73.9%) BNT162b2, 30,889 (23.7%) mRNA-1273, and 3,172 (2.4%) other types] during pregnancy [23,721 (18.3%) in the first trimester, 52,778 (40.5%) in the second trimester, and 53,886 (41.2%) in the third trimester].was associated with reduced risks of stillbirth or neonatal death (OR, 0.74; 95% CI, 0.60–0.92). Sensitivity analysis restricted to studies in participants without COVID-19 showed that the pooled effect was not robust. COVID-19 vaccination during pregnancy was not associated with congenital anomalies (OR, 0.83; 95% CI, 0.63–1.08), preterm birth (OR, 0.98; 95% CI, 0.90–1.06), NICU admission or hospitalization (OR, 0.94; 95% CI, 0.84–1.04), an Apgar score at 5 min <7 (OR, 0.93; 95% CI, 0.86–1.01), low birth weight (OR, 1.00; 95% CI, 0.88–1.14), miscarriage (OR, 0.99; 95% CI, 0.88–1.11), cesarean delivery (OR, 1.07; 95% CI, 0.96–1.19), or postpartum hemorrhage (OR, 0.91; 95% CI, 0.81–1.01).

Conclusions: COVID-19 vaccination during pregnancy was not associated with any of the adverse neonatal or maternal outcomes studied. Interpretation of study findings is limited by the types and timing of vaccination. The vaccinations in our study received during pregnancy were primarily mRNA vaccines administered in the second and third trimester. Future RCTs and meta-analysis are warranted to evaluate the efficacy and long-term effects of the COVID-19 vaccines.

(Author)

Full URL: <https://doi.org/10.3389/fpubh.2023.1044031>

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### 2023-02240

**Neutralizing antibodies against SARS-CoV-2 in Brazilian pregnant women vaccinated with one or two doses of BNT162b2 mRNA vaccine (Pfizer/Wyeth™).** da Silva MC, da Silva NCH, Ferreira ALCG, et al (2023), *Frontiers in Public Health* 4 January 2023, online

Pregnant women have an increased risk of developing severe coronavirus disease. In Brazil, the number of hospitalizations and adverse outcomes, including death caused by COVID-19, in women during the pregnancy-puerperal cycle was high in the first pandemic year. Doubts regarding vaccines' efficacy and safety for the mother and fetus delayed vaccination. This study evaluated the generation of IgG titers and neutralizing antibodies to the BNT162b2 mRNA vaccine in 209 healthy pregnant women. For this, were used the QuantiVac ELISA (IgG) and SARS-CoV-2 NeutralISA kits (EUROIMMUN, Lübeck, SH) following the manufacturer's recommendations. One dose vaccine produced anti-SARS-CoV-2 IgG in 85% (81/95), and two produced in 95% (76/80) women. Among unvaccinated women, four of 34 (12%) showed protection. The first dose of the BNT162b2 vaccine protected 69% of the women with neutralizing antibodies (median of %IH = 97). In the second dose, protection occurred in 94% of the pregnant women (median of IH% = 97). This study showed no differences in IgG antibody titers between one- and two-dose of the BNT162b2 mRNA vaccine groups, boosting with the second dose increased the number of women who produced specific IgG and neutralizing antibodies, raising by 114-folds the chance of producing the SARS-CoV-2 neutralizing antibodies compared to the unvaccinated pregnant woman, which may contribute to reduce the chance of severe COVID-19. (Author)

Full URL: <https://doi.org/10.3389/fpubh.2022.1054460>

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### 2023-02137

**Maternal mRNA covid-19 vaccination during pregnancy and delta or omicron infection or hospital admission in infants: test negative design study.** Jorgensen SCJ, Hernandez A, Fell DB, et al (2023), *British Medical Journal* vol 380, no 8370, February 2023, e074035

Objective To estimate the effectiveness of maternal mRNA covid-19 vaccination during pregnancy against delta and omicron severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection and hospital admission in infants.

Design Test negative design study.

Setting Community and hospital testing in Ontario, Canada.

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Participants Infants younger than six months of age, born between 7 May 2021 and 31 March 2022, who were tested for SARS-CoV-2 between 7 May 2021 and 5 September 2022.

Intervention Maternal mRNA covid-19 vaccination during pregnancy.

Main outcome measures Laboratory confirmed delta or omicron infection or hospital admission of the infant.

Multivariable logistic regression estimated vaccine effectiveness, with adjustments for clinical and sociodemographic characteristics associated with vaccination and infection.

Results 8809 infants met eligibility criteria, including 99 delta cases (4365 controls) and 1501 omicron cases (4847 controls). Infant vaccine effectiveness from two maternal doses was 95% (95% confidence interval 88% to 98%) against delta infection and 97% (73% to 100%) against infant hospital admission due to delta and 45% (37% to 53%) against omicron infection and 53% (39% to 64%) against hospital admission due to omicron. Vaccine effectiveness for three doses was 73% (61% to 80%) against omicron infection and 80% (64% to 89%) against hospital admission due to omicron. Vaccine effectiveness for two doses against infant omicron infection was highest with the second dose in the third trimester (53% (42% to 62%)) compared with the first (47% (31% to 59%)) or second (37% (24% to 47%)) trimesters. Vaccine effectiveness for two doses against infant omicron infection decreased from 57% (44% to 66%) between birth and eight weeks to 40% (21% to 54%) after 16 weeks of age.

Conclusions Maternal covid-19 vaccination with a second dose during pregnancy was highly effective against delta and moderately effective against omicron infection and hospital admission in infants during the first six months of life. A third vaccine dose bolstered protection against omicron. Effectiveness for two doses was highest with maternal vaccination in the third trimester, and effectiveness decreased in infants beyond eight weeks of age. (Author)

Full URL: <https://doi.org/10.1136/bmj-2022-074035>

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## 2023-02120

**COVID-19 vaccination in pregnancy.** Girling J (2021), Drug and Therapeutics Bulletin vol 59, no 6, 2021

Editorial commenting on the exclusion of pregnant and breastfeeding women from COVID-19 vaccination research in the early days of the pandemic. (MB)

Full URL: <http://dx.doi.org/10.1136/dtb.2021.000002>

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## 2023-01929

**Correlations between attitudes towards the COVID-19 vaccine and psychiatric symptoms among pregnant women.**

Ayık B, Yılmaz S (2023), International Journal of Gynecology & Obstetrics vol 162, no 1, July 2023, pp 88-94

Objective

As data continue to show that COVID-19 vaccines are safe for pregnant women, determining the factors that affect their attitudes towards vaccines has become increasingly important. Pregnancy increases the risk of depressive and obsessive-compulsive (OC) symptoms. We aimed to determine the correlations between psychiatric symptoms and attitudes towards vaccination in pregnant women.

Methods

A total of 100 pregnant women were enrolled in the present cross-sectional study. We used a standard data form to obtain the participants' sociodemographic and clinical characteristics. The Attitudes Towards the COVID-19 Vaccine Scale, the Maudsley Obsessive-Compulsive Inventory (MOCI) and the Depression Anxiety Stress Scale (DASS-21) were used to measure attitudes towards vaccination and psychiatric symptoms. We then investigated the correlations between the scale scores.

Results

There was a significant correlation between positive, negative, and total attitudes towards vaccines and MOCI total

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and subscale scores. According to the linear regression model, variables of MOCI total score, planned/unplanned pregnancy, and age were determined as the predictors for vaccination attitudes towards COVID-19 vaccines.

#### Conclusion

Increased OC symptoms seem to be associated with negative attitudes towards vaccination. It is important to screen pregnant women with lower vaccination rates for OC symptoms more carefully. A multidisciplinary approach would be beneficial to increase vaccination rates. (Author)

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#### 2023-01778

##### **Pregnant individuals' information needs and intention to vaccinate their children with routine and COVID-19**

**vaccines: Findings from a cross-sectional survey.** Vasudevan L, Stinnett SS, Hart L, et al (2023), International Journal of Gynecology & Obstetrics vol 162, no 1, July 2023, pp 78-87

#### Objective

The current study assessed pregnant individuals' intention to accept routine and COVID-19 vaccines for their baby after birth, and to identify key demographic (e.g., age) and nondemographic characteristics (e.g., prior birth) associated with vaccination intention.

#### Methods

The authors conducted a cross-sectional survey with pregnant individuals attending prenatal practices affiliated with a large academic medical center and two rural county health departments in the southeastern United States. The survey included 11 questions and was self-administered by pregnant individuals in clinic settings. The final analysis included responses from 443 pregnant individuals.

#### Results

Only 67% of pregnant individuals planned to vaccinate their baby with all recommended routine vaccines; an additional 22% reported having questions about recommendations. Only 35% of pregnant individuals said they would vaccinate their baby as soon as possible with a COVID-19 vaccine. Younger pregnant individuals and those identifying as Black or African American had lower routine and COVID-19 vaccination intention. Routine vaccination, but not COVID-19 vaccination intention, was associated with familiarity with routine vaccination schedule, trimester of pregnancy, Hispanic ethnicity, history of prior birth, and having access to a computer.

#### Conclusion

Study findings support differential tailoring of future interventions targeting pregnant individuals to promote routine and COVID-19 vaccines for children. (Author)

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#### 2023-01771

**Safety of COVID-19 vaccination in pregnant women: A study of the adverse perinatal outcomes.** Kugelman N, Riskin A, Kedar R, et al (2023), International Journal of Gynecology & Obstetrics vol 161, no 1, April 2023, pp 298-302

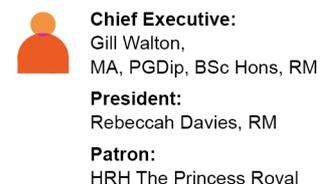
#### Objective

To compare adverse perinatal outcome among coronavirus disease 2019 (COVID-19)–vaccinated and –unvaccinated pregnant women.

#### Method

Retrospective equivalence cohort study comparing 930 women who received at least one BNT162b2 (Pfizer/BioNTech) COVID-19 vaccine during the second or third trimester of pregnancy and 964 unvaccinated women. The primary outcome was a composite adverse perinatal outcome including at least one of the following: preterm delivery <35 weeks of gestation, intrauterine fetal death >23 weeks of gestation, intrauterine growth restriction defined as birth weight < 10th percentile, 5-min APGAR score ≤ 7, and neonatal care unit admission.

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## Results

The authors found no effect of the COVID-19 vaccine on the rate of the individual adverse perinatal outcomes. At least one adverse perinatal outcome was found in 108 (11.25%) of unvaccinated women versus 82 (8.82%) of vaccinated pregnant women ( $P = 0.080$ ). The observed proportion difference (unvaccinated minus vaccinated) was 0.024. In the equivalence analysis with a margin of 0.05, the 90% confidence interval (0.01–0.05) was entirely within the equivalence zone (–0.05 to 0.05) with a  $P$  value of 0.032.

## Conclusion

The present study demonstrated an equivalent rate of adverse perinatal outcomes among vaccinated and unvaccinated women, thus supporting vaccine safety during the second and third trimesters of pregnancy. The authors believe this information is useful in counseling pregnant women regarding COVID-19 vaccination during pregnancy.

(Author)

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## 2023-01721

### **Increase in SARS-CoV-2 RBD-Specific IgA and IgG Antibodies in Human Milk From Lactating Women Following the COVID-19 Booster Vaccination.** Henle AM (2023), vol 39, no 1, February 2023, pp 51–58

#### Background:

The United States Centers for Disease Control and Prevention recommended a third dose or booster of the Pfizer-BioNTech Comirnaty (BNT162b2) COVID-19 mRNA vaccine in September 2021 for high-risk individuals. Pregnant and high-risk lactating women were encouraged to receive the booster to obtain potential prolonged protection for themselves and their infants.

#### Research Aim:

To investigate the ability of the booster vaccine to increase IgA and IgG antibodies specific to the receptor-binding domain of the SARS-CoV-2 spike protein in human milk compared to levels pre-booster.

#### Methods:

This was a prospective one-group study with a pretest-posttest design. Six of 12 participants were recruited prospectively. Participants were instructed to collect  $\geq 2$  ounces of milk in the morning at 30 days and 1-day pre-booster, and 7, 14, 21, 30, 45, and 60 days post-booster. Levels of IgA and IgG antibodies specific to the receptor-binding domain of the SARS-CoV-2 spike protein were quantified in human milk via an ELISA assay.

#### Results:

We found a significant increase in anti-receptor-binding domain-specific IgA and IgG antibodies in human milk 1–2 weeks after the Pfizer-BioNTech booster and at the study endpoint (45- and 60-days post-booster)

#### Conclusions:

This suggests that the booster vaccination enhances SARS-CoV-2 specific immunity in human milk, which may be protective for infants. (Author)

**Full URL:** <https://doi.org/10.1177/08903344221134631>

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## 2023-01716

### **Development of SARS-CoV-2 specific IgG and IgA antibodies in serum and milk with different SARS-COV-2 vaccines in lactating women.** Lechosa-Muñiz C, Paz-Zulueta M, Irure-Ventura J, et al (2023), International Breastfeeding Journal vol 18, no 3, January 2023

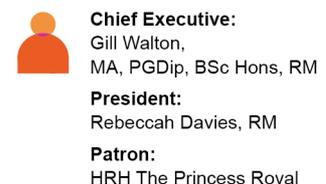
#### Background

Our main objective was to determine the evolution of IgG and IgA antibodies directed against SARS-CoV-2 protein S in the blood of lactating women and in breast milk.

#### Methods

A cohort of 110 uninfected and vaccinated breastfeeding women was followed-up for 6 months at the Marqués de Valdecilla University Hospital, Spain, in 2020. An additional group of 23 breastfeeding mothers who had no previously documented infection and had not been vaccinated against SARS-CoV-2 were included as a control group. The

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antibodies in blood and breast milk and their evolution at 6 months post-vaccination were analysed.

## Results

One hundred ten breastfeeding mothers were included; 70 women (63.6%) were vaccinated with two doses of BNT162b2, 20 women (18.2%) received two doses of mRNA-1273, and 20 women (18.2%) received a single dose of ChAdOx1-S. No evidence of differences between concentrations of antibodies was found according to the type of vaccine, with the exception of serum IgA antibodies, which was higher in women vaccinated with mRNA-1273: mean [95%CI]: 0.05 AU/mL [0.03,0.06] with mRNA-1273, 0.02 AU/mL [0.01,0.03] with BNT162b2 and 0.01 AU/mL [0.00,0.03] with ChAdOx1-S, ANOVA p value = 0.03. The lack of difference between vaccines was also found when anti-S1 specific IgG in serum and breast milk were measured.

## Conclusions

In lactating women vaccinated against COVID-19, anti-SARS-CoV-2 antibodies can be detected in both serum and breastmilk 6 months after receiving the second dose, although their concentrations decreased when compared with concentrations reached immediately after vaccination. (Author)

Full URL: <https://doi.org/10.1186/s13006-022-00536-y>

## 2023-01441

### Does Maternal SARS-CoV-2 Infection or SARS-CoV-2 Vaccination Trigger an Inflammatory Response in the Fetus? A

**Prospective Cohort Study.** Alhousseini A, Turkoglu O, Sajja S, et al (2022), *Gynecologic and Obstetric Investigation* vol 87, no 3-4, 2022, pp 219-225

**Objectives:** SARS-CoV-2 infection triggers a significant maternal inflammatory response. There is a dearth of information regarding whether maternal SARS-CoV-2 infection at admission for delivery or SARS-CoV-2 vaccination triggers an inflammatory response in the fetus. This study aims at evaluating fetal inflammatory response to maternal SARS-CoV-2 infection or SARS-CoV-2 vaccination compared to control group. **Design, Participants, Setting, and Methods:** A prospective cohort study was performed with a total of 61 pregnant women who presented for delivery at a single medical center (William Beaumont Hospital, Royal Oak, MI). All mothers were tested for SARS-CoV-2 infection using polymerase chain reaction (PCR) on admission to labor and delivery unit. Three groups were evaluated: 22 pregnant with a positive SARS-CoV-2 test (case group), 23 pregnant women with a negative SARS-CoV-2 test (control group), and 16 pregnant women who had recent SARS-CoV-2 vaccination and a negative SARS-CoV-2 test (vaccine group). At delivery, cord blood was collected to determine the levels of IL-6, C-reactive protein (CRP), and SARS-CoV-2 nucleocapsid IgG and IgM antibodies. In all cases, the newborn had a negative PCR test or showed no clinical findings consistent with SARS-CoV-2 infection. **Results:** Mean (SD) IL-6 level was not significantly different for the three groups: case group  $9.00 \pm 3.340$  pg/mL, control group  $5.19 \pm 0.759$  pg/mL, and vaccine group  $7.11 \pm 2.468$  pg/mL (p value 0.855). Pairwise comparison also revealed no statistical difference for IL-6 concentrations with p values for case versus control, case versus vaccine, and control versus vaccine = 0.57, 0.91, and 0.74, respectively. Similarly, there was no statistically significant difference in the frequency of elevated IL-6 (>11 pg/mL) between groups (p value 0.89). CRP levels across the three groups were not statistically significant different (p value 0.634). Pairwise comparison of CRP levels among the different groups was also not statistically different. SARS-CoV-2 nucleocapsid IgG was positive in 12 out of 22 cord blood samples in the case group, 2 out of 23 of the control group (indicating old resolved maternal infection), and 0 out of 16 of the vaccine group. SARS-CoV-2 nucleocapsid IgM was negative in all cord blood samples of the case group, control group, and vaccine group. **Limitations:** A total number of 61 mothers enrolled in the study which represents a relatively small number of patients. Most patients with positive SARS-CoV-2 PCR were mainly asymptomatic. In addition, our vaccine group received the mRNA-based vaccines (mRNA1273 and BNT162b2). We did not study fetal response to other SARS-CoV-2 vaccines. **Conclusion:** In our prospective cohort, neither IL-6 nor CRP indicated increased inflammation in the cord blood of newborns of SARS-CoV-2-infected or vaccinated mothers.

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**2023-01341**

**COVID-19 vaccine acceptance among pregnant women and the reasons for hesitancy: A multi-centre cross-sectional survey.** Rikard-Bell M, Elhindi J, Lam J, et al (2023), Australian and New Zealand Journal of Obstetrics and Gynaecology (ANZJOG) vol 63, no 3, June 2023, pp 335-343

**Background**

On 9 June 2021, the Australian Technical Advisory Group on Immunisation and Royal Australian and New Zealand College of Obstetricians and Gynaecologists recommended that pregnant women receive Comirnaty (Pfizer) messenger RNA vaccine at any stage of pregnancy.

**Aim**

This multi-centre study aimed to assess vaccine acceptance, reasons for hesitancy and determine if differences exist between health districts, to inform future policy strategies for COVID-19 vaccination in pregnancy.

**Materials and methods**

An online survey (developed based on the World Health Organization Behavioural and Social Drivers survey and modified for the pregnant population) was administered to a sample population of pregnant women attending antenatal clinics at two metropolitan hospitals (Westmead and Royal North Shore Hospital (RNSH)) in New South Wales between 15 September 2021 and 22 October 2021.

**Results**

There were 287 pregnant women surveyed (Westmead 198 (69%), RNSH 66 (23%), no site 23 (8%)). There was a significantly lower Socio-Economic Indexes for Areas score (5.66 vs 9.45,  $P = 0.001$ ), fewer women born in Australia (37% vs 53%,  $P = 0.02$ ) and higher number of children (0.77 vs 0.41,  $P = 0.01$ ) among Westmead respondents. There was lower vaccination uptake (68% vs 86%,  $P = 0.01$ ) and willingness to receive vaccine (68% vs 88%  $P = 0.01$ ) at Westmead compared to RNSH. There was an increased proportion of respondents who were concerned that the vaccine could cause harm to the unborn baby at Westmead (38% vs 11%,  $P = 0.01$ ).

**Conclusions**

Along with healthcare provider recommendation for vaccination in pregnancy, materials should be targeted to specific safety concerns of pregnant women. (Author)

**Full URL:** <https://doi.org/10.1111/ajog.13622>

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**2023-01290**

**Effectiveness and safety of COVID-19 vaccine in pregnant women: A systematic review with meta-analysis.** Tormen M, Taliento C, Salvioli S, et al (2023), BJOG: An International Journal of Obstetrics and Gynaecology vol 130, no 4, March 2023, pp 348-357

**Background**

There are limited data regarding COVID-19 vaccination during pregnancy.

**Objectives**

To evaluate the effects of COVID-19 vaccination received during pregnancy on SARS-CoV-2 infection, COVID-19-related hospitalisation, COVID-19-related intensive care unit (ICU) admission and maternal–fetal complications.

**Search strategy**

MEDLINE, CINHAL, Embase, Scopus and CENTRAL databases, as well as ClinicalTrials.gov, reference lists, related articles and grey literature sources.

**Selection criteria**

Randomised controlled trials, non-randomised studies of interventions, pregnant women, COVID-19 vaccination during pregnancy.

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## Data collection and analysis

Study selection, risk-of-bias assessment, data extraction and assessment of the certainty of evidence using the GRADE method were performed independently by two authors. Meta-analyses were performed using Cochrane RevMan 5.4. PROSPERO registration number: CRD42022308849.

## Main results

We included 14 observational studies (362 353 women). The administration of a COVID-19 vaccine during pregnancy resulted in a statistically significant reduction in SARS-CoV-2 infection (OR 0.46, 95% CI 0.28–0.76) and COVID-19-related hospitalisation (OR 0.41, 95% CI 0.33–0.51). The effect appeared to be greater in fully vaccinated women, for both infection (OR 0.31, 95% CI 0.16–0.59) and hospitalisation (OR 0.15, 95% CI 0.10–0.21). However, the certainty of evidence was very low. The difference in COVID-19-related ICU admission between vaccinated and unvaccinated individuals did not reach statistical significance (OR 0.58, 95% CI 0.13–2.58). Finally, there were no statistically significant differences in any of the maternal–fetal complications considered in the included studies.

## Conclusions

COVID-19 vaccination administered during pregnancy seems to reduce SARS-CoV-2 infection and COVID-19-related hospitalisation, with no significant effects on maternal–fetal complications. (Author)

**Full URL:** <https://doi.org/10.1111/1471-0528.17354>

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## 2023-01259

**Knowledge and attitudes of pregnant women about Coronavirus vaccines in Turkiye.** Odabaş RK, Demir R, Taspınar A (2022), *Journal of Obstetrics and Gynaecology* 12 November 2022, online

The aim of this cross-sectional study was to determine pregnant women's knowledge and attitudes regarding coronavirus vaccines in Turkiye. The research population consisted of 400 pregnant women who applied to a public hospital in this city. The data of the study was collected with the 'Personal Information Form' and 'Attitudes Towards COVID-19 Vaccine Scale'. Only 2% of the pregnant women stated that they wanted to receive coronavirus vaccines in their current pregnancy and 9.5% wanted it during the postpartum period. It has been concluded that the vast majority of pregnant women have insufficient knowledge and negative thoughts about coronavirus vaccines and the place where they live and their thoughts on the safety of coronavirus vaccines affect their positive attitudes about coronavirus vaccines.

## IMPACT STATEMENT

What is already known on this subject? Many epidemics in history have been controlled or eliminated with vaccines. However, there is still insufficient evidence about the effects of coronavirus infection and vaccines on pregnant women.

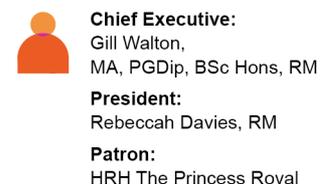
What do the results of this study add? As a result, it was found that the vast majority of pregnant women had insufficient knowledge and negative thoughts about coronavirus vaccines and very few of them wanted to receive the coronavirus vaccine during pregnancy and the postpartum period.

What are the implications of these findings for clinical practice and/or further research? In the light of these findings, it is recommended that increase the vaccination rates in pregnant women by turning existing negative attitudes towards coronavirus vaccines in pregnant women into positive ones, providing accurate and effective information by health professionals and the media to eliminate negative attitudes caused by lack of information in pregnant women, conducting more studies on obstacles to increasing vaccine acceptance during pregnancy, and conducting studies on the subject with wider audiences and regions. (Author)

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## 2023-01234

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**Pregnant women's acceptance and views on COVID-19 vaccine in Northern Italy.** Lubrano C, Vilca LM, Coco C, et al (2023), Journal of Obstetrics and Gynaecology vol 43, no 1, 2023

The rate of COVID-19 associated ICU admissions among pregnant women increased threefold in Italy between February 2021 and June 2021, compared to February 2020 and January 2021 (Donati et al. Citation2022). Similarly, in the UK, a 1.6-times higher rate of ICU admissions among pregnant women was reported during the Delta circulation period compared to the Alpha period (Vousden et al. Citation2022). Based on these findings and with the mounting evidence on vaccine safety, Italy extended vaccine recommendation to all pregnant women in September 2021 (Circolare del Ministero della Salute Citation2021). Due to the scarcity of European data at the time of the study, we aimed to estimate maternal COVID-19 vaccine uptake as well as vaccination barriers in the Lombardy region. (Author)

Full URL: <https://doi.org/10.1080/01443615.2022.2139596>

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**2023-00579**

**Perceived barriers to Palestinian pregnant women's acceptance of COVID-19 vaccination using the Health Believe**

**Model: a cross-sectional study.** Qasrawi H, Abdullah I, Masri H, et al (2022), Women and Health vol 62, no 8, September 2022, pp 678-687

This study aims to explore pregnant women's attitudes to COVID-19 vaccination and determinants of vaccine acceptance. We conducted a cross-sectional study among pregnant women attending PHC clinics and hospitals in the West-bank of Palestine. We used an interviewer-administered questionnaire based on Health Belief Model. The study's primary outcome was COVID-19 vaccination acceptance. We used the Chi-square test to compare those who accepted the vaccine versus those who refused it and conducted binary logistic regression to explore independent determinants of vaccination acceptance. Among the 728 pregnant women who took part in the study, 20.7 percent showed positive attitudes (acceptance) toward COVID-19 vaccination. Employment (aOR 4.0; 95 percentCI: 2.2–7.3), a history of COVID-19 (aOR 1.9; 95 percentCI: 1.2–3.1), and having a relative who died from COVID-19 (aOR 2.3; 95 percentCI: 1.2–4.7) increased the likelihood of vaccine acceptance, as did vaccine perceived effectiveness (aOR 1.9; 95 percentCI: 1.2–3.2) and perceived protection from severe disease (aOR 2.0; 95 percentCI: 1.2–3.5). On the other hand, perceived limited access (aOR 0.540; 95 percentCI: 0.31–0.87) and perceived harm to the baby (aOR 0.346; 95 percentCI 0.22–0.54) remained the main barriers toward vaccine acceptance. In conclusion, pregnant women's acceptance of the COVID-19 vaccine is unsatisfactory. Concerns about its effect on unborn babies were major barriers to vaccination. (Author)

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**2023-00523**

**COVID-19 vaccinations in pregnancy: Save mother and baby from COVID-19 pandemic.** Sunder A, Alqatari HM, Taha OE, et al (2023), International Journal of Gynecology & Obstetrics vol 160, no 3, March 2023, pp 864-873

**Objective**

The current study investigated the immune response of maternal coronavirus disease 2019 (COVID-19) vaccination and vertical transmission of anti-severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) spike (S) and nucleocapsid (N) proteins.

**Study design**

This retrospective study included pregnant women in Bahrain Defense Force Hospital from March 2021 to September 2021 who were vaccinated with Sinopharm or Pfizer/BioNTech. Testing of anti-N and -S levels from paired samples of maternal and umbilical cord blood was performed at the time of delivery. The immune response to vaccination, association with maternal and fetal factors, and vertical transmission of antibodies were studied.

**Results**

The current study included 79 pregnant women. The median gestational age for those vaccinated with Sinopharm was 28 weeks and those vaccinated with Pfizer was 31 weeks, with 100% of the vaccinated population generating antibodies and showing vertical transmission. The anti-N and -S titers and interval frequencies varied in both vaccinations. The anti-N and -S and transfer ratio statistically correlated with maternal age, gestational age at delivery,

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latency period, and birth weight of the neonates differently in both vaccines. In addition, the peak level of antibodies and transfer ratios varied.

#### Conclusion

Although variations are exhibited in both types of vaccination, the vaccinated pregnant population generated a significant level of anti-N and -S and showed vertical transmission. (Author)

Full URL: <https://doi.org/10.1002/ijgo.14532>

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#### 2023-00451

**Sociodemographic predictors of COVID-19 vaccine hesitancy and leading concerns with COVID-19 vaccines among pregnant women at a South Texas clinic.** Sutanto MY, Hosek MG, Stumpff SK, et al (2022), *Journal of Maternal-Fetal and Neonatal Medicine* vol 35, no 26, 2022, pp 10368-10374

#### Objective

COVID-19 vaccination rates among pregnant women remain low, despite increased risk of COVID-19-related illness and death and demonstrated vaccine safety and efficacy in this population. The objective of this study is to identify sociodemographic predictors of COVID-19 vaccine hesitancy and elucidate important concerns among the pregnant population in light of evolving conversations regarding COVID-19.

#### Methods

A prospective survey of pregnant women at a single urban clinic in South Texas was conducted August to September 2021 to identify predictors of COVID-19 vaccine hesitancy among the pregnant population. Collected variables included demographics, COVID-19 beliefs, tetanus–diphtheria–pertussis (Tdap)/influenza vaccine hesitancy, and primary vaccine concerns. Statistical analyses included Fisher’s exact test, asymptotic two-sample Brown-Mood median test, and multinomial logistic regression.

#### Results

One hundred and nine participants completed the survey, 35 vaccinated and 74 unvaccinated, with a response rate of 91.6%. Women who were COVID-19 vaccine hesitant were more likely to be younger (28.0 vs. 31.0 years,  $p < .004$ ) and further along in pregnancy (30.0 vs. 20.0 weeks,  $p = .001$ ). They were also more likely to report influenza (odds ratio (OR) 6.3; 95% confidence interval (CI) 2.5–17.1) and Tdap (OR 4.1; 95% CI 1.75–10.7) vaccine hesitancy. Furthermore, women who were vaccine hesitant were more likely to believe they did not have enough information to confidently make their decision (OR 4.0; 95% CI 1.4–11.4). Primary concerns with COVID-19 vaccines included: short- and long-term side effects on the pregnancy, personal long-term side effects, and harmful ingredients.

#### Conclusions

COVID-19 vaccine hesitant pregnant women were more likely to be younger, hesitant toward other vaccines, and concerned with pregnancy impact and harmful ingredients. Personal knowledge of other vaccinated pregnant women was associated with significantly higher vaccine acceptance rates. Access to vaccines and concerns about quality control were not cited as reasons for vaccine hesitancy, in contrast to earlier studies on this topic. (Author)

Full URL: <https://doi.org/10.1080/14767058.2022.2128652>

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#### 2023-00406

**COVID-19 vaccination is effective at preventing severe illness and complications during pregnancy.** Ellington S, Jatlaoui TC (2023), *Lancet* vol 401, no 10375, February 2023, pp 412-413

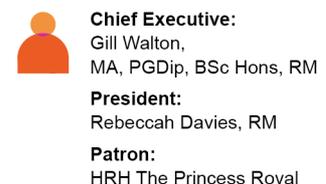
A commentary on Covid-19 vaccination and its effects in pregnancy. (AS)

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#### 2023-00405

**Pregnancy outcomes and vaccine effectiveness during the period of omicron as the variant of concern, INTERCOVID-2022: a multinational, observational study.** Villar J, Conti CPS, Gunier RB, et al (2023), *Lancet* vol 401, no 10375,

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## Background

In 2021, we showed an increased risk associated with COVID-19 in pregnancy. Since then, the SARS-CoV-2 virus has undergone genetic mutations. We aimed to examine the effects on maternal and perinatal outcomes of COVID-19 during pregnancy, and evaluate vaccine effectiveness, when omicron (B.1.1.529) was the variant of concern.

## Methods

INTERCOVID-2022 is a large, prospective, observational study, involving 41 hospitals across 18 countries. Each woman with real-time PCR or rapid test, laboratory-confirmed COVID-19 in pregnancy was compared with two unmatched women without a COVID-19 diagnosis who were recruited concomitantly and consecutively in pregnancy or at delivery. Mother and neonate dyads were followed until hospital discharge. Primary outcomes were maternal morbidity and mortality index (MMMI), severe neonatal morbidity index (SNMI), and severe perinatal morbidity and mortality index (SPMMI). Vaccine effectiveness was estimated, adjusted by maternal risk profile.

## Findings

We enrolled 4618 pregnant women from Nov 27, 2021 (the day after WHO declared omicron a variant of concern), to June 30, 2022: 1545 (33%) women had a COVID-19 diagnosis (median gestation 36.7 weeks [IQR 29.0–38.9]) and 3073 (67%) women, with similar demographic characteristics, did not have a COVID-19 diagnosis. Overall, women with a diagnosis had an increased risk for MMMI (relative risk [RR] 1.16 [95% CI 1.03–1.31]) and SPMMI (RR 1.21 [95% CI 1.00–1.46]). Women with a diagnosis, compared with those without a diagnosis, also had increased risks of SNMI (RR 1.23 [95% CI 0.88–1.71]), although the lower bounds of the 95% CI crossed unity. Unvaccinated women with a COVID-19 diagnosis had a greater risk of MMMI (RR 1.36 [95% CI 1.12–1.65]). Severe COVID-19 symptoms in the total sample increased the risk of severe maternal complications (RR 2.51 [95% CI 1.84–3.43]), perinatal complications (RR 1.84 [95% CI 1.02–3.34]), and referral, intensive care unit (ICU) admission, or death (RR 11.83 [95% CI 6.67–20.97]). Severe COVID-19 symptoms in unvaccinated women increased the risk of MMMI (RR 2.88 [95% CI 2.02–4.12]) and referral, ICU admission, or death (RR 20.82 [95% CI 10.44–41.54]). 2886 (63%) of 4618 total participants had at least a single dose of any vaccine, and 2476 (54%) of 4618 had either complete or booster doses. Vaccine effectiveness (all vaccines combined) for severe complications of COVID-19 for all women with a complete regimen was 48% (95% CI 22–65) and 76% (47–89) after a booster dose. For women with a COVID-19 diagnosis, vaccine effectiveness of all vaccines combined for women with a complete regimen was 74% (95% CI 48–87) and 91% (65–98) after a booster dose.

## Interpretation

COVID-19 in pregnancy, during the first 6 months of omicron as the variant of concern, was associated with increased risk of severe maternal morbidity and mortality, especially among symptomatic and unvaccinated women. Women with complete or boosted vaccine doses had reduced risk for severe symptoms, complications, and death. Vaccination coverage among pregnant women remains a priority. (Author)

Full URL: [https://doi.org/10.1016/S0140-6736\(22\)02467-9](https://doi.org/10.1016/S0140-6736(22)02467-9)

## 2023-00331

**Coronavirus: Vaccination [written answer].** House of Commons (2023), Hansard Written question 120090, 10 January 2023

Maria Caulfield responds to a written question from Maggie Throup to the Secretary of State for Health and Social Care, regarding what percentage by cohort of (a) people aged 50 to 64, (b) people aged 65 to 74, (c) people aged 75 and over, (d) pregnant women, (e) people aged 5 and over and at high risk from covid-19 due to a health condition or a weakened immune system, (f) people aged 5 and over who live with someone who has a weakened immune system, (g) people aged 16 and over and who are carers, either paid or unpaid, (h) people living or working in a care home for older people and (i) frontline health and social care workers who had taken up the offer of a free covid-19 booster vaccination by (A) 30 November 2022 and (B) 31 December 2022. (JSM)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2023-01-10/120090>

## 2023-00270

**Comparison of Maternal and Neonatal Antibody Levels After COVID-19 Vaccination vs SARS-CoV-2 Infection.** Flannery DD, Gouma S, Dhudasia MB, et al (2022), Vol 5, no 11, November 2022, e2240993

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**Importance** Pregnant persons are at an increased risk of severe COVID-19 from SARS-CoV-2 infection, and COVID-19 vaccination is currently recommended during pregnancy.

**Objective** To ascertain the association of vaccine type, time from vaccination, gestational age at delivery, and pregnancy complications with placental transfer of antibodies to SARS-CoV-2.

**Design, Setting, and Participants** This cohort study was conducted in Pennsylvania Hospital in Philadelphia, Pennsylvania, and included births at the study site between August 9, 2020, and April 25, 2021. Maternal and cord blood serum samples were available for antibody level measurements for maternal-neonatal dyads.

**Exposures** SARS-CoV-2 infection vs COVID-19 vaccination.

**Main Outcomes and Measures** IgG antibodies to the receptor-binding domain of the SARS-CoV-2 spike protein were measured by quantitative enzyme-linked immunosorbent assay. Antibody concentrations and transplacental transfer ratios were measured after SARS-CoV-2 infection or receipt of COVID-19 vaccines.

**Results** A total of 585 maternal-newborn dyads (median [IQR] maternal age, 31 [26-35] years; median [IQR] gestational age, 39 [38-40] weeks) with maternal IgG antibodies to SARS-CoV-2 detected at the time of delivery were included. IgG was detected in cord blood from 557 of 585 newborns (95.2%). Among 169 vaccinated persons without SARS-CoV-2 infection, the interval from first dose of vaccine to delivery ranged from 12 to 122 days. The geometric mean IgG level among 169 vaccine recipients was significantly higher than that measured in 408 persons after infection (33.88 [95% CI, 27.64-41.53] arbitrary U/mL vs 2.80 [95% CI, 2.50-3.13] arbitrary U/mL). Geometric mean IgG levels were higher after vaccination with the mRNA-1273 (Moderna) vaccine compared with the BNT162b2 (Pfizer/BioNTech) vaccine (53.74 [95% CI, 40.49-71.33] arbitrary U/mL vs 25.45 [95% CI, 19.17-33.79] arbitrary U/mL;  $P < .001$ ). Placental transfer ratios were lower after vaccination compared with after infection (0.80 [95% CI, 0.68-0.93] vs 1.06 [95% CI, 0.98-1.14];  $P < .001$ ) but were similar between the mRNA vaccines (mRNA-1273: 0.70 [95% CI, 0.55-0.90]; BNT162b2: 0.85 [95% CI, 0.69-1.06];  $P = .25$ ). Time from infection or vaccination to delivery was associated with transfer ratio in models that included gestational age at delivery and maternal hypertensive disorders, diabetes, and obesity. Placental antibody transfer was detectable as early as 26 weeks' gestation. Transfer ratio that was higher than 1.0 was present for 48 of 51 (94.1%) births at 36 weeks' gestation or later by 8 weeks after vaccination.

**Conclusions and Relevance** This study found that maternal and cord blood IgG antibody levels were higher after COVID-19 vaccination compared with after SARS-CoV-2 infection, with slightly lower placental transfer ratios after vaccination than after infection. The findings suggest that time from infection or vaccination to delivery was the most important factor in transfer efficiency. (Author)

**Full URL:** <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2798223>

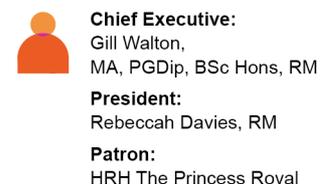
## 2023-00212

**COVID-19 Vaccine Acceptance in Pregnancy.** Odedokun T, Marquez R, Thakkar M, et al (2022), American Journal of Perinatology 19 October 2022, Online

**Objective** The purpose of the study is to evaluate the acceptance rate of the coronavirus disease 2019 (COVID-19) vaccine among pregnant women at our institution prior to recommendations by national organizations (American College of Obstetricians and Gynecologists/The Society for Maternal-Fetal Medicine) in July 2021 and to determine whether factors including health disparities are associated with acceptance.

**Study Design** This is an Institutional Review Board exempt descriptive study. Anonymous surveys were administered from February 2021 to May 2021 to pregnant patients at Mount Sinai South Nassau's affiliated Maternal Fetal Medicine office. The survey was completed by 701 pregnant women. Descriptive statistics were calculated for the overall sample, as well as separately by group (acceptance versus declining/undecided about getting the COVID-19 vaccine). The two groups were compared using the chi-square test or Fisher's exact test and the two-sample t-test.

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Analysis was compared between two groups (patients who accepted the COVID-19 vaccine and people who declined/undecided about the vaccine). A result was considered statistically significant at the  $p < 0.05$  level of significance.

**Results** Of the 701 pregnant women who completed the survey, 96 patients accepted the vaccine. More pregnant women who were older accepted the COVID-19 vaccine compared with those who were younger ( $p = 0.0343$ ). Pregnant women willing to get the flu vaccine and/or the Tdap vaccine in pregnancy were more likely to obtain the COVID-19 vaccine ( $p < 0.05$ ). Pregnant patients who had household members willing to receive the COVID-19 vaccine sought to obtain the vaccine for themselves ( $p < 0.0001$ ). Interestingly, pregnant women who had an underlying respiratory illness in the pregnancy were less likely to accept the COVID-19 vaccine than those who had either other or no medical problems ( $p < 0.05$ ).

**Conclusion** There is a low rate of COVID-19 vaccine acceptance among pregnant women (13.69%). Efforts should be made to encourage the vaccine in this vulnerable population to protect them from the health risks of the COVID-19 virus. (Author)

**Full URL:** <https://www.thieme-connect.com/products/ejournals/abstract/10.1055/s-0042-1757275>

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### 2023-00149

**The impact of maternal SARS-CoV-2 infection and COVID-19 vaccination on maternal-fetal outcomes.** Piekos SN, Price ND, Hood L, et al (2022), *Reproductive Toxicology* vol 114, December 2022, pp 33-43

The rapidly evolving COVID-19 pandemic has resulted in an upsurge of scientific productivity to help address the global health crisis. One area of active research is the impact of COVID-19 on pregnancy. Here, we provide an epidemiological overview about what is known about the effects of maternal SARS-CoV-2 infection and COVID-19 vaccination on maternal-fetal outcomes, and identify gaps in knowledge. Pregnant people are at increased risk for severe COVID-19, and maternal SARS-CoV-2 infection increases the risk of negative maternal-fetal outcomes. Despite this elevated risk, there have been high rates of vaccine hesitancy, heightened by the initial lack of safety and efficacy data for COVID-19 vaccination in pregnancy. In response, retrospective cohort studies were performed to examine the impact of COVID-19 vaccination during pregnancy. Here, we report the vaccine's efficacy during pregnancy and its impact on maternal-fetal outcomes, as well as an overview of initial studies on booster shots in pregnancy. We found that pregnant people are at risk for more severe COVID-19 outcomes, maternal SARS-CoV-2 infection is associated with worse birth outcomes, COVID-19 vaccine hesitancy remains prevalent in the pregnant population, and COVID-19 vaccination and boosters promote better maternal-fetal outcomes. The results should help reduce vaccine hesitancy by alleviating concerns about the safety and efficacy of administering the COVID-19 vaccine during pregnancy. Overall, this review provides an introduction to COVID-19 during pregnancy. It is expected to help consolidate current knowledge, accelerate research of COVID-19 during pregnancy and inform clinical, policy, and research decisions regarding COVID-19 vaccination in pregnant people. (Author)

**Full URL:** <https://doi.org/10.1016/j.reprotox.2022.10.003>

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### 2023-00039

**Why Mandating Vaccines is Wrong for Midwives and Everyone.** Grace N (2022), *Midwifery Matters* no 172, Spring 2022, pp 10-13

Midwife Nicky Grace shares her concerns that vaccine mandates may breach the NMC Code. (Author)

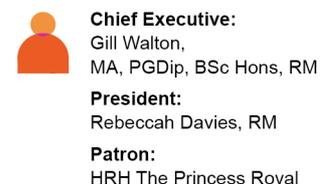
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### 2023-00007

**Coronavirus: Vaccination [written answer].** House of Commons (2022), Hansard Written question 108406, 12 December 2022

Maria Caulfield responds to a written question from Feryal Clark to the Secretary of State for Health and Social Care, with reference to Page 78 of the Women's Health Strategy for England published in August 2022, regarding what steps his Department has taken to encourage research on any long term impacts of receiving covid-19 vaccines during pregnancy. (MB)

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2022-10961

**Longitudinal antibody response kinetics following SARS-CoV-2 messenger RNA vaccination in pregnant and**

**nonpregnant persons.** Prabhu M, Yang YJ, Johnston CD, et al (2023), American Journal of Obstetrics & Gynecology MFM vol 5, no 2, February 2023, 100796

BACKGROUND

For some vaccine-preventable diseases, the immunologic response to vaccination is altered by a pregnant state. The effect of pregnancy on SARS-CoV-2 vaccine response remains unclear.

OBJECTIVE

We sought to characterize the peak and longitudinal anti-S immunoglobulin G, immunoglobulin M, and immunoglobulin A responses to messenger RNA-based SARS-CoV-2 vaccination in pregnant persons and compare them with those in nonpregnant, reproductive-aged persons.

STUDY DESIGN

We conducted 2 parallel prospective cohort studies among pregnant and nonpregnant persons who received SARS-CoV-2 messenger RNA vaccinations. Blood was collected at the time of first and second vaccine doses, 2 weeks post second dosage, and with serial longitudinal follow-up up to 41.7 weeks post vaccination initiation. Anti-S immunoglobulin M, immunoglobulin G, and immunoglobulin A were analyzed by enzyme-linked immunosorbent assay. We excluded those with previous evidence of SARS-CoV-2 infection by history or presence of antinucleocapsid antibodies. In addition, for this study, we did not include individuals who received a third or booster vaccine dosage during the study period. We also excluded pregnant persons who were not fully vaccinated (14 days post receipt of the second vaccine dosage) by time of delivery and nonpregnant persons who became pregnant through the course of the study. We studied the effect of gestational age at vaccination on the anti-S response using Spearman correlation. We compared the peak anti-S antibody responses between pregnant and nonpregnant persons using a Mann-Whitney U test. We visualized and studied the longitudinal anti-S antibody response using locally weighted scatterplot smoothing, Mann-Whitney U test, and mixed analysis of variance test.

RESULTS

Data from 53 pregnant and 21 nonpregnant persons were included in this analysis. The median (interquartile range) age of the pregnant and nonpregnant participants was 35.0 (33.3–37.8) years and 36.0 (33.0–41.0) years, respectively. Six (11.3%) participants initiated vaccination in the first trimester, 23 (43.3%) in the second trimester, and 24 (45.3%) in the third trimester, with a median gestational age at delivery of 39.6 (39.0–40.0) weeks. The median (interquartile range) follow-up time from vaccine initiation to the last blood sample collected was 25.9 (11.9) weeks and 28.9 (12.9) weeks in the pregnant and nonpregnant cohort, respectively. Among pregnant persons, anti-S immunoglobulin G, immunoglobulin A, and immunoglobulin M responses were not associated with gestational age at vaccine initiation (all  $P > .05$ ). The anti-S immunoglobulin G response at 2 weeks post second dosage was not statistically different between pregnant and nonpregnant persons ( $P > .05$ ). However, the anti-S immunoglobulin M and immunoglobulin A responses at 2 weeks post second dosage were significantly higher in nonpregnant persons ( $P < .001$  for both). The anti-S immunoglobulin G and immunoglobulin M levels 6 to 8 months after vaccine initiation fell to comparable proportions of the peak 2 weeks post second dosage antibody levels between pregnant and nonpregnant persons (immunoglobulin G  $P = .77$ ; immunoglobulin M  $P = .51$ ). In contrast, immunoglobulin A levels 6 to 8 months after vaccine initiation fell to statistically significantly higher proportions of peak 2 weeks post second dosage antibody levels in pregnant compared with nonpregnant persons ( $P = .002$ ). Maternal anti-S immunoglobulin G levels were strongly correlated with umbilical cord anti-S immunoglobulin G levels ( $R = 0.8$ ,  $P < .001$ ).

CONCLUSION

The anti-S immunoglobulin A, immunoglobulin M, and immunoglobulin G response to SARS-CoV-2 vaccination in pregnancy is independent of gestational age of vaccine initiation. Maintenance of the immunoglobulin G response is comparable between pregnant and nonpregnant persons. The differential peak response of immunoglobulin M and immunoglobulin A and the differential decline of anti-S immunoglobulin A between pregnant and nonpregnant persons requires further investigation. (Author)

Full URL: <https://doi.org/10.1016/j.ajogmf.2022.100796>

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## 2022-10950

**COVID-19 vaccine uptake and attitudes among pregnant and postpartum parents.** Kapinos KA, DeYoreo M, Lawrence R, et al (2022), American Journal of Obstetrics & Gynecology MFM vol 4, no 6, November 2022, 100735

### BACKGROUND

Pregnancy poses increased risks from COVID-19, including hospitalization and premature delivery. Yet pregnant individuals are less likely to have received a COVID-19 vaccine.

### OBJECTIVE

This study aimed to investigate COVID-19 vaccine uptake and reasons for delay or refusal among perinatal parents.

### STUDY DESIGN

A total of 1542 eligible parents who delivered between 2019 and 2021 were surveyed through the Ovia parenting app, which has a nationally representative user base. Adjusted and nationally weighted means were calculated.

Multivariate logistic regression and survival models were used to examine uptake.

### RESULTS

At least 1 dose of the COVID-19 vaccine was received by 70% of the parents. Those with a bachelor's or graduate degree were significantly more likely to have received a vaccine relative to those with some college or less (adjusted odds ratio for bachelor's degree, 1.854; 95% confidence interval, 1.19–2.90; adjusted odds ratio for graduate degree, 2.833; 95% confidence interval, 1.69–4.75). Parents living in rural areas were significantly less likely to have received a vaccine relative to those living in urban areas (adjusted odds ratio for small city, 0.62; 95% confidence interval, 0.45–0.86; adjusted odds ratio for rural area, 0.56; 95% confidence interval, 0.35–0.89); 56% (281/502) of unvaccinated parents considered that the vaccine “was too new.” Among those pregnant in 2021, 44% (258/576) received at least 1 dose, and 34% (195/576) reported that pregnancy had “no impact” on their vaccine decision.

### CONCLUSION

There was significant heterogeneity in vaccine uptake and attitudes toward vaccines during pregnancy by sociodemographics and over time. Public health experts need to consider and test more tailored approaches to reduce vaccine hesitancy in this population. (Author)

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## 2022-10552

**COVID-19 vaccination influences subtypes of  $\gamma\delta$ -T cells during pregnancy.** Wang L, Li J, Jiang S, et al (2022), 12 October 2022, online

Up to now, there has been insufficient clinical data to support the safety and effects of vaccination on pregnancy post COVID-19 vaccination. The  $\gamma\delta$ -T cells are considered an important component in the immune system to fight against viral infection and exhibit critical roles throughout the pregnancy period. However, the immunological roles of  $\gamma\delta$ -T cells in pregnant women with the COVID-19 vaccination remain unclear. Therefore, the objective of this study is to investigate the alteration of frequency and expression pattern of activation receptors and inhibitory receptors in  $\gamma\delta$ -T cell and its subsets in peripheral blood samples collected from non-pregnant vaccinated women, vaccinated pregnant women, and unvaccinated pregnant women. Our findings indicated that the frequency of CD3+ $\gamma\delta$ -T+ cells is lower in vaccinated pregnant women than in unvaccinated pregnant women. But no significant difference was found in the frequency of CD3+ $\gamma\delta$ -T+ cells between non-pregnant vaccinated women and vaccinated pregnant women. In addition, there were no significant differences in the frequencies of CD3+ $\gamma\delta$ -T+V $\delta$ 1+T cells, CD3+ $\gamma\delta$ -T+V $\delta$ 2+T cells, CD3+ $\gamma\delta$ -T+V $\delta$ 1-V $\delta$ 2-T cells, and V $\delta$ 1+T cell/V $\delta$ 2+T cell ratio between the pregnant women with or without COVID-19 vaccination. Similar results were found after comparing non-pregnant and pregnant women who received the COVID-19 vaccine. However, there was a significant difference in the fraction of V $\delta$ 1-V $\delta$ 2-T cells in CD3+ $\gamma\delta$ -T+ cells between non-pregnant vaccinated women and vaccinated pregnant women. The frequency of NKG2D+ cells in V $\delta$ 2+T cells was not significantly different in the vaccinated pregnant women when compared to that in unvaccinated pregnant women or non-pregnant vaccinated women. But the percentage of NKG2D+ cells in V $\delta$ 1+T cells was the lowest in pregnant women after COVID-19 vaccination. Furthermore, down-regulation of NKP46 and NKP30 were found in V $\delta$ 2+T and V $\delta$ 1+T cells in the vaccinated pregnant women, respectively. After the vaccination, up-regulation of PD-1 expression in V $\delta$ 1+T cells and V $\delta$ 2+T cells indicated  $\gamma\delta$ -T cells could respond to COVID-19 vaccination and

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display an exhausted phenotype following activation. In conclusion, COVID-19 vaccination influences subtypes of  $\gamma\delta$ -T cells during pregnancy, but the side effects might be limited. The phenotypical changes of V $\delta$ 1+T cells and V $\delta$ 2+T cells will be a promising predictor for evaluating the clinical outcome of the COVID-19 vaccine. (Author)

Full URL: <https://doi.org/10.3389/fimmu.2022.900556>

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#### 2022-10537

**Vaccination in pregnancy: The role of the midwife.** Homer CSE, Javid N, Wilton K, et al (2022), 24 October 2022, online  
Midwives are the front-line workers providing maternity care for women in many countries. The role of the midwife includes providing information about, and recommendations for, maternal vaccination in pregnancy and for the baby in the postnatal period. Vaccinations recommended in pregnancy include those to prevent influenza, pertussis, tetanus and now COVID-19. Vaccinations for the newborn baby include hepatitis B. Healthcare professionals play an important role in influencing decision-making around vaccination and midwives are key in supporting vaccination uptake. Midwives are strong influencer in women's decisions around vaccination for themselves and their babies. The COVID-19 vaccination programs have shone a light on vaccination in pregnancy especially as SARS-COV-2 infection has significant adverse effects in pregnancy. COVID-19 vaccination has been shown to be safe and effective in pregnancy. Despite this, there is vaccine hesitancy from pregnant women in many countries. Midwives play a unique role in the provision of care to women and families but they need specific support and information regarding vaccination in pregnancy. Targeted education, supportive mentoring and supervision and opportunities to lead innovative ways of ensuring vaccine access is logistically easy and possible are all needed. This Commentary outlines the key vaccinations recommended in pregnancy including COVID-19 vaccination and highlights some strategies to scale-up vaccination programs in pregnancy with a particular focus on the role of midwives. (Author)

Full URL: <https://doi.org/10.3389/fghw.2022.929173>

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#### 2022-10514

**Maternal, fetal and neonatal outcomes among pregnant women receiving COVID-19 vaccination: The preg-co-vax study.** Mascolo A, di Mauro G, Fraenza F, et al (2022), 3 October 2022, online

Introduction: Although the European Medicines Agency (EMA) encourage coronavirus disease 2019 (COVID-19) vaccination in pregnant women, the scientific evidence supporting the use of COVID-19 vaccines during pregnancy is still limited.

Aim: We aimed to investigate adverse events following immunization (AEFI) with COVID-19 vaccines during pregnancy.

Methods: We retrieved Individual Case Safety Reports (ICSRs) related to the use of COVID-19 vaccines during pregnancy from the EudraVigilance database for the year 2021. We analyzed AEFI related to the mother and fetus/newborn. The reporting odds ratio (ROR) was computed to compare the reporting probability of spontaneous abortion between COVID-19 vaccines.

Results: During the study period, among 1,315,315 ICSRs related to COVID-19 vaccines, we retrieved 3,252 (0.25%) reports related to the use in pregnancy. More than half (58.24%) of ICSRs were submitted by non-healthcare professionals. Although the majority (87.82%) of ICSRs concerned serious AEFI, their outcomes were mostly favorable. In this study, 85.0% of total ICSRs referred to pregnant women (n = 2,764), while 7.9% referred to fetuses/newborns (n = 258). We identified 16,569 AEFI. Moreover, 55.16% were AEFI not related to pregnancy (mostly headache, pyrexia, and fatigue), while 17.92% were pregnancy-, newborn-, or fetus-related AEFI. Among pregnancy-related AEFI, the most reported was spontaneous abortion. Messenger RNA (mRNA) vaccines had a lower reporting probability of spontaneous abortion than viral vector-based vaccines (ROR 0.80, 95% CI 0.69–0.93). Moderna and Oxford-AstraZeneca vaccines had a higher reporting probability of spontaneous abortion (ROR 1.2, 95% CI 1.05–1.38 and ROR 1.26, 95% CI 1.08–1.47, respectively), while a lower reporting probability was found for Pfizer-BioNTech vaccine compared with all other COVID-19 vaccines (ROR 0.73, 95% CI 0.64–0.84). In addition, 5.8% of ICSRs reported a fatal outcome.

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Conclusions: No strong insight of unknown AEFI associated with COVID-19 vaccination in pregnant women was observed. Considering the high risk associated with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, our analysis suggests that the benefits of COVID-19 vaccines during pregnancy outweigh the possible risks. However, it is important to continue monitoring the safety profile of COVID-19 vaccines in this subpopulation.

(Author)

Full URL: <https://doi.org/10.3389/fimmu.2022.965171>

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## 2022-10512

**COVID-19 vaccination hesitancy and willingness among pregnant women in Italy.** del Giudice GM, Folcarelli L, Napoli A, et al (2022), 3 October 2022, online

Background: Pregnant women, especially those with comorbidities, compared to those non-pregnant, have higher risk of developing a severe form of COVID-19. However, COVID-19 vaccine uptake is very low among them.

Methods: An anonymous questionnaire was administered to randomly selected women 18 years of age that were currently pregnant or had just given birth between September 2021 and May 2022 in the geographic area of Naples. Vaccine hesitancy was assessed using the vaccine hesitancy scale (VHS).

Results: A total of 385 women participated. Women who had not been infected by SARS-CoV-2 and who needed information about vaccination against COVID-19 had a higher perceived risk of being infected with SARS-CoV-2. More than half (54.3%) of the women were very afraid of the potential side effects of the COVID-19 vaccination on the fetus. There was higher concern of the side effects of the vaccine on the fetus among those who did not have a graduate degree, those with high-risk pregnancy, those who had not been infected by SARS-CoV-2, those who were more concerned that they could be infected by SARS-CoV-2, those who did not know that this vaccination was recommended for them, and those trusting mass media/internet/social networks for information. Only 21.3% were vaccinated when pregnant, mostly women with a university degree, those who had been infected by SARS-CoV-2 before pregnancy, those who did not need information, and those who acquired information about the vaccination from gynecologists. Almost three-quarters (71.9%) were willing to receive the vaccination and those more likely were those with a university degree, those who have had at least one relative/cohabitant partner/friend who had been infected by SARS-CoV-2, those who were more concerned that they could be infected by SARS-CoV-2, and those who were not extremely concerned of the side effects of the vaccine on the fetus. A total of 86.4% were highly hesitant. Highly hesitant were respondents who did not get a graduate degree, those less concerned that they could be infected by SARS-CoV-2, and those trusting mass media/internet/social networks for information.

Conclusion: Public health efforts and education campaigns for pregnant women are needed for changing their perception patterns and for supporting gynecologists in promoting the uptake of this vaccination. (Author)

Full URL: <https://doi.org/10.3389/fpubh.2022.995382>

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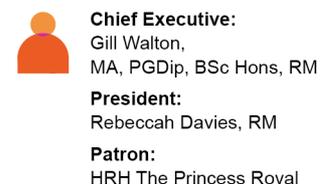
## 2022-10508

**SARS-CoV-2-Specific IgG and IgA response in maternal blood and breastmilk of vaccinated naïve and convalescent lactating participants.** Longueira Y, Ojeda DS, Battistelli RBA, et al (2022), 3 October 2022, online

Background: Recent studies have shown the presence of SARS-CoV-2-specific antibodies in the milk of breastfeeding mothers vaccinated with mRNA and convalescent. However, limited information is available in lactating women receiving other vaccine platforms used in developing countries, such as the inactivated SARS-CoV-2 vaccine BBIBP-CorV (Sinopharm) and the non-replicating adenovirus vaccines Sputnik V (Gamaleya Institute) and ChAdOx1-S (Oxford AstraZeneca).

Methods: Here, we evaluated anti-SARS-CoV-2 IgG and IgA levels in both serum and milk samples using a longitudinal and a cross-sectional cohort of 208 breastfeeding vaccinated women from Argentina with or without previous

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SARS-CoV-2 infection.

Results: The analysis showed that IgA levels remain constant in serum and milk of breastfeeding mothers between the first and second doses of vector-based vaccines (Sputnik V and ChAdOx1-S). After the second dose, anti-spike IgA was found positive in 100% of the serum samples and in 66% of breastmilk samples. In addition, no significant differences in milk IgA levels were observed in participants receiving BBIBP-CorV, Sputnik V or ChAdOx1-S. IgG levels in milk increased after the second dose of vector-based vaccines. Paired longitudinal samples taken at 45 and 120 days after the second dose showed a decrease in milk IgG levels over time. Study of IgA levels in serum and milk of vaccinated naïve of infection and vaccinated-convalescent breastfeeding participants showed significantly higher levels in vaccinated-convalescent than in participants without previous infection.

Conclusion: This study is relevant to understand the protection against SARS-CoV-2 by passive immunity in newborns and children who are not yet eligible to receive vaccination. (Author)

Full URL: <https://doi.org/10.3389/fimmu.2022.909995>

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## 2022-10359

### Effectiveness of BNT162b2 Vaccination During Pregnancy in Preventing Hospitalization for SARS-CoV-2 in Infants.

Danino D, Ashkenazi-Hoffnung L, Diaz A, et al (2023), The Journal of Pediatrics vol 254, March 2023, pp 48-53.e1

#### Objective

To Assess the clinical effectiveness of the BNT162b2 vaccine during pregnancy in preventing severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) hospitalizations of infants.

#### Study design

A retrospective, multicenter, 1:3 case-control (test-negative) study. Symptomatic hospitalized infants <6 months, with positive SARS-CoV-2 polymerase chain reaction (PCR) test between 1/3/2021-31/11/2021 were matched by age and time to negative controls, hospitalized with symptoms compatible with SARS-CoV-2 infection. Mothers were defined as fully vaccinated; received 2 doses of BNT162b2 with the second given 2 weeks to 6 months before delivery, or partially vaccinated; received only one dose or 2 doses with the second given >6 months or <2 weeks before delivery. Severe SARS-CoV-2 was defined as need for assisted ventilation.

#### Results

116 SARS-CoV-2 positive infants were matched to 348 negative controls with symptoms compatible with SARS-CoV-2 infection. The effectiveness of fully vaccinated mothers was 61.6% (CI: 31.9-78.4) and the effectiveness of partially vaccinated mothers was not significant. Effectiveness was higher in infants 0-2 vs. 3-6 months of age. The effectiveness (57.1%, CI: 22.8-76.4) was similar when excluding mothers who were infected with SARS-CoV-2 during pregnancy. OR of severe infection in infants born to unvaccinated versus fully vaccinated mothers was 5.8.

#### Conclusions

At least 2 doses of BNT162b2 vaccine administered during the second or third trimester of pregnancy had an effectiveness of 61.6% in reduction of hospitalization for SARS-CoV-2 infection in infants <6 months. (Author)

Full URL: <https://doi.org/10.1016/j.jpeds.2022.09.059>

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## 2022-10178

### Women's attitude towards COVID-19 vaccination in pregnancy: A survey study in northern Italy.

Colciago E, Capitoli G, Vergani P, et al (2023), International Journal of Gynecology & Obstetrics vol 162, no 1, July 2023, pp 139-146

#### Objective

To investigate attitudes and risk perceptions towards the coronavirus disease 2019 (COVID-19) vaccine and reasons for hesitancy among pregnant women.

#### Methods

A prospective survey study was conducted at a University Maternity Department. Participants included any pregnant woman aged 18 years or older, able to understand the Italian language, who accessed the antenatal clinic for a

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prenatal appointment. The survey comprised questions about sociodemographic characteristics, pregnancy vaccination history, and perception of risk related to the immunization for the woman herself and her infant.

#### Results

A total of 538 women completed the questionnaire, 445 (82.7%) accepted COVID-19 vaccination. Women vaccinated against pertussis were three times more likely to take up the COVID-19 vaccine (odds ratio [OR] 3.19; 95% confidence interval [CI] 1.78–5.72). Having had COVID-19 during pregnancy (OR 0.24; 95% CI 0.11–0.54), and having a high-risk perception towards the immunization for the fetus (OR 0.18; 95% CI 0.09–0.34) were factors associated with vaccine hesitancy. Lack of safety data in pregnancy and the possibility of harm to the fetus were the main concerns.

#### Conclusion

A trusting and supportive relationship with the healthcare professional to address fears, and the transmission of evidence-based information, are pivotal to guide women through an informed choice. Understanding the determinants implicated in women's decision making might guide towards effective public health strategies to boost vaccine acceptance. (Author)

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#### 2022-10097

**A population-based matched cohort study of early pregnancy outcomes following COVID-19 vaccination and SARS-CoV-2 infection.** Calvert C, Carruthers J, Denny C, et al (2022), Nature Communications vol 13, no 6124, 17 October 2022.

Data on the safety of COVID-19 vaccines in early pregnancy are limited. We conducted a national, population-based, matched cohort study assessing associations between COVID-19 vaccination and miscarriage prior to 20 weeks gestation and, separately, ectopic pregnancy. We identified women in Scotland vaccinated between 6 weeks preconception and 19 weeks 6 days gestation (for miscarriage; n = 18,780) or 2 weeks 6 days gestation (for ectopic; n = 10,570). Matched, unvaccinated women from the pre-pandemic and, separately, pandemic periods were used as controls. Here we show no association between vaccination and miscarriage (adjusted Odds Ratio [aOR], pre-pandemic controls = 1.02, 95% Confidence Interval [CI] = 0.96–1.09) or ectopic pregnancy (aOR = 1.13, 95% CI = 0.92–1.38). We undertook additional analyses examining confirmed SARS-CoV-2 infection as the exposure and similarly found no association with miscarriage or ectopic pregnancy. Our findings support current recommendations that vaccination remains the safest way for pregnant women to protect themselves and their babies from COVID-19. (Author)

Full URL: <https://doi.org/10.1038/s41467-022-33937-y>

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#### 2022-09835

**Coronavirus disease 2019 (COVID-19) vaccination uptake among healthcare workers.** Gilboa M, Tal I, Levin EG (2022), Infection Control and Hospital Epidemiology vol 43, no 10, October 2022, pp 1433-1438

#### Objective:

To assess reasons for noncompliance with COVID-19 vaccination among healthcare workers (HCWs).

#### Design:

Cohort observational and surveillance study.

#### Setting:

Sheba Medical Center, a 1,600-bed tertiary-care medical center in Israel.

#### Participants:

The study included 10,888 HCWs including all employees, students, and volunteers.

#### Intervention:

The BNT162b2 mRNA COVID-19 vaccine was offered to all HCWs of the hospital. Noncompliance was assessed, and

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pre-rollout and post-rollout surveys were conducted. Data regarding uptake of the vaccine as well as demographic data and compliance with prior influenza vaccination were collected, and 2 surveys were distributed. The survey before the rollout pertained to the intention to receive the vaccine, and the survey after the rollout pertained to all unvaccinated HCWs regarding causes of hesitancy.

#### Results:

In the pre-rollout survey, 1,673 (47%) of 3,563 HCWs declared their intent to receive the vaccine. Overall, 8,108 (79%) HCWs received the COVID-19 vaccine within 40 days of rollout. In a multivariate logistic regression model, the factors that were significant predictors of vaccine uptake were male sex, age 40–59 years, occupation (paramedical professionals and doctors), high socioeconomic level, and compliance with flu vaccine. Among 425 unvaccinated HCWs who answered the second survey, the most common cause for hesitancy was the risk during pregnancy (31%).

#### Conclusions:

Although vaccine uptake among HCWs was higher than expected, relatively low uptake was observed among young women and those from lower socioeconomic levels and educational backgrounds. Concerns regarding vaccine safety during pregnancy were common and more data about vaccine safety, especially during pregnancy, might improve compliance. (Author)

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#### 2022-09783

**Covid-19 third vaccination during pregnancy: maternal and neonatal outcomes—a retrospective study.** Rottenstreich M, Rotem R, Wiener-Well Y, et al (2023), Archives of Gynecology and Obstetrics vol 308, no 4, October 2023, pp 1197 - 1205

#### Purpose

To evaluate the impact of Covid-19 (Pfizer-BioNTech BNT162b2) third booster dose vaccination during pregnancy on maternal and neonatal outcomes.

#### Methods

This is a multicenter, retrospective computerized database study. Parturients who delivered in Israel between August and December 2021 with full records of Covid-19 disease and vaccination status were included. Those who received third booster during pregnancy were compared to those who received two doses of vaccine during pregnancy and to unvaccinated parturients. Various adverse maternal and neonatal outcomes were evaluated. Parturients who were previously positive with Covid-19 PCR swabs during pregnancy or before pregnancy were excluded. Univariate analysis was followed by multivariate analysis.

#### Results

A total of 2583 women were included in the analysis; 626 received the third booster dose of the BNT162b2 Covid-19 vaccine, 1094 received two doses of the vaccine, and 863 unvaccinated women. Maternal and neonatal outcomes were comparable between the study groups. An adjusted multivariable logistic regression analysis demonstrated that receiving the third booster was not associated with an increase in neither composite adverse maternal or neonatal outcome (aOR 0.9; 95% CI [0.65–1.22],  $p = 0.47$ ; aOR 0.7; 95% CI [0.53–1.035],  $p = 0.09$ , respectively) when compared to those who received two doses of the vaccine. However, administration of the third booster dose during pregnancy was associated with a reduced composite adverse neonatal outcome when compared to unvaccinated women (aOR 0.6; 95% CI [0.42–0.86],  $p = 0.01$ ).

#### Conclusion

Receiving the third booster dose of the BNT162b2 Covid-19 vaccine during pregnancy is not associated with an increased risk of any adverse maternal outcomes and may be beneficial for the neonates. (Author)

**Full URL:** <https://doi.org/10.1007/s00404-022-06786-9>

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#### 2022-09674

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## Boosting maternal and neonatal humoral immunity following SARS-CoV-2 infection using a single messenger RNA

**vaccine dose.** Nevo L, Cahen-Peretz A, Vorontzov O, et al (2022), American Journal of Obstetrics & Gynecology (AJOG) vol 227, no 3, September 2022, pp 486.E1-486.E10

### Background

Post-COVID-19 vaccine boosting is a potent tool in the ongoing pandemic. Relevant data regarding this approach during pregnancy are lacking, which affects vaccination policy guidance, public acceptance, and vaccine uptake during pregnancy. We aimed to investigate the dynamics of anti-SARS-CoV-2 antibody levels following SARS-CoV-2 infection during pregnancy and to characterize the effect of a single postinfection vaccine booster dose on the anti-SARS-CoV-2 antibody levels in parturients in comparison with the levels in naïve vaccinated and convalescent, nonboosted parturients.

### Study Design

Serum samples prospectively collected from parturients and umbilical cords at delivery at our university-affiliated urban medical center in Jerusalem, Israel, from May to October 2021, were selected and analyzed in a case-control manner. Study groups comprised the following participants: a consecutive sample of parturients with a polymerase chain reaction-confirmed history of COVID-19 during any stage of pregnancy; and comparison groups selected according to time of exposure comprising (1) convalescent, nonboosted parturients with polymerase chain reaction-confirmed COVID-19; (2) convalescent parturients with polymerase chain reaction-confirmed COVID-19 who received a single booster dose of the BNT162b2 messenger RNA vaccine; and (3) infection-naïve, fully vaccinated parturients who received 2 doses of the BNT162b2 messenger RNA vaccine. Outcomes that were determined included maternal and umbilical cord blood anti-SARS-CoV-2 antibody levels detected at delivery, the reported side effects, and pregnancy outcomes.

### Results

A total of 228 parturients aged 18 to 45 years were included. Of those, samples from 64 were studied to characterize the titer dynamics following COVID-19 at all stages of pregnancy. The boosting effect was determined by comparing (1) convalescent (n=54), (2) boosted convalescent (n=60), and (3) naïve, fully vaccinated (n=114) parturients. Anti-SARS-CoV-2 antibody levels detected on delivery showed a gradual and significant decline over time from infection to delivery ( $r=0.4371$ ;  $P=.0003$ ). Of the gravidae infected during the first trimester, 34.6% (9/26) tested negative at delivery, compared with 9.1% (3/33) of those infected during the second trimester ( $P=.023$ ). Significantly higher anti-SARS-CoV-2 antibody levels were observed among boosted convalescent than among nonboosted convalescent (17.6-fold;  $P<.001$ ) and naïve vaccinated parturients (3.2-fold;  $P<.001$ ). Similar patterns were observed in umbilical cord blood. Side effects in convalescent gravidae resembled those in previous reports of mild symptoms following COVID-19 vaccination during pregnancy.

### Conclusion

Postinfection maternal humoral immunity wanes during pregnancy, leading to low or undetectable protective titers for a marked proportion of patients. A single boosting dose of the BNT162b2 messenger RNA vaccine induced a robust increase in protective titers for both the mother and newborn with moderate reported side effects. (Author)

**Full URL:** <https://doi.org/10.1016/j.ajog.2022.04.010>

## 2022-09600

**CoronaVac vaccine is effective in preventing symptomatic and severe COVID-19 in pregnant women in Brazil: a test-negative case-control study.** Paixao ES, Wong KLM, Alves FJO, et al (2022), BMC Medicine vol 20, no 146, 5 April 2022

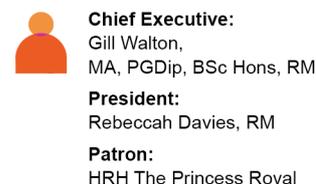
### Background

More doses of CoronaVac have been administered worldwide than any other COVID-19 vaccine. However, the effectiveness of COVID-19 inactivated vaccines in pregnant women is still unknown. We estimated the vaccine effectiveness (VE) of CoronaVac against symptomatic and severe COVID-19 in pregnant women in Brazil.

### Methods

We conducted a test-negative design study in all pregnant women aged 18–49 years with COVID-19-related symptoms in Brazil from March 15, 2021, to October 03, 2021, linking records of negative and positive SARS-CoV-2 reverse transcription polymerase chain reaction (RT-PCR) tests to national vaccination records. We also linked records of

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test-positive cases with notifications of severe, hospitalised or fatal COVID-19. Using logistic regression, we estimated the adjusted odds ratio and VE against symptomatic COVID-19 and against severe COVID-19 by comparing vaccine status in test-negative subjects to test-positive symptomatic cases and severe cases.

## Results

Of the 19,838 tested pregnant women, 7424 (37.4%) tested positive for COVID-19 and 588 (7.9%) had severe disease. Only 83% of pregnant women who received the first dose of CoronaVac completed the vaccination scheme. A single dose of the CoronaVac vaccine was not effective at preventing symptomatic COVID-19. The effectiveness of two doses of CoronaVac was 41% (95% CI 27.1–52.2) against symptomatic COVID-19 and 85% (95% CI 59.5–94.8) against severe COVID-19.

## Conclusions

A complete regimen of CoronaVac in pregnant women was effective in preventing symptomatic COVID-19 and highly effective against severe illness in a setting that combined high disease burden and marked COVID-19-related maternal deaths. (Author)

Full URL: <https://doi.org/10.1186/s12916-022-02353-w>

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## 2022-09523

**Routine Maternal Vaccine Uptake during the COVID-19 Pandemic.** Cotter S, Taylor L, Grace R, et al (2022), American Journal of Perinatology 29 September 2022, online

**Objective** This study examines the impact of the coronavirus disease 2019 (COVID-19) pandemic on influenza and tetanus toxoid, reduced diphtheria toxoid and acellular pertussis (Tdap) vaccine uptake in a pregnant, low-income population.

**Study Design** This retrospective cohort study included women initiating prenatal care before (May–November 2019) or during the COVID-19 pandemic (May–November 2020) at two large Medicaid clinics. All patients entered prenatal care before 20 weeks and delivered full-term. Medical records were reviewed for vaccine uptake and demographic data. Multivariate logistic regression analysis was used to compare vaccination rates prior to and during the COVID-19 pandemic. Additional analysis was performed to identify association of demographic factors with vaccine uptake. IRB approval was obtained for this study.

**Results** A total of 939 patients met inclusion criteria, with 462 initiating care prior to and 477 initiating care during the COVID-19 pandemic. Influenza vaccination uptake was 78% (362/462) in the prepandemic group, significantly decreasing to 61% (291/477) in the pandemic group ( $p < 0.01$ , odds ratio [OR] = 0.38, confidence interval [CI]: 0.26–0.53). Tdap vaccination uptake was 85% (392/462) in the prepandemic group, significantly decreasing to 76% (361/477) in the pandemic group ( $p < 0.01$ , OR = 0.56, CI: 0.40–0.79). The decrease in influenza vaccine uptake was most significant in non-Hispanic Black patients, decreasing from 64% (73/114) in the prepandemic group to 35% (35/101) in the pandemic group ( $p < 0.01$ , OR = 0.30, CI: 0.17–0.52), while there was no significant difference in age or parity in relation to vaccination status.

**Conclusion** Routine vaccination uptake significantly decreased during the COVID-19 pandemic in a low-income population of pregnant women, with decrease more pronounced on influenza vaccine than on Tdap vaccine uptake, especially in non-Hispanic Black patients. (Author)

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## 2022-09516

**Safety-Related Outcomes of Novel mRNA COVID-19 Vaccines in Pregnancy.** Nakahara A, Biggio JR, Elmayan A, et al (2022), American Journal of Perinatology vol 39, no 13, October 2022, pp 1484–1488

**Objective** The objective of this study was to describe the safety profile and demographic data for a cohort of pregnant individuals who received an mRNA coronavirus disease 2019 (COVID-19) vaccine.

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**Study Design** Prospective cohort study (with exposure matching) of individuals with active pregnancy who underwent immunization with a novel mRNA COVID-19 vaccine matched 1:2 with vaccinated age-matched female nonpregnant controls was carried out. The primary outcome was defined as any vaccine-related complaints as defined in the original safety data. Secondary outcomes included specific complaints, COVID-19 screening test, and positive COVID-19 test.

**Results** Eighty-three vaccinated pregnant persons were age-matched with 166 female controls, all of whom were vaccinated between December 2020 and January, 2021. There was no difference in race or ethnicity between the groups. The mean body mass index of pregnant patients was lower than that of controls (26.1 vs. 29.2,  $p = 0.002$ ). The frequency of complaints following vaccine administration was not different between pregnant and nonpregnant patients (18.1 vs. 16.9%,  $p = 0.201$ ). Pregnant individuals were more likely to report fever (4.8 vs. 0.6%,  $p = 0.044$ ) and gastrointestinal symptoms (4.8 vs. 0%,  $p = 0.012$ ).

**Conclusions** Side effect profiles of COVID-19 vaccine administration at our institution were relatively similar between pregnant and nonpregnant individuals and no serious complications occurred in either group. As COVID-19 infection in pregnancy can have significant morbidity, our data support the continued use of the vaccine for pregnant patients. (Author)

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## 2022-09307

### **Analysis of Vaccine Reactions After COVID-19 Vaccine Booster Doses Among Pregnant and Lactating Individuals.**

Kachikis A, Englund JA, Covelli I, et al (2022), JAMA Network Open Vol 5, no 9, September 2022, e2230495

**Importance** COVID-19 vaccine boosters or third doses are recommended for adolescents and adults who completed their initial COVID-19 vaccine course more than 5 months prior. Minimal data are available on COVID-19 vaccine booster or third dose reactogenicity among pregnant and lactating individuals.

**Objective** To describe the reactions to the booster or third dose of the COVID-19 vaccine and vaccine experiences among pregnant and lactating individuals.

**Design, Setting, and Participants** Beginning in October 2021, a follow-up Research Electronic Data Capture (REDCap) survey regarding a COVID-19 vaccine booster or third dose was sent to 17 504 participants in an ongoing online prospective cohort study on COVID-19 vaccines among pregnant and lactating individuals. A convenience sample of adults enrolled in the online prospective study who were pregnant, lactating, or neither pregnant nor lactating at the time of their booster or third dose was eligible for this follow-up survey; 17 014 (97.2%) completed the follow-up survey.

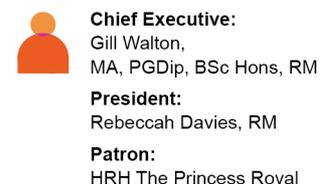
**Exposure** Receipt of a booster or third dose of the COVID-19 vaccine.

**Main Outcomes and Measures** Self-reported vaccine reactions less than 24 hours after the dose.

**Results** As of April 4, 2022, 17 014 eligible participants (mean [SD] age, 33.3 [3.5] years) responded to the booster or third dose survey; of these, 2009 (11.8%) were pregnant at the time of their booster or third dose, 10 279 (60.4%) were lactating, and 4726 (27.8%) were neither pregnant nor lactating. After a COVID-19 booster or third dose, most individuals (14 074 of 17 005 [82.8%]) reported a local reaction, and 11 542 of 17 005 (67.9%) reported at least 1 systemic symptom. Compared with individuals who were neither pregnant nor lactating, pregnant participants were more likely to report any local reaction to a COVID-19 booster or third dose (adjusted odds ratio [aOR], 1.2; 95% CI, 1.0-1.4;  $P = .01$ ) but less likely to report any systemic reaction (aOR, 0.7; 95% CI, 0.6-0.8;  $P < .001$ ). Most pregnant (1961 of 2009 [97.6%]) and lactating (9866 of 10 277 [96.0%]) individuals reported no obstetric or lactation concerns after vaccination.

**Conclusions and Relevance** This study suggests that COVID-19 vaccine boosters or third doses were well tolerated

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among pregnant and lactating individuals. Data to evaluate tolerability of boosters or additional doses among pregnant and lactating individuals will be important as they are considered for these populations. (Author)

Full URL: <https://doi.org/10.1001/jamanetworkopen.2022.30495>

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## 2022-09229

**COVID-19 vaccination hesitancy and willingness among pregnant women in Italy.** del Giudice GM, Folcarelli L, di Napoli A, et al (2022), *Frontiers in Public Health* 3 October 2022, online

Background: Pregnant women, especially those with comorbidities, compared to those non-pregnant, have higher risk of developing a severe form of COVID-19. However, COVID-19 vaccine uptake is very low among them.

Methods: An anonymous questionnaire was administered to randomly selected women 18 years of age that were currently pregnant or had just given birth between September 2021 and May 2022 in the geographic area of Naples. Vaccine hesitancy was assessed using the vaccine hesitancy scale (VHS).

Results: A total of 385 women participated. Women who had not been infected by SARS-CoV-2 and who needed information about vaccination against COVID-19 had a higher perceived risk of being infected with SARS-CoV-2. More than half (54.3%) of the women were very afraid of the potential side effects of the COVID-19 vaccination on the fetus. There was higher concern of the side effects of the vaccine on the fetus among those who did not have a graduate degree, those with high-risk pregnancy, those who had not been infected by SARS-CoV-2, those who were more concerned that they could be infected by SARS-CoV-2, those who did not know that this vaccination was recommended for them, and those trusting mass media/internet/social networks for information. Only 21.3% were vaccinated when pregnant, mostly women with a university degree, those who had been infected by SARS-CoV-2 before pregnancy, those who did not need information, and those who acquired information about the vaccination from gynecologists. Almost three-quarters (71.9%) were willing to receive the vaccination and those more likely were those with a university degree, those who have had at least one relative/cohabitant partner/friend who had been infected by SARS-CoV-2, those who were more concerned that they could be infected by SARS-CoV-2, and those who were not extremely concerned of the side effects of the vaccine on the fetus. A total of 86.4% were highly hesitant. Highly hesitant were respondents who did not get a graduate degree, those less concerned that they could be infected by SARS-CoV-2, and those trusting mass media/internet/social networks for information.

Conclusion: Public health efforts and education campaigns for pregnant women are needed for changing their perception patterns and for supporting gynecologists in promoting the uptake of this vaccination. (Author)

Full URL: <https://doi.org/10.3389/fpubh.2022.995382>

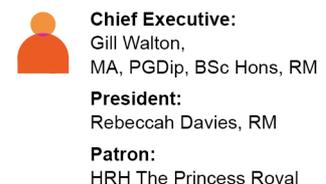
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## 2022-09045

**Covid-19 vaccination in pregnancy.** Badell ML, Dude CM, Rasmussen SA, et al (2022), *British Medical Journal* vol 378, no 8353, September 2022, e069741

Pregnancy is an independent risk factor for severe covid-19. Vaccination is the best way to reduce the risk for SARS-CoV-2 infection and limit its morbidity and mortality. The current recommendations from the World Health Organization, Centers for Disease Control and Prevention, and professional organizations are for pregnant, postpartum, and lactating women to receive covid-19 vaccination. Pregnancy specific considerations involve potential effects of vaccination on fetal development, placental transfer of antibodies, and safety of maternal vaccination. Although pregnancy was an exclusion criterion in initial clinical trials of covid-19 vaccines, observational data have been rapidly accumulating and thus far confirm that the benefits of vaccination outweigh the potential risks. This review examines the evidence supporting the effectiveness, immunogenicity, placental transfer, side effects, and perinatal outcomes of maternal covid-19 vaccination. Additionally, it describes factors associated with vaccine hesitancy in pregnancy. Overall, studies monitoring people who have received covid-19 vaccines during pregnancy have not identified any pregnancy specific safety concerns. Additional information on non-mRNA vaccines, vaccination early in pregnancy, and longer term outcomes in infants are needed. To collect this information, vaccination during

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### 2022-09013

#### **Safety of Booster Doses of Coronavirus Disease 2019 (COVID-19) Vaccine in Pregnancy in the Vaccine Adverse Event**

**Reporting System.** Moro PL, Olson CK, Zhang B, et al (2022), *Obstetrics & Gynecology* Vol 140, no 3, September 2022, pp 421-427

#### OBJECTIVE:

To evaluate and summarize reports to the Vaccine Adverse Event Reporting System (VAERS), a national spontaneous reporting system, in pregnant people who received a booster dose of mRNA coronavirus disease 2019 (COVID-19) vaccine.

#### METHODS:

We searched VAERS for U.S. reports of adverse events in pregnant people who received a booster dose of an mRNA COVID-19 vaccine from September 22, 2021, to March 24, 2022. Clinicians reviewed reports and available medical records.

#### RESULTS:

The Vaccine Adverse Event Reporting System received 323 reports of adverse events in pregnant people who received a booster dose of COVID-19 vaccine; 178 (55.1%) after BNT162b2 from Pfizer–BioNTech and 145 (44.9%) after mRNA-1273 from Moderna. Seventy-two (22.3%) reports were coded as serious. One neonatal death was reported, but no maternal deaths occurred. Pregnancy-specific outcomes included 56 (17.3%) spontaneous abortions (before 20 weeks of gestation), eight (2.5%) episodes of vaginal bleeding, five (1.5%) stillbirths (at or after 20 weeks of gestation), four (1.2%) episodes of preeclampsia, and two (0.6%) preterm deliveries. Reporting rates for stillbirth and preterm delivery were below background rates. Ten instances of adverse events in neonates were reported, which included two reports of birth defects. Non–pregnancy-specific adverse events (n=207; 64.1%) were mostly systemic (eg, headache, fatigue) and local reactions and occurred in proportions comparable with those seen in pregnant people who received the primary COVID-19 vaccination series and reported to VAERS during the same period.

#### CONCLUSION:

Review of reports after a booster dose of mRNA COVID-19 vaccine in pregnant people in VAERS found their safety profile was comparable with that of published reports after primary COVID-19 vaccination in pregnant people.

(Author)

**Full URL:** <https://doi.org/10.1097/AOG.0000000000004889>

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### 2022-08888

**Covid vaccine: 'Get the jab' says woman who nearly died while pregnant.** BBC News (2022), BBC News 27 September 2022

Fourteen months ago Jade Sheppard-Palomares was 29 weeks pregnant with no plans to have the Covid vaccination.

(Author)

**Full URL:** [https://www.bbc.co.uk/news/uk-england-bristol-62993479?at\\_medium=RSS&at\\_campaign=KARANGA](https://www.bbc.co.uk/news/uk-england-bristol-62993479?at_medium=RSS&at_campaign=KARANGA)

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### 2022-08843

**COVID Vaccine Information Sources Utilized by Female Healthcare Workers.** Paul R, Raghuraman N, Carter EB, et al (2022),

*American Journal of Obstetrics & Gynecology* MFM 2 August 2022, online, 100704

#### BACKGROUND

Clinical trials of the messenger RNA COVID-19 vaccines excluded individuals with active reproductive needs (attempting to conceive, currently pregnant, and/or lactating). Women comprise three-quarters of healthcare workers in the United States—an occupational field among the first to receive the vaccine. Professional medical and government organizations have encouraged shared decision-making and access to vaccination among those with active reproductive needs.

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## OBJECTIVE

This study aimed to characterize the information sources used by pregnancy-capable healthcare workers for information about the COVID-19 vaccines and to compare the self-reported “most important” source by the respondents’ active reproductive needs, if any.

## STUDY DESIGN

This was a web-based national survey of female, US-based healthcare workers in January 2021. Recruitment was done using social media and subsequent sharing via word of mouth. We classified the respondents into 6 groups on the basis of self-reported reproductive needs as follows: (1) preventing pregnancy, (2) attempting pregnancy, (3) currently pregnant, (4) lactating, (5) attempting pregnancy and lactating, and (6) currently pregnant and lactating. We provided respondents with a list of information sources (friends, family, obstetrician-gynecologists, pediatrician, news, social media, government organizations, their employer, and “other”) and asked respondents which source(s) they used when looking for information about the vaccine and their most important source. We used descriptive statistics to characterize the information sources and compared the endorsement of government organizations and obstetrician-gynecologists, which were the most important information source between reproductive groups, using the chi-square test. The effect size was calculated using Cramér V.

## RESULTS

Our survey had 11,405 unique respondents: 5846 (51.3%) were preventing pregnancy, 955 (8.4%) were attempting pregnancy, 2196 (19.3%) were currently pregnant, 2250 (19.7%) were lactating, 67 (0.6%) were attempting pregnancy and lactating, and 91 (0.8%) were currently pregnant and lactating. The most endorsed information sources were government organizations (88.7%), employers (48.5%), obstetrician-gynecologists (44.9%), and social media (39.6%). Considering the most important information source, the distribution of respondents endorsing government organizations was different between reproductive groups ( $P < .001$ ); it was most common among respondents preventing pregnancy (62.6%) and least common among those currently pregnant (31.5%). We observed an inverse pattern among the respondents endorsing an obstetrician-gynecologist as the most important source; the source was most common among currently pregnant respondents (51.4%) and least common among those preventing pregnancy (5.8%),  $P < .001$ . The differences in the endorsement of social media as an information source between groups were significant but had a small effect size.

## CONCLUSION

Healthcare workers use government and professional medical organizations for information. Respondents attempting pregnancy and those pregnant and/or lactating are more likely to use social media and an obstetrician-gynecologist as information sources for vaccine decision-making. These data can inform public health messaging and counseling for clinicians. (Author)

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## 2022-08624

### **Safety of Booster Doses of Coronavirus Disease 2019 (COVID-19) Vaccine in Pregnancy in the Vaccine Adverse Event Reporting System.** Moro PL, Olson CK, Zhang B, et al (2022), *Obstetrics & Gynecology* Vol 140, no 3, September 2022, pp 421-427

## OBJECTIVE:

To evaluate and summarize reports to the Vaccine Adverse Event Reporting System (VAERS), a national spontaneous reporting system, in pregnant people who received a booster dose of mRNA coronavirus disease 2019 (COVID-19) vaccine.

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but no maternal deaths occurred. Pregnancy-specific outcomes included 56 (17.3%) spontaneous abortions (before 20 weeks of gestation), eight (2.5%) episodes of vaginal bleeding, five (1.5%) stillbirths (at or after 20 weeks of gestation), four (1.2%) episodes of preeclampsia, and two (0.6%) preterm deliveries. Reporting rates for stillbirth and preterm delivery were below background rates. Ten instances of adverse events in neonates were reported, which included two reports of birth defects. Non-pregnancy-specific adverse events (n=207; 64.1%) were mostly systemic (eg, headache, fatigue) and local reactions and occurred in proportions comparable with those seen in pregnant people who received the primary COVID-19 vaccination series and reported to VAERS during the same period.

#### CONCLUSION:

Review of reports after a booster dose of mRNA COVID-19 vaccine in pregnant people in VAERS found their safety profile was comparable with that of published reports after primary COVID-19 vaccination in pregnant people.

(Author)

Full URL: <https://doi.org/10.1097/AOG.0000000000004889>

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#### 2022-08602

**COVID-19 vaccination uptake among pregnant individuals in a middle-income setting.** Rodriguez-Sibaja MJ, Acevedo-Gallegos S, Campos-Zamora M, et al (2022), International Journal of Gynecology & Obstetrics vol 159, no 2, November 2022, pp 607-609

Overall rate of COVID-19 vaccination during pregnancy was strikingly low in this middle-income setting. Vaccine uptake was more likely among individuals with high-risk pregnancies. (Author)

Full URL: <https://doi.org/10.1002/ijgo.14344>

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#### 2022-08601

**COVID-19 vaccine and pregnancy outcomes: A systematic review and meta-analysis.** Carbone L, Trinchillo MG, Di Girolamo R, et al (2022), International Journal of Gynecology & Obstetrics vol 159, no 3, December 2022, pp 651-661

Objectives

To explore perinatal outcomes in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)-vaccinated pregnant women compared with unvaccinated counterparts.

Methods

Search was conducted using Web of Science, Scopus, ClinicalTrial.gov, MEDLINE, Embase, OVID, and Cochrane Library as electronic databases. We included observational studies evaluating pregnant women undergoing SARS-CoV-2 vaccination and compared pregnancy and perinatal outcomes with those in unvaccinated women. Categorical variables were assessed using odds ratio (OR) with 95% confidence interval (CI), whereas for continuous variables, the results were expressed as mean difference with their 95% CI. All analyses were performed by adopting the random effect model of DerSimonian and Laird.

Results

There was no difference in the probability of having a small-for-gestational-age fetus (OR 0.97, 95% CI 0.85–1.09; P = 0.570), but we observed a reduced probability of a non-reassuring fetal monitoring, a reduced gestational age at delivery, and a reduced probability of premature delivery in vaccinated pregnant women versus unvaccinated ones.

Conclusion

The probability of small for gestational age is similar between vaccinated and unvaccinated pregnant women, and the former also had a slightly reduced rate of premature delivery. (Author)

Full URL: <https://doi.org/10.1002/ijgo.14336>

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#### 2022-08587

**COVID-19 vaccine hesitancy among pregnant women: a systematic review and meta-analysis.** Bhattacharya O, Siddiquea

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**Objective** The aim of this study was to perform a systematic review and meta-analysis to estimate the vaccines' acceptance level and to find the factors influencing pregnant women's vaccination decisions, with the goal of assisting in the development of interventions and promoting more research in this area.

**Design** Systematic review and meta-analysis.

**Data sources** MEDLINE, Embase, CINAHL and PubMed.

**Eligibility criteria** Studies providing any kind of quantitative assessment of overall COVID-19 vaccination acceptance among pregnant women in any country or region across the globe.

**Data extraction and synthesis** The pooled prevalence of COVID-19 vaccine acceptance among pregnant women was calculated using the random-effects model. Subgroup (sensitivity) analysis was performed to determine the overall COVID-19 vaccine acceptance level to understand the sources of substantial heterogeneity.

**Results** Out of the 375 studies identified, 17 studies from four continents assessing 25 147 participants (pregnant women) were included in this study. Among the participants, only 49% (95% CI 42% to 56%,  $p < 0.001$ ) had COVID-19 vaccine acceptance. High-income countries (47%; 95% CI 38% to 55%,  $p < 0.001$ ), participants with fewer than 12 years of education (38%; 95% CI 19% to 58%,  $p < 0.001$ ) and multiparous women (48%; 95% CI 31% to 66%,  $p < 0.001$ ) had lower COVID-19 vaccine acceptance. Overall heterogeneity was high ( $I^2 \geq 98\%$ ), and publication bias was present ( $p < 0.001$ ). A very weak positive correlation between COVID-19 knowledge and COVID-19 vaccine acceptance was observed ( $r = 0.164$ ; 95% CI  $-0.946$  to  $0.972$ ;  $p = 0.8359$ ).

**Conclusion** Overall, COVID-19 vaccine acceptance among pregnant women was low across the studies and considerably low among some specific subgroups of participants. These research findings have implications for the development of effective interventions that could increase the COVID-19 vaccine acceptance level among pregnant women to attain herd immunity.

PROSPERO registration number CRD42021277754. (Author)

**Full URL:** <http://dx.doi.org/10.1136/bmjopen-2022-061477>

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## 2022-08445

**A qualitative study of pregnant women's opinions on COVID-19 vaccines in Turkey.** Uludağ E, Serçekuş P, Yıldırım DF, et al (2022), Midwifery vol 114, November 2022, 103459

### Objectives

to examine pregnant Turkish women's opinions on COVID-19 vaccines.

### Design

a qualitative approach was used to gather data through semi-structured interviews.

### Participants and setting

16 women about to receive a vaccine during their pregnancy and who did or did not experience vaccine hesitancy participated.

### Analysis

qualitative content analysis.

### Findings

three main themes emerged regarding the pregnant women's opinions on COVID-19 vaccines: fear,

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security/insecurity and social support.

Key conclusions and implications for practice

pregnant women mostly recalled their babies and fears about COVID-19 vaccines. Although the fear of vaccines created vaccine hesitancy during pregnancy, the fear of contracting COVID-19 led to a positive attitude to the vaccines. It is critical to provide pregnant women with information about COVID-19 and vaccines for the disease in order to enhance vaccination rates among pregnant women. (Author)

Full URL: <https://doi.org/10.1016/j.midw.2022.103459>

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#### 2022-08288

**COVID-19: the green book, chapter 14a [Last updated 18 August 2022].** UK Health Security Agency (2020), 27 November 2020

Provides Coronavirus (COVID-19) vaccination information for public health professionals. Includes information on coronavirus disease in pregnant women and infants, and gives recommendations for vaccination during this coming Autumn 2022 season. (JSM)

Full URL: <https://www.gov.uk/government/publications/covid-19-the-green-book-chapter-14a>

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#### 2022-08286

**Covid: Pregnant women targeted with false vaccine claims.** Schraer R (2022), BBC News 1 September 2022

Covid vaccination advice in pregnancy has not changed, contrary to false social media posts, UK health agencies have clarified. (Author)

Full URL: [https://www.bbc.co.uk/news/health-62739554?at\\_medium=RSS&at\\_campaign=KARANGA](https://www.bbc.co.uk/news/health-62739554?at_medium=RSS&at_campaign=KARANGA)

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#### 2022-07920

**Risk of preterm birth, small for gestational age at birth, and stillbirth after covid-19 vaccination during pregnancy: population based retrospective cohort study.** Fell DB, Dimanlig-Cruz S, Regan AK, et al (2022), BMJ vol 378, no 8349, 17 August 2022, e071416

Objective To assess the risk of preterm birth, small for gestational age at birth, and stillbirth after covid-19 vaccination during pregnancy.

Design Population based retrospective cohort study.

Setting Ontario, Canada, 1 May to 31 December 2021.

Participants All liveborn and stillborn infants from pregnancies conceived at least 42 weeks before the end of the study period and with gestational age  $\geq 20$  weeks or birth weight  $\geq 500$  g.

Main outcome measures Using Cox regression, hazard ratios and 95% confidence intervals were estimated for preterm birth before 37 weeks (overall and spontaneous preterm birth), very preterm birth (<32 weeks), small for gestational age at birth (<10th centile), and stillbirth. Vaccination against covid-19 was treated as a time varying exposure in the outcome specific risk window, and propensity score weighting was used to adjust hazard ratios for potential confounding.

Results Among 85 162 births, 43 099 (50.6%) occurred in individuals who received one dose or more of a covid-19 vaccine during pregnancy—42 979 (99.7%) received an mRNA vaccine. Vaccination during pregnancy was not associated with any increased risk of overall preterm birth (6.5% among vaccinated v 6.9% among unvaccinated; adjusted hazard ratio 1.02, 95% confidence interval 0.96 to 1.08), spontaneous preterm birth (3.7% v 4.4%; 0.96, 0.90 to 1.03), or very preterm birth (0.59% v 0.89%; 0.80, 0.67 to 0.95). No increase was found in risk of small for gestational age at birth (9.1% v 9.2%; 0.98, 0.93 to 1.03) or stillbirth (0.25% v 0.44%; 0.65, 0.51 to 0.84). Findings were similar by trimester of vaccination, mRNA vaccine product, and number of doses received during pregnancy.

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Conclusion The findings suggest that vaccination against covid-19 during pregnancy is not associated with a higher risk of preterm birth, small for gestational age at birth, or stillbirth. (Author)

Full URL: <https://doi.org/10.1136/bmj-2022-071416>

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## 2022-07828

### Safety of COVID-19 vaccines in pregnancy: a Canadian National Vaccine Safety (CANVAS) network cohort study.

Sadarangani M, Soe P, Shulha HP, et al (2022), The Lancet Infectious Diseases 11 August 2022, online

#### Background

Pregnant individuals have been receiving COVID-19 vaccines following pre-authorisation clinical trials in non-pregnant people. This study aimed to determine the frequency and nature of significant health events among pregnant females after COVID-19 vaccination, compared with unvaccinated pregnant controls and vaccinated non-pregnant individuals.

#### Methods

We did an observational cohort study, set in seven Canadian provinces and territories including Ontario, Quebec, British Columbia, Alberta, Nova Scotia, Yukon, and Prince Edward Island. Eligibility criteria for vaccinated individuals were a first dose of a COVID-19 vaccine within the previous 7 days; an active email address and telephone number; ability to communicate in English or French; and residence in the aforementioned provinces or territories. Study participants were pregnant and non-pregnant females aged 15–49 years. Individuals were able to participate as controls if they were unvaccinated and fulfilled the other criteria. Data were collected primarily by self-reported survey after both vaccine doses, with telephone follow-up for those reporting any medically attended event. Participants reported significant health events (new or worsening of a health event sufficient to cause work or school absenteeism, medical consultation, or prevent daily activities) occurring within 7 days of vaccination or within the past 7 days for unvaccinated individuals. We employed multivariable logistic regression to examine significant health events associated with mRNA vaccines, adjusting for age group, previous SARS-CoV-2 infection, and trimester, as appropriate.

#### Findings

As of Nov 4, 2021, 191 360 women aged 15–49 years with known pregnancy status had completed the first vaccine dose survey and 94 937 had completed the second dose survey. 180 388 received one dose and 94 262 received a second dose of an mRNA vaccine, with 5597 pregnant participants receiving dose one and 3108 receiving dose two, and 174 765 non-pregnant participants receiving dose one and 91 131 receiving dose two. Of 6179 included unvaccinated control participants, 339 were pregnant and 5840 were not pregnant. Overall, 226 (4.0%) of 5597 vaccinated pregnant females reported a significant health event after dose one of an mRNA vaccine, and 227 (7.3%) of 3108 after dose two, compared with 11 (3.2%) of 339 pregnant unvaccinated females. Pregnant vaccinated females had an increased odds of a significant health event within 7 days of the vaccine after dose two of mRNA-1273 (adjusted odds ratio [aOR] 4.4 [95% CI 2.4–8.3]) compared with pregnant unvaccinated controls within the past 7 days, but not after dose one of mRNA-1273 or any dose of BNT162b2. Pregnant vaccinated females had decreased odds of a significant health event compared with non-pregnant vaccinated females after both dose one (aOR 0.63 [95% CI 0.55–0.72]) and dose two (aOR 0.62 [0.54–0.71]) of any mRNA vaccination. There were no significant differences in any analyses when restricted to events which led to medical attention.

#### Interpretation

COVID-19 mRNA vaccines have a good safety profile in pregnancy. These data can be used to appropriately inform pregnant people regarding reactogenicity of COVID-19 vaccines during pregnancy, and should be considered alongside effectiveness and immunogenicity data to make appropriate recommendations about best use of COVID-19 vaccines in pregnancy.

#### Funding

Canadian Institutes of Health Research, Public Health Agency of Canada. (Author)

Full URL: [https://doi.org/10.1016/S1473-3099\(22\)00426-1](https://doi.org/10.1016/S1473-3099(22)00426-1)

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## 2022-07826

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**Covid-19: Study provides further evidence that mRNA vaccines are safe in pregnancy.** Wise J (2022), BMJ vol 378, 12 August 2022, o2013

Pregnant women experienced lower rates of significant adverse events after vaccination with a covid-19 mRNA vaccine than a group of similarly aged women who were not pregnant, a Canadian study has concluded (1).

1. Sadarangani M. The Lancet Infectious Diseases, 11 August 2022, online.

[https://doi.org/10.1016/S1473-3099\(22\)00426-1](https://doi.org/10.1016/S1473-3099(22)00426-1).

(Author, edited)

Full URL: <https://doi.org/10.1136/bmj.o2013>

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## 2022-07825

**Covid-19 vaccination in pregnancy.** Badell ML, Dude CM, Rasmussen SA, et al (2022), BMJ vol 378, 10 August 2022, e069741

Pregnancy is an independent risk factor for severe covid-19. Vaccination is the best way to reduce the risk for SARS-CoV-2 infection and limit its morbidity and mortality. The current recommendations from the World Health Organization, Centers for Disease Control and Prevention, and professional organizations are for pregnant, postpartum, and lactating women to receive covid-19 vaccination. Pregnancy specific considerations involve potential effects of vaccination on fetal development, placental transfer of antibodies, and safety of maternal vaccination. Although pregnancy was an exclusion criterion in initial clinical trials of covid-19 vaccines, observational data have been rapidly accumulating and thus far confirm that the benefits of vaccination outweigh the potential risks. This review examines the evidence supporting the effectiveness, immunogenicity, placental transfer, side effects, and perinatal outcomes of maternal covid-19 vaccination. Additionally, it describes factors associated with vaccine hesitancy in pregnancy. Overall, studies monitoring people who have received covid-19 vaccines during pregnancy have not identified any pregnancy specific safety concerns. Additional information on non-mRNA vaccines, vaccination early in pregnancy, and longer term outcomes in infants are needed. To collect this information, vaccination during pregnancy must be prioritized in vaccine research. (Author)

Full URL: <https://doi.org/10.1136/bmj-2021-069741>

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## 2022-07693

**Countering COVID-19 Vaccine Hesitancy in Pregnancy: the “4 Cs”.** Shook LL, Kishkovich TP, Edlow AG (2022), American Journal of Perinatology vol 39, no 10, July 2022

Despite evidence to support the safety and efficacy of COVID-19 vaccination in pregnancy, and clear recommendations from professional organizations and the Centers for Disease Control and Prevention (CDC) for pregnant people to get vaccinated, COVID-19 vaccine hesitancy in pregnancy remains a significant public health problem. The emergence of the highly transmissible B.1.617.2 (Delta) variant among primarily unvaccinated people has exposed the cost of vaccine hesitancy. In this commentary, we explore factors contributing to COVID-19 vaccine hesitancy in pregnancy and potential solutions to overcome them.

### Key Points

Low COVID-19 vaccination coverage in pregnant people is a major public health problem in the United States.

COVID-19 vaccine hesitancy in pregnancy is multifactorial.

The “4 Cs” framework may be useful in countering COVID-19 vaccine hesitancy. (Author)

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## 2022-07689

**Large study confirms safety of Covid-19 vaccines during pregnancy.** Ford S (2022), Nursing Times 12 August 2022

Covid-19 vaccines are safe to use in pregnancy and pregnant women experienced lower rates of side effects post-vaccination, according to the authors of a major study in Canada. (Author)

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2022-07682

**Perceptions and Attitudes toward COVID-19 Vaccination among Pregnant and Postpartum Individuals.** Siegel MR, Lumbreras-Marquez MI, James K, et al (2022), American Journal of Perinatology vol 29, no 14, October 2022, pp 1489-1495

**Objective** This study aimed to characterize attitudes toward novel coronavirus disease 2019 (COVID-19) vaccination and to evaluate factors associated with vaccine uptake among pregnant individuals.

**Study Design** An anonymous survey was distributed to a convenience sample of pregnant individuals receiving prenatal care at two large urban academic hospitals in a single health care network in Massachusetts. Individual demographic variables were included in the survey along with questions assessing attitudes toward COVID-19 and vaccination in pregnancy. Data were analyzed using parametric or nonparametric tests when appropriate, and associated odds ratios (OR) were calculated via univariable logistic regression.

**Results** There were 684 surveys distributed, and 477 pregnant and postpartum individuals completed the survey, for a response rate of 69.7%. Overall, 233 (49.3%) had received or were scheduled to receive a COVID-19 vaccine. Age, White race, non-Hispanic or Latinx ethnicity, working from home, and typical receipt of the influenza vaccine were associated with COVID-19 vaccination. Further, 276 respondents (58.4%) reported that their provider recommended the COVID-19 vaccine in pregnancy; these participants were more likely to have received a vaccine (OR = 5.82, 95% confidence interval [CI]: 3.68–9.26,  $p < 0.005$ ). Vaccinated individuals were less likely to be worried about the effects of the vaccine on themselves (OR = 0.18, 95% CI: 0.12–0.27,  $p < 0.005$ ) or their developing babies (OR = 0.17, 95% CI: 0.11–0.26,  $p < 0.005$ ). Unvaccinated individuals were less likely to report that it is easy to schedule a COVID-19 vaccine (OR = 0.56, 95% CI: 0.34–0.93,  $p = 0.02$ ), to travel to receive a vaccine (OR = 0.19, 95% CI: 0.10–0.36,  $p < 0.005$ ), and to miss work to receive a vaccine (OR = 0.30, 95% CI: 0.18–0.48,  $p < 0.005$ ).

**Conclusion** Strategies are needed to improve patient education regarding vaccine side effects and safety in pregnancy. Policy changes should focus on making it feasible for patients to schedule a vaccine and miss work without loss of pay to get vaccinated.

#### Key Points

There were racial and ethnic disparities in COVID-19 vaccination.

Unvaccinated respondents were more likely to be concerned about vaccine effects for themselves or their growing babies.

Unvaccinated respondents cited work and scheduling-related barriers to vaccination, indicating areas for advocacy.

(Author)

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2022-07642

**COVID-19 booster dose induces robust antibody response in pregnant, lactating, and nonpregnant women.** Atyeo C, Shook LL, Nziza N, et al (2023), American Journal of Obstetrics & Gynecology (AJOG) vol 228, no 1, January 2023, p 68.e1-68.e12

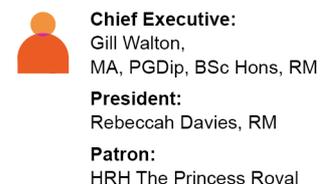
#### BACKGROUND

While emerging data during the SARS-CoV-2 pandemic have demonstrated robust mRNA vaccine-induced immunogenicity across populations, including pregnant and lactating individuals, the rapid waning of vaccine-induced immunity and the emergence of variants of concern motivated the use of mRNA vaccine booster doses. Whether all populations, including pregnant and lactating individuals, will mount a comparable response to a booster dose is not known.

#### OBJECTIVE

We sought to profile the humoral immune response to a COVID-19 mRNA booster dose in a cohort of pregnant, lactating, and age-matched nonpregnant women.

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## STUDY DESIGN

We characterized the antibody response against ancestral Spike and Omicron in a cohort of 31 pregnant, 12 lactating and 20 nonpregnant age-matched controls who received a BNT162b2 or mRNA-1273 booster dose after primary COVID-19 vaccination. We also examined the vaccine-induced antibody profiles of 15 maternal:cord dyads at delivery.

## RESULTS

Receipt of a booster dose during pregnancy resulted in increased IgG1 against Omicron Spike (post-primary vaccination vs post-booster,  $p = 0.03$ ). Pregnant and lactating individuals exhibited equivalent Spike-specific total IgG1, IgM and IgA levels and neutralizing titers against Omicron compared to nonpregnant women. Subtle differences in Fc-receptor binding and antibody subclass profiles were observed in the immune response to a booster dose in pregnant compared to nonpregnant individuals. Analysis of maternal and cord antibody profiles at delivery demonstrated equivalent total Spike-specific IgG1 in maternal and cord blood, yet higher Spike-specific Fc $\gamma$ R3a-binding antibodies in the cord relative to maternal blood ( $p = 0.002$ ), consistent with preferential transfer of highly functional IgG. Spike-specific IgG1 levels in the cord were positively correlated with time elapsed since receipt of the booster dose (Spearman  $R = 0.574$ ,  $p = 0.035$ ).

## CONCLUSIONS

These data suggest that receipt of a booster dose during pregnancy induces a robust Spike-specific humoral immune response, including against Omicron. If boosting occurs in the third trimester, higher Spike-specific cord IgG1 levels are achieved with greater time elapsed between receipt of the booster and delivery. Receipt of a booster dose has the potential to augment maternal and neonatal immunity. (Author)

Full URL: <https://doi.org/10.1016/j.ajog.2022.07.014>

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## 2022-07618

### **One Vax Two Lives: a social media campaign and research program to address COVID-19 vaccine hesitancy in pregnancy.**

Marcell L, Dokania E, Navia I, et al (2022), American Journal of Obstetrics & Gynecology (AJOG) vol 227, no 5, November 2022, pp 685-695.e2

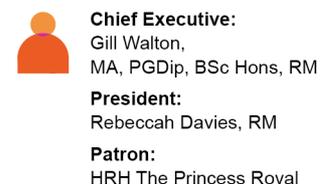
The COVID-19 pandemic has disproportionately affected pregnant people by increasing health risks of maternal morbidity and mortality, stillbirth, and preterm birth. Although numerous studies have supported the safety and efficacy of COVID-19 vaccination in pregnancy in preventing or mitigating the risk for these adverse outcomes, many pregnant people remain hesitant. Approximately half of US adults regularly consume news from social media platforms, which are a fertile ground for the spread of vaccine disinformation. The lack of information regarding COVID-19 vaccine safety early in the pandemic fueled vaccine myths targeting the fears of pregnant people about vaccination risks. Saddened by the spike in maternal deaths of unvaccinated individuals during the COVID-19 Delta variant surge in the fall of 2021, we created a social media campaign to promote scientific communication regarding the risks of COVID-19 disease in pregnancy and the benefits of vaccination. We called the campaign "One Vax Two Lives," which refers to the ability of 1 maternal vaccine to benefit the health and lives of both the pregnant individual and their fetus. We present a blueprint of how we leveraged a large, interdisciplinary student workforce to create a social media campaign and research program studying vaccine hesitancy, which can be replicated by other groups. Community engagement and partnerships with key stakeholders, such as the Washington State Department of Health, were essential for amplifying the campaign and providing our team with feedback on content and approach. We present the analytics of our social media advertisements, web articles, and video content that helped inform the iterative design process of the multimedia content. Moving forward, we are launching collaborative research programs to study vaccine hesitancy and inform the development of new social media content designed for pregnant individuals who are: (1) Spanish-speaking Hispanic/Latina/x, (2) Black or Afro-Latinx, and (3) residents of rural communities in the State of Washington. Data from these mixed methods studies will inform new communication campaigns to reach vaccine-hesitant individuals. Finally, we discuss lessons learned and how the most impactful elements of the campaign can be translated to related areas of maternal public health. (Author)

Full URL: <https://doi.org/10.1016/j.ajog.2022.06.022>

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## 2022-07588

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## Safety of Booster Doses of Coronavirus Disease 2019 (COVID-19) Vaccine in Pregnancy in the Vaccine Adverse Event

**Reporting System.** Moro PL, Olson CK, Zhang B, et al (2022), *Obstetrics & Gynecology* 3 August 2022, online

### OBJECTIVE:

To evaluate and summarize reports to the Vaccine Adverse Event Reporting System (VAERS), a national spontaneous reporting system, in pregnant people who received a booster dose of mRNA coronavirus disease 2019 (COVID-19) vaccine.

### METHODS:

We searched VAERS for U.S. reports of adverse events in pregnant people who received a booster dose of an mRNA COVID-19 vaccine from September 22, 2021, to March 24, 2022. Clinicians reviewed reports and available medical records.

### RESULTS:

The Vaccine Adverse Event Reporting System received 323 reports of adverse events in pregnant people who received a booster dose of COVID-19 vaccine; 178 (55.1%) after BNT162b2 from Pfizer–BioNTech and 145 (44.9%) after mRNA-1273 from Moderna. Seventy-two (22.3%) reports were coded as serious. One neonatal death was reported, but no maternal deaths occurred. Pregnancy-specific outcomes included 56 (17.3%) spontaneous abortions (before 20 weeks of gestation), eight (2.5%) episodes of vaginal bleeding, five (1.5%) stillbirths (at or after 20 weeks of gestation), four (1.2%) episodes of preeclampsia, and two (0.6%) preterm deliveries. Reporting rates for stillbirth and preterm delivery were below background rates. Ten instances of adverse events in neonates were reported, which included two reports of birth defects. Non–pregnancy-specific adverse events (n=207; 64.1%) were mostly systemic (eg, headache, fatigue) and local reactions and occurred in proportions comparable with those seen in pregnant people who received the primary COVID-19 vaccination series and reported to VAERS during the same period.

### CONCLUSION:

Review of reports after a booster dose of mRNA COVID-19 vaccine in pregnant people in VAERS found their safety profile was comparable with that of published reports after primary COVID-19 vaccination in pregnant people.

(Author)

**Full URL:** <https://doi.org/10.1097/AOG.0000000000004889>

## 2022-07514

### Hesitancy about COVID-19 vaccination among pregnant women: a cross-sectional study based on the health belief

**model.** Firouzbakht M, Nia HS, Kazeminavaei F, et al (2022), *BMC Pregnancy and Childbirth* vol 22, no 611, 2 August 2022

#### Background

Pregnant women are at high risk for affliction by coronavirus disease 2019 (COVID-19). Vaccination is a main strategy to prevent and manage the COVID-19 pandemic. However, hesitancy about COVID-19 vaccination (HACV) is a major public health threat and a major barrier to herd immunity. The aim of the study was to evaluate pregnant women's HACV based on the Health Belief Model (HBM).

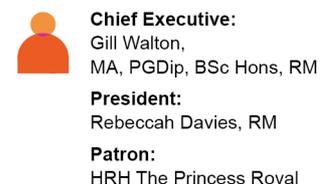
#### Methods

This cross-sectional study was conducted in 2021–2022. Participants were 352 pregnant women selected from several healthcare centers in the north of Iran. Instruments for data collection were a demographic questionnaire, a COVID-19 Knowledge Questionnaire, a COVID-19 Health Belief Questionnaire, and a question about HACV. Logistic regression analysis was used to assess the effects of the study variables on HACV.

#### Results

The rate of HACV was 42.61%. In the regression model, the three factors of perceived benefits (aOR: 0.700; 95% CI: 0.594 to 0.825), cues to action (aOR: 0.621; 95% CI: 0.516 to 0.574), and history of reproductive problems (aOR: 2.327; 95% CI: 0.1.262 to 4.292) had significant effects on HACV ( $P < 0.001$ ).

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## Conclusion

HACV is highly prevalent among pregnant women. The perceived benefits and cues to action components of HBM have significant effects on pregnant women's HACV, while the perceived threat component has no significant effect on it. HBM is a good model to explain HACV among pregnant women. Educational interventions are necessary to improve pregnant women's awareness of the risks of COVID-19 for them and their fetus. (Author)

Full URL: <https://doi.org/10.1186/s12884-022-04941-3>

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## 2022-07409

### **An imperative to offer pregnant and lactating women access to the COVID-19 vaccination roll-out programme.**

Moodley J, Ngene NC, Khaliq OP, et al (2021), South African Medical Journal (SAMJ) vol 111, no 6, June 2021, pp 567-569

In view of the continuing worldwide spread of COVID-19 infection, the increased morbidity and mortality from the disease during pregnancy, and the current efficacy and safety of vaccines in non-pregnant individuals, vaccines should not be withheld from women simply because of pregnancy or lactation. All pregnant women, especially healthcare professionals, should be offered vaccination and counselled about its advantages and disadvantages by their maternity care providers. Complete eradication of COVID-19 infection will be possible if potential niduses of the infection, which may act as sources for future outbreaks, are protected against the pathogen. However, if a hypothetical medication is the only means yet proven of limiting severe compromise to maternal health, access to the medication should be at the pregnant woman's discretion. Shared decision-making requires physicians to actively engage with their patients and share their knowledge about the subject matter. (Author)

Full URL: <http://www.samj.org.za/index.php/samj/article/view/13271/9814>

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## 2022-07406

### **Considerations for COVID-19 vaccination in pregnancy.** Zamparini J, Murray L, Siggers RT, et al (2021), South African Medical Journal (SAMJ) vol 111, no 6, June 2021, pp 544-549

Pregnant women are at greater risk of severe COVID-19 than non-pregnant women. Despite limited safety data on use of COVID-19 vaccines in pregnancy, many international societies have recommended their use when pregnant women are at particularly high risk of acquiring COVID-19, or have suggested that vaccines should not be withheld from pregnant women where no other contraindications to COVID-19 vaccination exist. A number of vaccines, including those against influenza, tetanus and pertussis, have been shown to reduce both maternal and infant morbidity and mortality when used antenatally. We explore the role of COVID-19 vaccination in the setting of pregnancy, discuss the limited data available, and summarise current international guidelines. (Author)

Full URL: <http://www.samj.org.za/index.php/samj/article/view/13267/9815>

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## 2022-07378

### **Breastfeeding Women's Attitudes About the SARS-COV-2 Vaccine in Spain.** Blazquez RA, González-Timoneda A, González-Timoneda M, et al (2022), Journal of Human Lactation vol 38, no 4, November 2022, pp 609–618

#### Background:

Severe Acute Respiratory Syndrome Coronavirus 2 has spread globally, causing the coronavirus disease 2019 (COVID-19) pandemic. To control the pandemic and to achieve herd immunity, four vaccines have obtained market authorization in Europe. Researchers have reported that the sequence of administration of the vaccines depends on the risk of exposure to COVID-19 and age, recommending the vaccine to pregnant and breastfeeding women.

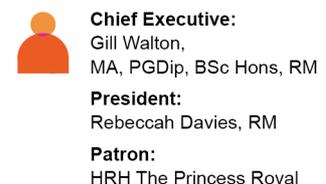
#### Research Aim:

To examine the knowledge, willingness and attitudes of breastfeeding women in Spain regarding the possibility of receiving the COVID-19 vaccine.

#### Methods:

An observational descriptive cross-sectional study in two tertiary-level hospitals from Valencia was conducted. Breastfeeding women (N = 301) were recruited by non-probability sampling of consecutive cases. Questionnaires

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were collected in June 2021.

#### Results:

More than one in every two participants would accept a COVID-19 vaccine, and the percentage rose in participants who were older, more educated, or worked in high-risk jobs. Their main source of information was the Internet, and midwives were the professionals who most recommended vaccination. Participants who would not accept vaccination during lactation reported reasons linked to lack of information regarding vaccination in their condition and how it might affect newborns.

#### Conclusion:

It is of primary concern for healthcare professionals to foster a greater understanding by providing updated information regarding the need, safety, and efficacy of the vaccine for both lactating mothers and their newborns.

(Author)

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#### 2022-07148

**Maternal and neonatal safety outcomes after SAR-CoV-2 vaccination during pregnancy: a systematic review and meta-analysis.** Hagrass AI, Almadhoon HW, Al-Kafarna M, et al (2022), BMC Pregnancy and Childbirth vol 22, no 581, 21 July 2022

#### Background and objective

More than five million individuals died because of problems connected to COVID-19. SARS-Cov-2 poses a particular challenge to expectant mothers, who comprise one of the most vulnerable segments of the population. Our aim is to demonstrate the maternal and neonatal safety of the COVID-19 vaccine during pregnancy.

#### Methods

We searched PubMed, Cochrane Library, Scopus, Web of Science (WOS), Embase, Ovid, MedRxiv, and BioRxiv databases from inception till December 2021 and then updated it in April 2022. Additionally, we searched ClinicalTrials.gov, Research Square and grey literature. Cohort, case-control studies, and randomized controlled trials detecting the safety of the Covid-19 vaccine during pregnancy were included. We used the Cochrane tool and Newcastle-Ottawa Scale to assess the risk of bias of the included studies and the GRADE scale to assess the quality of evidence. A meta-analysis was conducted using review manager 5.4.

#### Results

We included 13 studies with a total number of 56,428 patients. Our analysis showed no statistically significant difference in the following outcomes: miscarriage (1.56% vs 0.3%. RR 1.23; 95%CI 0.54 to 2.78); length of maternal hospitalization (MD 0.00; 95%CI -0.08 to 0.08); puerperal fever (1.71% vs 1.1%. RR 1.04; 95%CI 0.67 to 1.61); postpartum hemorrhage (4.27% vs 3.52%. RR 0.84; 95%CI 0.65 to 1.09); instrumental or vacuum-assisted delivery (4.16% vs 4.54%. RR 0.94; 95%CI 0.57 to 1.56); incidence of Apgar score  $\leq 7$  at 5 min (1.47% vs 1.48%. RR 0.86; 95%CI 0.54 to 1.37); and birthweight (MD -7.14; 95%CI -34.26 to 19.99).

#### Conclusion

In pregnancy, the current meta-analysis shows no effect of SAR-CoV-2 vaccination on the risk of miscarriage, length of stay in the hospital, puerperal fever, postpartum hemorrhage, birth weight, or the incidence of an Apgar score of  $\leq 7$  at 5 min. (Author)

Full URL: <https://doi.org/10.1186/s12884-022-04884-9>

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#### 2022-07126

**Changes in prenatal care and vaccine willingness among pregnant women during the COVID-19 pandemic.** Erchick DJ, Agarwal S, Kaysin A, et al (2022), BMC Pregnancy and Childbirth vol 22, no 558, 13 July 2022

#### Introduction

Concerns about SARS-CoV-2 infection risk in health care settings have resulted in changes in prenatal care and birth

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plans, such as shifts to in-person visits and increased Cesarean delivery. These changes may affect quality of care and limit opportunities for clinicians to counsel pregnant individuals, who are at higher risk of severe COVID-19 disease and adverse pregnancy outcomes, about prevention and vaccination.

## Methods

We conducted a cross-sectional online survey of United States adults on changes in prenatal care, COVID-19 vaccine willingness, and reasons for unwillingness to receive a vaccine. We summarized changes in access to care and examined differences in vaccine willingness between pregnant and propensity-score matched non-pregnant controls using chi-squared tests and multivariable conditional logistic regression.

## Results

Between December 15–23, 2020, 8481 participants completed the survey, of which 233 were pregnant. Three-quarters of pregnant women (n = 186) experienced a change in prenatal care, including format of care (n = 84, 35%) and reduced visits (n = 69, 24%). Two-thirds experienced a change in birth plans, from a hospital birth to home birth (n = 45, 18%) or vaginal birth to a Cesarean delivery (n = 42, 17%). Although 40% of pregnant women (n = 78) were unwilling to receive COVID-19 vaccination, they had higher, though non-significant, odds of reporting willingness to receive vaccination compared to similar non-pregnant women (aOR 1.38, 95% CI: 0.95, 2.00).

## Conclusion

To support pregnant women through the perinatal care continuum, maternity care teams should develop protocols to foster social support, patient-centered education around infection prevention that focuses on improved risk perception, expected changes in care due to COVID-19, and vaccine effectiveness and safety. (Author)

**Full URL:** <https://doi.org/10.1186/s12884-022-04882-x>

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## 2022-06993

**SARS-CoV-2 Immunoglobulin G Antibody Levels in Infants Following Messenger RNA COVID-19 Vaccination During Pregnancy.** Kugelman N, Nahshon C, Shaked-Mishan P, et al (2022), American Journal of Obstetrics & Gynecology (AJOG) vol 227, no 6, December 2022, pp 911-913

Research letter aiming to evaluate SARS-CoV-2 immunoglobulin G (IgG) levels in infants up to six months of age following maternal vaccination in the second trimester of pregnancy. Results show that vaccination provides protection in early infancy and this is enhanced by breastfeeding. (LDO)

**Full URL:** <https://doi.org/10.1016/j.ajog.2022.07.016>

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## 2022-06900

**Frequently asked questions: COVID-19 vaccines and breastfeeding based on WHO interim recommendations, 12 August 2021.** IFE Core Group, UNICEF, USAID, World Health Organization (2021), September 2021. 2 pages

The FAQs are intended to provide answers to health care providers and the public, including mothers who are breastfeeding or expressing milk, on breastfeeding and the following COVID-19 vaccines:

- Pfizer-BioNTech BNT162b2
- Moderna mRNA-1273
- Oxford University - AstraZeneca AZD1222
- Janssen Ad26.COV2.S
- Sinopharm - BIBP vaccine
- Sinovac - CoronaVac. (Author)

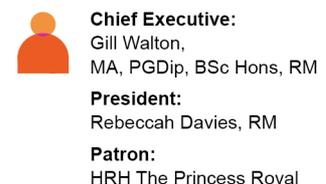
**Full URL:** <https://www.who.int/publications/i/item/WHO-2019-nCoV-FAQ-Breast-feeding-Vaccines-2021.1>

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## 2022-06884

**Questions and Answers: COVID-19 vaccines and pregnancy.** World Health Organization (2022), February 2022. 5 pages

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These questions and answers are intended to provide answers to health providers and the public on COVID-19 vaccination during pregnancy. (Author)

Full URL: <https://www.who.int/publications/i/item/WHO-2019-nCoV-FAQ-Pregnancy-Vaccines-2022.1>

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## 2022-06865

### **Third trimester messenger RNA COVID-19 booster vaccination upsurge maternal and neonatal SARS-CoV-2 immunoglobulin G antibody levels at birth.** Kugelman N, Nahshon C, Shaked-Mishan P, et al (2022),

European Journal of Obstetrics & Gynecology and Reproductive Biology vol 274, July 2022, pp 148-152

#### Objective

BNT162b2 messenger RNA (mRNA) COVID-19 vaccine administered during pregnancy was found to produce a strong maternal immunoglobulin (IgG) response which crosses the placenta to the newborn. Our aim was to evaluate maternal and neonatal SARS-CoV-2 IgG antibody levels at birth, following a COVID-19 booster vaccine during the third trimester.

#### Study design

A prospective cohort study including women admitted to delivery ward at least 7 days after their BNT162b2 (Pfizer/BioNTech) booster vaccination without a prior clinical COVID-19 infection. SARS-CoV-2 IgG antibodies levels were measured in maternal blood upon admission to delivery and in the umbilical blood within 30 min following delivery. The correlation between antibody titers, feto-maternal characteristics, maternal side effects following vaccination, and time interval from vaccination to delivery were analyzed.

#### Results

Between September to November 2021, high antibody levels were measured in all 102 women and 93 neonatal blood samples, at a mean  $\pm$  standard deviation duration of  $7.0 \pm 2.9$  weeks after the third vaccine. We found positive correlation between maternal and neonatal antibodies ( $r = 0.73$ , 95% confidence interval [CI] 0.61 to 0.81,  $p < 0.001$ ), with neonatal titers approximately 1.4 times higher compared to maternal titers. In the multivariable analysis maternal antibody levels dropped by  $-7.2\%$  (95% CI  $-12.0$  to  $-2.3\%$ ,  $p = 0.005$ ) for each week that passed since the receipt of the third vaccine dose. In contrary, systemic side effects after the third vaccine were associated with higher maternal antibody levels of 52.0% (95% CI 4.7 to 120.8%,  $p = 0.028$ ). Also, for each 1 unit increase in maternal body mass index, maternal antibody levels increased by 3.6% (95% CI 0.4 to 6.9%,  $p = 0.025$ ).

#### Conclusions

BNT162b2 mRNA COVID-19 booster dose during the third trimester of pregnancy was associated with strong maternal and neonatal responses as reflected by maternal and neonatal SARS-CoV-2 IgG antibody levels measured at birth. These findings support the administration of the COVID-19 booster to pregnant women to restore maternal and neonatal protection during the ongoing pandemic. (Author)

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## 2022-06766

### **Evaluation of Acute Adverse Events after Covid-19 Vaccination during Pregnancy.** DeSilva M, Haapala J, Vazquez-Benitez G, et al (2022), The New England Journal of Medicine vol 387, no 2, 14 July 2022, pp 187-189

Correspondence piece exploring acute adverse events after COVID-19 vaccination in pregnant women. Acute adverse events occurred in less than 1% of the study population, and common reactions included fever, fatigue and lymphadenopathy. (LDO)

Full URL: <https://doi.org/10.1056/NEJMc2205276>

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## 2022-06763

### **Maternal Vaccination and Risk of Hospitalization for Covid-19 among Infants.** Halasa NB, Olson SM, Staat MA, et al (2022), The New England Journal of Medicine vol 387, no 2, 14 July 2022, pp 109-119

#### BACKGROUND

Infants younger than 6 months of age are at high risk for complications of coronavirus disease 2019 (Covid-19) and are not eligible for vaccination. Transplacental transfer of antibodies against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) after maternal Covid-19 vaccination may confer protection against Covid-19 in infants.

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## METHODS

We used a case–control test-negative design to assess the effectiveness of maternal vaccination during pregnancy against hospitalization for Covid-19 among infants younger than 6 months of age. Between July 1, 2021, and March 8, 2022, we enrolled infants hospitalized for Covid-19 (case infants) and infants hospitalized without Covid-19 (control infants) at 30 hospitals in 22 states. We estimated vaccine effectiveness by comparing the odds of full maternal vaccination (two doses of mRNA vaccine) among case infants and control infants during circulation of the B.1.617.2 (delta) variant (July 1, 2021, to December 18, 2021) and the B.1.1.259 (omicron) variant (December 19, 2021, to March 8, 2022).

## RESULTS

A total of 537 case infants (181 of whom had been admitted to a hospital during the delta period and 356 during the omicron period; median age, 2 months) and 512 control infants were enrolled and included in the analyses; 16% of the case infants and 29% of the control infants had been born to mothers who had been fully vaccinated against Covid-19 during pregnancy. Among the case infants, 113 (21%) received intensive care (64 [12%] received mechanical ventilation or vasoactive infusions). Two case infants died from Covid-19; neither infant's mother had been vaccinated during pregnancy. The effectiveness of maternal vaccination against hospitalization for Covid-19 among infants was 52% (95% confidence interval [CI], 33 to 65) overall, 80% (95% CI, 60 to 90) during the delta period, and 38% (95% CI, 8 to 58) during the omicron period. Effectiveness was 69% (95% CI, 50 to 80) when maternal vaccination occurred after 20 weeks of pregnancy and 38% (95% CI, 3 to 60) during the first 20 weeks of pregnancy.

## CONCLUSIONS

Maternal vaccination with two doses of mRNA vaccine was associated with a reduced risk of hospitalization for Covid-19, including for critical illness, among infants younger than 6 months of age. (Funded by the Centers for Disease Control and Prevention.) (Author)

Full URL: <https://doi.org/10.1056/NEJMoa2204399>

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### 2022-06732

**Coronavirus: Vaccination in Pregnancy [written answer].** Scottish Parliament (2022), Official Report Written question S6W-09468, 29 June 2022

Humza Yousaf responds to a written question asked by Pam Duncan-Glancy to the Scottish Government, regarding what it is doing to ensure that pregnant people are able to access their COVID-19 booster vaccine. (LDO)

Full URL: <https://archive2021.parliament.scot/parliamentarybusiness/28877.aspx?SearchType=Advance&ReferenceNumbers=S6W-09468>

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### 2022-06731

**Coronavirus: Vaccination in Pregnancy [written answer].** Scottish Parliament (2022), Official Report Written question S6W-09469, 29 June 2022

Humza Yousaf responds to a written question asked by Pam Duncan-Glancy to the Scottish Government, regarding what it is doing to ensure that information on the provision of COVID-19 booster vaccines for pregnant people is easily accessible online. (LDO)

Full URL: <https://archive2021.parliament.scot/parliamentarybusiness/28877.aspx?SearchType=Advance&ReferenceNumbers=S6W-09469>

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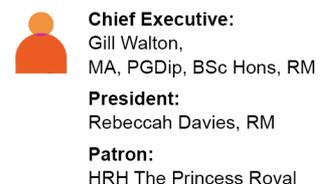
### 2022-06698

**Human Milk Antibody Response After Combining Two Different COVID-19 Vaccines: Mix-and-Match.** Mulleners SJ, Juncker HG, van Gils MJ, et al (2022), Journal of Human Lactation vol 38, no 3, August 2022, pp 401-406

#### Background

SARS-CoV-2-specific antibodies are secreted into human milk after women are vaccinated against COVID-19, which

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might protect the breastfed infant. Due to several reports of severe side-effects of the Oxford-AstraZeneca ChAdOx1 (AZD1222) vaccine against COVID-19, some lactating women followed a heterologous vaccination schedule consisting of the first dose of AZD1222 and a second dose of an mRNA-based vaccine. However, it is unclear whether this generates a significant SARS-CoV-2-specific antibody response in human milk.

#### Main Issue

To quantify the SARS-CoV-2-specific antibody response in human milk of two lactating women receiving a heterologous vaccination schedules: AZD1222 and mRNA-based vaccine (Pfizer-BioNTech [BNT162b2] and Moderna [mRNA-1273]).

#### Management

Both participants collected 16 samples of human milk longitudinally. SARS-CoV-2-specific Immunoglobulin A was measured using an enzyme-linked immunosorbent assay.

#### Conclusion

Based on our results, it could be suggested that heterologous vaccination with AZD1222 and an mRNA-based vaccine can elicit a significant SARS-CoV-2 specific IgA response in human milk. (Author)

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#### 2022-06560

##### **Coronavirus (COVID-19) hospital admissions by vaccination and pregnancy status, England: 8 December 2020 to 31**

**August 2021.** Office for National Statistics (2022), 11 July 2022

Estimates of coronavirus (COVID-19) hospital admission rates in England by vaccination status in pregnant and non-pregnant women. (Author)

**Full URL:** <https://www.ons.gov.uk/releases/coronaviruscovid19hospitaladmissionsinpregnantwomenengland8december2020to31august2021>

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#### 2022-06246

**Placental Pathology in Women Vaccinated and Unvaccinated against SARS-CoV-2.** Smithgall MC, Murphy EA, Schatz-Siemers N, et al (2022), American Journal of Obstetrics & Gynecology (AJOG) vol 227, no 5, November 2022, pp 782-784

Research letter exploring the effects of SARS-CoV-2 mRNA vaccination on placental pathology, birth weight and Apgar score. Results show that SARS-CoV-2 vaccines are safe in pregnancy and there were no differences between the vaccinated and unvaccinated groups. (LDO)

**Full URL:** <https://doi.org/10.1016/j.ajog.2022.06.039>

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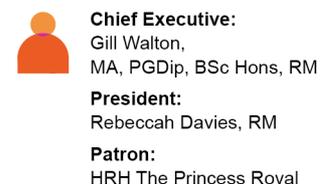
#### 2022-06093

##### **Comparative Profiles of SARS-CoV-2 Spike-Specific Human Milk Antibodies Elicited by mRNA- and Adenovirus-Based COVID-19 Vaccines.** Yang X, Fox A, DeCarlo C, et al (2022), Breastfeeding Medicine vol 17, no 8, August 2022, pp 638–646

Background: Numerous COVID-19 vaccines are authorized globally. To date, 71% of doses comprise the Pfizer/BioNTech vaccine, and 17% the Moderna/NIH vaccine, both of which are messenger RNA (mRNA) based. The chimpanzee Ad-based Oxford/AstraZeneca (AZ) vaccine comprises 9%, while the Johnson & Johnson/Janssen (J&J) human adenovirus (Ad26) vaccine ranks fourth at 2%. No COVID-19 vaccine is yet available for children 0–4. One method to protect this population may be passive immunization through antibodies (Abs) provided in the milk of a lactating vaccinated person. Our early work and other reports have demonstrated that unlike the post-SARS-CoV-2 infection milk Ab profile, which is rich in specific secretory (s)IgA, the vaccine response is highly IgG dominant.

Results: In this report, we present a comparative assessment of the milk Ab response elicited by Pfizer, Moderna, J&J, and AZ vaccines. This analysis revealed 86–100% of mRNA vaccine recipient milk exhibited Spike-specific IgG endpoint titers, which were 12- to 28-fold higher than those measured for Ad vaccine recipient milk. Ad-based vaccines elicited Spike-specific milk IgG in only 33–38% of recipients. Specific IgA was measured in 52–71% of mRNA vaccine recipient

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milk and 17–23% of Ad vaccine recipient milk. J&J recipient milk exhibited significantly lower IgA than Moderna recipients, and AZ recipients exhibited significantly lower IgA titers than Moderna and Pfizer. Less than 50% of milk of any group exhibited specific secretory Ab, with Moderna recipient IgA titers measuring significantly higher than AZ. Moderna appeared to most frequently elicit greater than twofold increases in specific secretory Ab titer relative to prevaccine sample.

Conclusion: These data indicate that current Ad-based COVID-19 vaccines poorly elicit Spike-specific Ab in milk compared to mRNA-based vaccines, and that mRNA vaccines are preferred for immunizing the lactating population. This study highlights the need to design vaccines better aimed at eliciting an optimal milk Ab response. (Author)

Full URL: <https://doi.org/10.1089/bfm.2022.0019>

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**2022-06011**

**Maternal and Neonatal Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Immunoglobulin G Levels After the Pfizer-BioNTech Booster Dose for Coronavirus Disease 2019 (COVID-19) Vaccination During the Second Trimester of Pregnancy.** Kugelman N, Nahshon C, Shaked-Mishan P, et al (2022), *Obstetrics & Gynecology* vol 140, no 2, August 2022, pp 187-193

OBJECTIVE:

To evaluate maternal and neonatal severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) immunoglobulin G (IgG) antibody levels at birth after a third (booster) dose of the Pfizer-BioNTech messenger RNA (Pfizer) coronavirus disease 2019 (COVID-19) vaccine during the second trimester of pregnancy, and compare them with those in women who received two vaccine doses during the second trimester.

METHODS:

We conducted a prospective cohort study of women admitted to the delivery ward at a single center who received the third Pfizer COVID-19 vaccine dose (booster group) at 17–30 weeks of pregnancy and who did not have previous SARS-CoV-2 infection. Maternal and neonatal antibody levels were measured on admission for delivery and in the umbilical cord blood after birth. Antibody levels for the booster group were compared with those in a historical control group of pregnant women who received their second vaccine dose (two-dose group) within the same gestational age window.

RESULTS:

Between October 2021 and February 2022, antibody levels were measured in 121 women and 109 neonates at a mean  $\pm$ SD of 15.3 $\pm$ 3.9 weeks after booster vaccination. Neonatal titers measured two times higher than maternal titers, with inverse correlation between maternal and neonatal titers at birth and time interval from third vaccination. The two-dose group included 121 women and 107 neonates, with antibody levels measured at a mean $\pm$ SD of 14.6 $\pm$ 2.6 weeks after the second dose. Median [interquartile range] maternal antibody titers were higher in the booster group (4,485 [2,569–9,702] AU/mL) compared with the two-dose group (1,122 [735–1,872] AU/mL) ( $P$ <.001). Furthermore, neonatal antibody titers were higher in the booster group (8,773 [5,143–18,830] AU/mL) compared with the two-dose group (3,280 [2,087–5,754] AU/mL) ( $P$ <.001).

CONCLUSION:

Maternal and neonatal SARS-CoV-2 IgG antibody titers after second-trimester maternal Pfizer COVID-19 vaccination were significantly higher after the booster dose compared with the two-dose vaccination series. Although there is uncertainty as to whether antibody levels correlate with protection, these data support the importance of booster vaccination during pregnancy to restore maternal and neonatal protection against COVID-19. (Author)

Full URL: <https://doi.org/10.1097/AOG.0000000000004867>

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**2022-05995**

**Assessment of factors affecting attitudes and knowledge of pregnant women about COVID-19 vaccination.** Ekmez M,

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The aim of this study was to analyse knowledge and attitudes of pregnant women about Coronavirus disease (COVID-19) and its vaccine. Pregnant women who attended outpatient maternal care between October 2020 and March 2021 were invited to participate in this cross-sectional survey study. To identify the effect of baseline characteristics of participants on their vaccination decision, the pregnant women were divided into two groups as accepting or rejecting the COVID-19 vaccine. The Multiparity rate was significantly higher in the rejection group (73.8 vs. 42.3,  $p = .001$ ). Education level and rate of employment in the professional health sector were significantly higher in the acceptance group ( $p = .001$  and  $p = .008$ ). A total of 103 (26.4%) pregnant women from the acceptance group, and 23 (10.9%) from the rejection group had a history of the death of relatives and acquaintances from COVID-19 ( $p = .001$ ). The present study demonstrated that nulliparous status, higher education level, working as a professional healthcare provider and incidence of death in relatives due to COVID-19 significantly rise pregnant women's acceptance of the COVID-19 vaccine. Considering the overall acceptance rate of 65%, improved vaccination programmes using all types of information sources need to be the main task to block the COVID-19 pandemic.

#### IMPACT STATEMENT

What is already known on this subject? There are previous studies that evaluated the attitudes and beliefs about several vaccine types among pregnant women. An important part of tackling the COVID-19 pandemic is the success of the COVID-19 vaccination program in pregnant women. In this respect, it is important to know the attitudes of pregnant women regarding COVID-19 vaccination.

What do the results of this study add? The baseline characteristics of pregnant women with or without acceptance of COVID-19 vaccination were similar regarding COVID-19 infection. The rates of being not multiparous and a health worker were higher in women with acceptance of COVID-19 vaccination. The rate of loss of relatives was also higher in women with acceptance of COVID-19 vaccination. In women without acceptance of COVID-19 vaccination, the major drawback was related to the possibility of harm to their baby's and own health.

What are the implications of these findings for clinical practice and/or further research? In pregnant women, the attitude to COVID-19 vaccination may be modifiable by the design of focussed information media with respect to their education, occupation, and parity. Longitudinal studies are needed to determine whether this approach can effectively increase the rate of COVID-19 vaccination in pregnant women. (Author)

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#### 2022-05548

**The Trust Gap Between the Coronavirus Vaccine and Communities of Color: What Midwives Can Do To Help.** Vines S (2021), Journal of Midwifery & Women's Health vol 66, no 3, May/June 2021, pp 295-297

Commentary on the role of midwives in encouraging communities of colour to receive the COVID-19 vaccine. Suggests that midwives need to foster trust between communities of colour and the general health community in order to reduce medical mistrust and vaccine hesitancy. (LDO)

Full URL: <https://doi.org/10.1111/jmwh.13248>

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#### 2022-05538

**Association of initial COVID-19 vaccine hesitancy with subsequent vaccination among pregnant and postpartum**

**individuals.** Germann K, Kiefer MK, Rood KM, et al (2022), BJOG: An International Journal of Obstetrics and Gynaecology vol 129, no 8, July 2022, pp 1352-1360

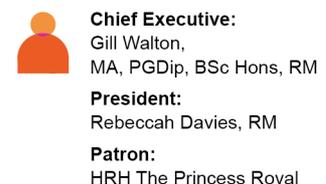
Objective

To examine the association between initial COVID-19 vaccine hesitancy and subsequent vaccination among pregnant and postpartum individuals.

Design

Prospective cohort.

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## Setting

A Midwestern tertiary-care academic medical center. Individuals completed a baseline vaccine hesitancy assessment from 22 March 2021 to 2 April 2021, with subsequent ascertainment of vaccination status at 3–6 months follow-up.

## Methods

We used multivariable Poisson regression to estimate the relative risk of vaccination by baseline vaccine hesitancy status, and then characteristics associated with vaccination.

## Main outcome measures

Self-report of COVID-19 vaccination, and secondarily, consideration of COVID-19 vaccination among those not vaccinated.

## Results

Of 456 individuals (93% pregnant, 7% postpartum) initially surveyed, 290 individuals (64%; 23% pregnant, 77% postpartum) provided subsequent vaccination status (median = 17 weeks). Of these 290 individuals, 40% (116/290) reported COVID-19 vaccine hesitancy upon enrolment, of whom 52% reported subsequent vaccination at follow-up. Few individuals transitioned during the study period from vaccine hesitant to vaccinated (10%); in comparison, 80% of those who were not vaccine hesitant were vaccinated at follow-up (aRR 0.19, 95% CI 0.11–0.33). Among those who remained unvaccinated at follow-up, 38% who were vaccine hesitant at baseline were considering vaccination, compared with 71% who were not vaccine hesitant (aRR 0.48, 95% CI 0.33–0.67). Individuals who were older, parous, employed and of higher educational attainment were more likely to be vaccinated, and those who identified as non-Hispanic black, were Medicaid beneficiaries, and were still pregnant at follow-up were less likely to be vaccinated.

## Conclusions

COVID-19 vaccine hesitancy persisted over time in the peripartum period, and few individuals who reported hesitancy at baseline were later vaccinated. Interventions that address vaccine hesitancy in pregnancy are needed. (Author)

**Full URL:** <https://doi.org/10.1111/1471-0528.17189>

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## 2022-05536

### **Knowledge, attitudes, and practices of pregnant women regarding COVID-19 vaccination in pregnancy in 7 low- and middle-income countries: An observational trial from the Global Network for Women and Children's Health Research.**

Naqvi S, Saleem S, Naqvi F, et al (2022), BJOG: An International Journal of Obstetrics and Gynaecology vol 129, no 12, November 2022, pp 2002-2009

## Objectives

We sought to determine the knowledge, attitudes and practices of pregnant women regarding COVID-19 vaccination in pregnancy in seven low- and middle-income countries (LMIC).

## Design

Prospective, observational, population-based study.

## Settings

Study areas in seven LMICs: Bangladesh, India, Pakistan, Guatemala, Democratic Republic of the Congo (DRC), Kenya and Zambia.

## Population

Pregnant women in an ongoing registry.

## Methods

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COVID-19 vaccine questionnaires were administered to pregnant women in the Global Network's Maternal Newborn Health Registry from February 2021 through November 2021 in face-to-face interviews.

#### Main outcome measures

Knowledge, attitude and practice regarding vaccination during pregnancy; vaccination status.

#### Results

No women were vaccinated except for small proportions in India (12.9%) and Guatemala (5.5%). Overall, nearly half the women believed the COVID-19 vaccine is very/somewhat effective and a similar proportion believed that the COVID-19 vaccine is safe for pregnant women. With availability of vaccines, about 56.7% said they would get the vaccine and a 34.8% would refuse. Of those who would not get vaccinated, safety, fear of adverse effects, and lack of trust predicted vaccine refusal. Those with lower educational status were less willing to be vaccinated. Family members and health professionals were the most trusted source of information for vaccination.

#### Conclusions

This COVID-19 vaccine survey in seven LMICs found that knowledge about the effectiveness and safety of the vaccine was generally low but varied. Concerns about vaccine safety and effectiveness among pregnant women is an important target for educational efforts to increase vaccination rates. (Author)

**Full URL:** <https://doi.org/10.1111/1471-0528.17226>

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#### 2022-05270

**Impact of COVID-19 disease and vaccination on maternal/fetal inflammatory response, placental pathology, and perinatal outcomes.** Boelig RC, Aghai Z, Chauhdury S, et al (2022), American Journal of Obstetrics & Gynecology (AJOG) vol 227, no 4, October 2022, pp 652-656

Research letter aiming to evaluate the impact of COVID-19 disease and vaccination on the maternal-fetal unit through the inflammatory cytokine panel at delivery, placental pathology and perinatal outcomes. Results show that COVID-19 disease, but not vaccination, is associated with inflammatory cytokines, placental vascular pathology and preterm delivery. (LDO)

**Full URL:** <https://doi.org/10.1016/j.ajog.2022.05.049>

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#### 2022-05161

**COVID-19 Vaccinations in Pregnancy: Comparative Evaluation of Acute Side Effects and Self-Reported Impact on Quality of Life between Pregnant and Non-pregnant Women in the United States..** Brinkley E, DeFilippo Mack C, Halbert LA, et al (2022), American Journal of Perinatology vol 39, no 16, December 2022, pp 1750-1753

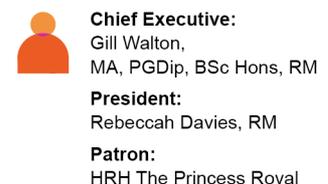
**Objective** The objective of this study was to describe the acute side effects experienced by pregnant women who received a coronavirus disease 2019 (COVID-19) vaccine in the United States and to compare their experience to non-pregnant women of similar age.

**Study Design** Adults who received a COVID-19 vaccine in the United States were invited via social media to enroll in an online, longitudinal, community-based registry ([www.helpstopCOVID19.com](http://www.helpstopCOVID19.com)). Participants self-reported pregnancy status, vaccination dates, manufacturer, acute side effects, impact on work and self-care, medical consultation, and hospitalization. This analysis was restricted to women aged 20 to 39 at the time of vaccination. Side effects reported by pregnant women were compared to those reported by non-pregnant women.

**Results** This analysis included 946 pregnant women, with 572 (60%) receiving at least one dose of Pfizer, 321 (34%) Moderna, and 53 (6%) J&J, and 1,178 non-pregnant women. Demographic and medical history were similar across manufacturers for both cohorts.

Overall, pregnant women reported similar side effects as non-pregnant women, with the most common being

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injection site reactions (83 vs. 87%), fatigue (72 vs. 78%), and headache (45 vs. 59%). Pregnant women reported fewer side effects (median: 3 vs. 4, respectively) ([Table 2]). In both cohorts, very few reported seeking medical care (<5%) or being hospitalized (<0.3%) after vaccination. Fewer pregnant women reported working less after vaccination than non-pregnant women (32 vs. 40%) or trouble with self-care (32 vs. 46%), respectively ([Table 2]).

**Conclusion** Pregnant women reported similar COVID-19 vaccine side effects as non-pregnant women, although fewer total side effects; pregnant women judged these side effects to have less impact on work and self-care. While these results do not address pregnancy outcomes or long-term effects, findings about acute side effects and impact offer reassurance for all three vaccines in terms of tolerability.

#### Key Points

COVID vaccines were well tolerated by pregnant women.

Pregnant women reported fewer total side effects.

Pregnant women reported less impact on work and self-care. (Author)

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#### 2022-04964

**COVID-19 Vaccines.** American College of Nurse-Midwives (2021), *Journal of Midwifery & Women's Health* vol 66, no 5, September/October 2021, pp 699-700

Provides an overview of the safety of COVID-19 vaccination and highlights its impact on pregnancy and fertility. (LDO)

**Full URL:** <https://doi.org/10.1111/jmwh.13301>

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#### 2022-04924

**COVID-19 vaccination in pregnancy: Time to act, time to advocate.** Clarricoats G, Ormandy J, Henry C, et al (2021), *Australian and New Zealand Journal of Obstetrics and Gynaecology (ANZJOG)* vol 61, no 6, December 2021, p e30

Letter to the editor highlighting the importance of COVID-19 vaccination uptake among pregnant women, also known as hapu Māmā in the Māori language. (LDO)

**Full URL:** <https://doi.org/10.1111/ajo.13461>

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#### 2022-04859

**Vaccine Counseling Fatigue.** Bunnell ME (2022), *Obstetrics & Gynecology* vol 139, no 6, June 2022, pp 1191-1192

A resident reflects on compassion fatigue during the coronavirus disease 2019 (COVID-19) pandemic. (Author)

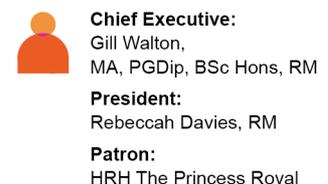
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#### 2022-04761

**COVID-19 vaccination in pregnancy.** Kalafat E, Heath P, Prasad S, et al (2022), *American Journal of Obstetrics & Gynecology (AJOG)* vol 227, no 2, August 2022, pp 136-147

Despite recent endorsement from official and professional bodies, unequivocally recommending COVID-19 vaccination, hesitancy among pregnant persons remains high. The accumulated evidence clearly demonstrates that pregnant persons are a special risk group for COVID-19, with increased risk of intensive care unit admission, extracorporeal membranous oxygenation requirement, preterm birth and perinatal death. These risks are further increased with some variants of concern, and vaccination of pregnant persons reduces the COVID related increase in maternal or fetal morbidity. Data from over 180,000 vaccinated show immunization against COVID-19 with an mRNA vaccine is safe for pregnant persons. Many observational studies comparing perinatal outcomes between vaccinated and unvaccinated pregnant persons have had reassuring findings and did not demonstrate detrimental effects on pregnancy or the newborn. Immunization with mRNA vaccines does not increase the risk of miscarriage, preterm delivery, low birth weight, maternal or neonatal intensive care unit admission, fetal death, fetal abnormality or

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pulmonary embolism. Moreover, observational data corroborate the findings of randomized trials that mRNA vaccination is highly effective at preventing severe SARS-CoV-2 infection in pregnant persons, emphasizing that the potential maternal and fetal benefits of vaccination greatly outweigh the potential risks of vaccination. Ensuring pregnant persons have unrestricted access to COVID-19 vaccination should be a priority in every country around the globe. (Author)

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#### 2022-04720

**COVID-19 vaccination in pregnancy: Experience in Viet Nam.** Vuong LN, Chau MN, Nguyen DL, et al (2022), European Journal of Obstetrics & Gynecology and Reproductive Biology vol 274, July 2022, pp 251-252

Correspondence piece presenting a study comparing pregnancy and neonatal outcomes in Vietnamese women vaccinated against COVID-19 with the Astra Zeneca versus Pfizer-BioNTech vaccines. Results suggest that women who received the Astra Zeneca or Pfizer-BioNTech vaccine had similar post-vaccination rates of COVID-19, but women who received the Pfizer-BioNTech vaccine had significantly higher rates of low birthweight infants. (LDO)

Full URL: <https://doi.org/10.1016/j.ejogrb.2022.05.008>

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#### 2022-04538

**Intention to Receive COVID-19 Vaccine during Pregnancy: A Systematic Review and Meta-analysis.** Shamshirsaz AA, Hessami K, Morain S, et al (2022), American Journal of Perinatology vol 39, no 5, April 2022, pp 492-500

**Objective** This meta-analysis aimed to assess the level of intent to receive coronavirus disease 2019 (COVID-19) vaccination and demographical factors influencing vaccine uptake among pregnant individuals.

**Study Design** PubMed, Scopus, and archive/pre-print servers were searched up to May 22nd, 2021. Cross sectional surveys reporting the percentage of the pregnant individuals intending to get a COVID-19 vaccine were considered eligible for meta-analysis. This review was registered with PROSPERO (CRD42021254484). The primary outcome was to estimate the prevalence of COVID-19 vaccination intent among pregnant population. The secondary outcome was to evaluate the factors influencing the intention for vaccination.

**Results** Twelve studies sourcing data of 16,926 individuals who were identified as pregnant were eligible. The estimated intention for the receipt of COVID-19 vaccine among women who were pregnant was 47% (95% CI: 38–57%), with the lowest prevalence in Africa 19% (95% CI: 17–21%) and the highest in Oceania 48.0% (95% CI: 44.0–51.0%). Uptake of other vaccines (influenza and/or Tdap) during pregnancy was associated with higher rate of intent to receive the COVID-19 vaccine (OR = 3.03; 95% CI: 1.37–6.73; p = 0.006).

**Conclusion** The intent to receive COVID-19 vaccine is relatively low among women who are pregnant and substantially varies based on the country of residence. In our meta-analysis, intent of women who were pregnant to receive the COVID-19 vaccine was significantly associated with the history of receiving influenza or Tdap vaccine during pregnancy. Given that in every country only a minority of gravidae have received the COVID-19 vaccine, despite known risks of maternal morbidity and mortality with no evidence of risks of vaccination, it highlights the importance of revised approaches at shared decision making and focused public health messaging by national and international advisories. (Author)

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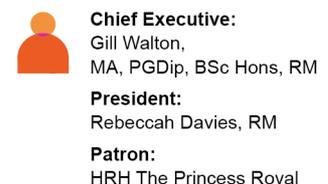
#### 2022-04141

**COVID-19 vaccination among pregnant people in the United States: a systematic review.** Rawal S, Tackett RL, Stone RH, et al (2022), American Journal of Obstetrics & Gynecology MFM vol 4, no 4, July 2022, 100616

##### OBJECTIVE

Pregnant people are at increased risk of COVID-19–related morbidity and mortality, and vaccination presents an important strategy for preventing negative outcomes. However, pregnant people were not included in vaccine trials, and there are limited data on COVID-19 vaccines during pregnancy. The objectives of this systematic review were to identify the safety, immunogenicity, effectiveness, and acceptance of COVID-19 vaccination among pregnant people in

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the United States.

#### DATA SOURCES

Four databases (PubMed, Web of Science, CINAHL, and Google Scholar) were used to identify eligible studies published from January 1, 2020 through February 6, 2022.

#### STUDY ELIGIBILITY CRITERIA

Inclusion criteria were peer-reviewed empirical research conducted in the United States, publications in English, and research addressing 1 of the following topics: safety, immunogenicity, effectiveness, and acceptance of COVID-19 vaccination among pregnant people.

#### METHODS

A narrative synthesis approach was used to synthesize findings. Critical appraisal was done using the JBI (formerly Joanna Briggs Institute) tool.

#### RESULTS

Thirty-two studies were identified. Most studies (n=24) reported the use of Pfizer and Moderna COVID-19 vaccines among pregnant people; only 6 reported the Janssen vaccine. Of the 32 studies, 11 examined COVID-19 vaccine safety, 10 investigated immunogenicity and effectiveness, and 11 assessed vaccine acceptance among pregnant people. Injection-site pain and fatigue were the most common adverse events. One case study reported immune thrombocytopenia. COVID-19 vaccination did not increase the risk of adverse pregnancy or neonatal outcomes compared with unvaccinated pregnant people. After COVID-19 vaccination, pregnant people had a robust immune response, and vaccinations conferred protective immunity to newborns through breast milk and placental transfer. COVID-19 vaccine acceptance was low among pregnant people in the United States. African American race, Hispanic ethnicity, younger age, low education, previous refusal of the influenza vaccine, and lack of provider counseling were associated with low vaccine acceptance.

#### CONCLUSION

Peer-reviewed studies support COVID-19 vaccine safety and protective effects on pregnant people and their newborns. Future studies that use rigorous methodologies and include diverse populations are needed to confirm current findings. In addition, targeted and tailored strategies are needed to improve vaccine acceptance, especially among minorities. (Author)

Full URL: <https://doi.org/10.1016/j.ajogmf.2022.100616>

#### 2022-04133

**Safety of third SARS-CoV-2 vaccine (booster dose) during pregnancy.** Dick A, Rosenbloom JI, Karavani G, et al (2022), American Journal of Obstetrics & Gynecology MFM vol 4, no 4, July 2022, 100637

#### BACKGROUND

COVID-19 during pregnancy is associated with adverse outcomes for both the mother and fetus. SARS-CoV-2 vaccination has significantly reduced the risk for symptomatic disease. Several studies have reported on the safety of SARS-CoV-2 vaccination during pregnancy, with no adverse effects on the obstetrical outcomes. However, data regarding the obstetrical outcomes following a booster dose of the SARS CoV-2 vaccination during pregnancy have not yet to be published.

#### OBJECTIVE

This study aimed to examine the association between the booster dose of the SARS CoV-2 vaccination during pregnancy and obstetrical outcomes.

#### STUDY DESIGN

This was a retrospective cohort study of women who delivered between July and October 2021 at a large tertiary

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medical center. We compared women who received the booster vaccination dose during pregnancy with women who were not vaccinated and with those who only received 2 vaccination doses. Primary outcomes were the incidence of preterm labor and of small for gestational age neonates. Secondary outcomes were other maternal and neonatal complications. A secondary analysis investigating the association between the time from vaccination to delivery and the outcomes was also performed. Multivariable logistic regression models were used to adjust for potential confounders.

## RESULTS

There were 6507 women who met the inclusion criteria: 294 women received 3 doses of the vaccination, 2845 women received only 2 doses, and 3368 were unvaccinated. Patients receiving 3 doses of the vaccine were older and more likely to smoke than unvaccinated patients. No differences were noted among the triple-vaccinated, twice-vaccinated, and unvaccinated groups with regards to preterm birth and the incidence of small for gestational age neonates. Regarding the secondary outcomes, women in the triple-vaccinated group had higher rates of postpartum hemorrhage (9.5% vs 3.21%;  $P < .001$ ) and gestational diabetes mellitus (12.2% vs 8.3%;  $P = .02$ ) and were less likely to have hypertensive disorders of pregnancy (0% vs 1.4%;  $P = .041$ ) than the unvaccinated group. Compared with the twice-vaccinated patients, patients with 3 doses of the vaccine were more likely to experience postpartum hemorrhage (9.5% vs 3.5%;  $P < .001$ ) and were less likely to have a low umbilical artery pH (0.7% vs 6.1%;  $P < .001$ ). In the sensitivity analysis comparing patients who delivered within 2 weeks of the third vaccination dose ( $n = 53$ ) with those who delivered at least 6 weeks after vaccination ( $n = 96$ ), there were no differences in the rates of small for gestational age neonates, preterm birth, postpartum hemorrhage, or cesarean delivery.

## CONCLUSION

Receiving the booster dose of the SARS-CoV-2 vaccination during pregnancy was not associated with adverse obstetrical outcomes when compared with unvaccinated or twice-vaccinated women. However, higher rates of postpartum hemorrhage were observed. Further studies on a larger scale are needed to confirm these findings.

(Author)

Full URL: <https://doi.org/10.1016/j.ajogmf.2022.100637>

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## 2022-03623

**Safety of components and platforms of COVID-19 vaccines considered for use in pregnancy: A rapid review.** Ciapponi A, Bardach A, Mazzoni A, et al (2021), *Vaccine* vol 39, no 40, 24 September 2021, pp 5891-5908

Background

Rapid assessment of COVID-19 vaccine safety during pregnancy is urgently needed.

Methods

We conducted a rapid systematic review, to evaluate the safety of COVID-19 vaccines selected by the COVID-19 Vaccines Global Access-Maternal Immunization Working Group in August 2020, including their components and their technological platforms used in other vaccines for pregnant persons. We searched literature databases, COVID-19 vaccine pregnancy registries, and explored reference lists from the inception date to February 2021 without language restriction. Pairs of reviewers independently selected studies through COVIDENCE, and performed the data extraction and the risk of bias assessment. Discrepancies were resolved by consensus. Registered on PROSPERO (CRD42021234185).

Results

We retrieved 6757 records and 12 COVID-19 pregnancy registries from the search strategy; 38 clinical and non-clinical studies (involving 2,398,855 pregnant persons and 56 pregnant animals) were included. Most studies (89%) were conducted in high-income countries and were cohort studies (57%). Most studies (76%) compared vaccine exposures with no exposure during the three trimesters of pregnancy. The most frequent exposure was to AS03 adjuvant, in the context of A/H1N1 pandemic influenza vaccines, ( $n = 24$ ) and aluminum-based adjuvants ( $n = 11$ ). Only one study reported exposure to messenger RNA in lipid nanoparticles COVID-19 vaccines. Except for one preliminary report

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about A/H1N1 influenza vaccination (adjuvant AS03), corrected by the authors in a more thorough analysis, all studies concluded that there were no safety concerns.

#### Conclusion

This rapid review found no evidence of pregnancy-associated safety concerns of COVID-19 vaccines or of their components or platforms when used in other vaccines. However, the need for further data on several vaccine platforms and components is warranted, given their novelty. Our findings support current WHO guidelines recommending that pregnant persons may consider receiving COVID-19 vaccines, particularly if they are at high risk of exposure or have comorbidities that enhance the risk of severe disease. (Author)

**Full URL:** <https://doi.org/10.1016/j.vaccine.2021.08.034>

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#### 2022-03572

**Attitudes and Beliefs Associated With COVID-19 Vaccination During Pregnancy.** Cui Y, Binger K, Palatnik A (2022), JAMA Network Open vol 5, no 4, April 2022, e227430

This survey study examines the attitudes and beliefs associated with receipt of the COVID-19 vaccination during pregnancy among pregnant people. (Author)

**Full URL:** <https://doi.org/10.1001/jamanetworkopen.2022.7430>

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#### 2022-03551

**COVID-19 Drugs and Breastfeeding Update.** Anderson PO (2022), Breastfeeding Medicine vol 17, no 5, May 2022, pp 377-379

Many products are being investigated for prevention and treatment of COVID-19, and a few have been formally approved. This column updates a 2020 column on this topic and reviews the use in breastfeeding of the most prominent therapies used against the SARS-CoV-2 virus. Additional breastfeeding references on specific drugs can be found in the corresponding LactMed records. (Author) [Erratum: Breastfeeding Medicine, vol 17, no 7, July 2022, p 630.

<https://doi.org/10.1089/bfm.2022.0066.correx>

**Full URL:** <https://doi.org/10.1089/bfm.2022.0066>

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#### 2022-03545

**COVID-19 Vaccination During Breastfeeding and Its Possible Negative Effect on Milk Production and Supply: A Preliminary Observation.** Lamers M, van der Mijle A, van Hunsel F, et al (2022), Breastfeeding Medicine vol 17, no 7, July 2022, pp 627-628

Correspondence piece aiming to provide systematically collected information on the incidence of decreased milk supply after COVID-19 vaccination. Results show that 10.3% of women reported reduced milk production and this mainly occurred after the Pfizer/BioNTech vaccine. (LDO)

**Full URL:** <https://doi.org/10.1089/bfm.2022.0057>

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#### 2022-03516

**COVID-19 vaccination rates in an antenatal population: A survey of women's perceptions, factors influencing vaccine uptake and potential contributors to vaccine hesitancy.** Ward C, Megaw L, White S, et al (2022), Australian and New Zealand Journal of Obstetrics and Gynaecology (ANZJOG) vol 62, no 5, October 2022, pp 695-700

#### Background

Pregnant women are at increased risk for severe COVID-19 and are a priority group for vaccination. The discrepancy in vaccination rates between pregnant and non-pregnant cohorts is concerning.

#### Aims

This study aimed to assess the perceptions and intentions of pregnant women toward COVID-19 vaccination and explored vaccine uptake and reasons for vaccine hesitancy.

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## Materials and method

A cross-sectional exploratory design was performed evaluating pregnant women receiving care in two metropolitan maternity units in Western Australia. The main measurable outcomes included vaccination status, intention to be vaccinated, and reasons for delaying or declining vaccination.

## Results

In total, 218 women participated. Of these, 122 (56%) had not received either dose of the COVID-19 vaccine. Sixty (28%) claimed that vaccination was not discussed with them and 33 (15%) reported being dissuaded from vaccination by a healthcare practitioner. Compared to vaccinated women, those who had not accepted vaccination were less likely to have had vaccination discussed by maternity staff, less aware that pregnant women are a priority group, and less aware that pregnancy increased the risk of severe illness. Unvaccinated women were concerned about the side effects of the vaccine for their newborn and their own health, felt there was inadequate information on safety during pregnancy, and felt that a lack of community transmission in Western Australia reduced the necessity to be vaccinated.

## Conclusion

Vaccine delay and hesitancy is common among pregnant women in Western Australia. Education of healthcare professionals and pregnant women on the recommendation for COVID-19 vaccination in pregnancy is required.

(Author)

Full URL: <https://doi.org/10.1111/ajpo.13532>

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## 2022-03299

### Receipt of COVID-19 Booster Dose Among Fully Vaccinated Pregnant Individuals Aged 18 to 49 Years by Key

**Demographics.** Razzaghi H, Meghani M, Crane B, et al (2022), JAMA (Journal of the American Medical Association) vol 327, no 23, 21 June 2022, pp 2351-2354

This study uses data from the Vaccine Safety Datalink on receipt of booster doses of COVID-19 vaccines among pregnant individuals aged 18 to 49 years. (Author)

Full URL: <https://doi.org/10.1001/jama.2022.6834>

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## 2022-03278

### Helping patients with ethical concerns about COVID-19 vaccines in light of fetal cell lines used in some COVID-19

**vaccines.** Zimmerman RK (2021), Vaccine vol 39, no 31, 13 July 2021, pp 4242-4244

Many persons with religious convictions report hesitancy about COVID-19 vaccines, in part due to ethical concerns that fetal cell lines are used in the development of certain vaccines. The issue of abortion is contentious and, given the potential impact on COVID-19 vaccination, it is important for clinicians to be aware of this issue, whatever their personal beliefs. I provide four responses that clinicians may offer their patients: 1) Ethical analyses of moral complicity and COVID vaccines. 2) Altruism and protecting others from a virus that is often transmitted while asymptomatic or pre-symptomatic. 3) Religious texts and many religious leaders support prevention and, therefore, vaccination. 4) Administration of vaccines not developed in fetal cell lines. Although I wish for all my patients to be vaccinated, I respect their autonomy to make the choice to be or not to be vaccinated and understand that many have a deep regard for fetal life. (Author)

Full URL: <https://doi.org/10.1016/j.vaccine.2021.06.027>

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## 2022-03116

**Preserved recognition of Omicron Spike following COVID-19 mRNA vaccination in pregnancy.** Bartsch YC, Atyeo C, Kang J, et al (2022), American Journal of Obstetrics & Gynecology (AJOG) vol 227, no 3, September 2022, pp 493.e1-493.e7

## Background

SARS-CoV-2 infection is associated with enhanced disease severity in pregnant women. Despite the potential of COVID-19 vaccines to reduce severe disease, vaccine uptake remained relatively low among pregnant women. Just as

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coordinated messaging from the CDC and leading obstetrics organizations began to increase vaccine confidence in this vulnerable group, the evolution of SARS-CoV-2 variants of concerns (VOC) including the Omicron VOC raised new concerns about vaccine efficacy, given their ability to escape vaccine-induced neutralizing antibodies. Early data point to a milder disease course following omicron VOC infection in vaccinated individuals. Thus, these data suggest that alternate vaccine induced immunity, beyond neutralization, may continue to attenuate omicron disease, such as antibody-Fc-mediated activity.

#### Objectives

To test whether vaccine induced antibodies raised in pregnancy continue to bind and leverage Fc-receptors against VOCs including the Omicron variant.

#### Study Design

VOC including Omicron receptor binding domain (RBD) or full Spike specific antibody isotype binding titers and FcγR binding were analyzed in pregnant women after the full dose regimen of either Pfizer/BioNTech BNT62b2 (n=10) or Moderna mRNA-1273 (n=10) vaccination using a multiplexing Luminex assay.

#### Results

Reduced, isotype recognition was observed to the Omicron receptor binding domain (RBD) following both vaccines, with relatively preserved, albeit reduced, recognition of Omicron full Spike by IgM and IgG antibodies. Despite the near complete loss of Fc-receptor binding to the Omicron RBD, Fc-receptor binding was more variable but largely preserved to the Omicron Spike.

#### Conclusion

Reduced binding titers to the Omicron RBD aligns with observed loss of neutralizing activity. Despite the loss of neutralization, preserved, albeit reduced, Omicron Spike recognition and Fc-receptor binding potentially continues to attenuate disease severity in pregnant women. (Author)

**Full URL:** <https://doi.org/10.1016/j.ajog.2022.04.009>

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## 2022-03107

### Boosting maternal and neonatal humoral immunity following SARS-CoV-2 infection using a single mRNA vaccine

**dose.** Nebo L, Cahen-Peretz A, Vorontsov O, et al (2022), American Journal of Obstetrics & Gynecology (AJOG) 14 April 2022, online

#### Background

Post-COVID-19 boosting is a potent tool in the ongoing pandemic. Relevant data regarding this approach during pregnancy are lacking, affecting vaccination policy guidance, public acceptance, and vaccine uptake during pregnancy. We aimed to investigate the dynamics of anti-SARS-CoV-2 antibody levels following SARS-CoV-2 infection during pregnancy, and characterize the effect of a single post-infection boosting dose in parturients, as compared to naïve vaccinated and convalescent, non-boosted parturients.

#### Methods

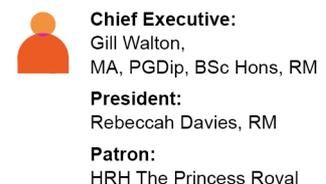
Serum samples prospectively collected from parturients and umbilical cords at delivery in our university-affiliated urban medical center in Jerusalem, Israel from May-October, 2021, were selected and analyzed in case-control manner. Study groups were comprised of 1: Consecutive sample of parturients with PCR-confirmed history of COVID-19 disease at all stages of pregnancy; 2: Comparison groups selected by time of exposure, a: PCR-confirmed COVID-19 convalescent non-boosted parturients; b: PCR-confirmed COVID-19 convalescent parturients who received a single BNT162b2 mRNA vaccine boosting dose; and c: infection-naïve fully vaccinated parturients who received two doses of BNT162b2 mRNA vaccine. Outcome measures included maternal and cord blood anti-SARS-CoV-2 antibody levels detected at delivery, reported side effects, and pregnancy outcomes.

#### Results

228 parturients aged 18-45 years were included: 64 were studied to characterize titer dynamics following COVID-19 at all stages of pregnancy; boosting effect was determined by comparing a: convalescent (n=54); b: boosted convalescent (n=60); and c: naïve fully vaccinated (n=114) parturients.

Anti-SARS-CoV-2 antibody levels detected upon delivery showed a gradual and significant decline over time from infection to delivery ( $r = 0.4371$ ;  $p = 0.0003$ ). Of gravidæ infected in the first trimester 34.6% (9/26) tested negative at delivery, vs. 9.1% (3/33) following second trimester infection ( $p=0.023$ ). Significantly higher anti-SARS-CoV-2 antibody levels were observed among boosted convalescent vs. non-boosted convalescent (17.6 fold,  $p<0.001$ ) and naïve

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vaccinated parturients (3.2 fold,  $p < 0.001$ ). Similar patterns were observed in cord blood. Side effects in convalescent gravidae resembled previous reports of mild symptoms following COVID-19 vaccination during pregnancy.

#### Conclusions

Post-infection maternal humoral immunity wanes during pregnancy, resulting in low or absent protective titers for a significant proportion of patients. A single boosting dose of BNT162b2 mRNA vaccine induced a robust increase in protective titers for both mother and newborn with modest reported side effects. (Author)

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#### 2022-03010

**Guidance for people previously considered clinically extremely vulnerable from COVID-19.** Department of Health and Social Care (2022), 1 April 2022

Government advice for those who had previously received a letter or email identifying them as clinically extremely vulnerable (CEV) during the coronavirus pandemic. Includes advice on vaccination against COVID-19 in pregnancy.

(JSM)

**Full URL:** <https://www.gov.uk/government/publications/guidance-on-shielding-and-protecting-extremely-vulnerable-persons-from-covid-19/guidance-on-shielding-and-protecting-extremely-vulnerable-persons-from-covid-19>

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#### 2022-03008

**COVID-19 vaccines and medicines: updates for April 2022.** Medicines and Healthcare Products Regulatory Agency (MHRA) (2022), Drug Safety Update vol 15, no 9, April 2022

Recent information relating to COVID-19 vaccines and medicines, including the administration of Spikevax COVID-19 vaccine and Comirnaty COVID-19 Vaccine in pregnancy and while breastfeeding, that has been published since the March 2022 issue of Drug Safety Update, up to 14 April 2022. (Author, edited)

**Full URL:** <https://www.gov.uk/drug-safety-update/covid-19-vaccines-and-medicines-updates-for-april-2022>

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#### 2022-02874

**Pregnant women 'afterthought' in Covid jab rollout.** Collinson A, Harris-White L, Bowen A (2022), BBC News 20 April 2022

Pregnant women have been an "afterthought" during the coronavirus pandemic and some of their deaths were "preventable", a leading scientist has told Newsnight. (Author)

**Full URL:** <https://www.bbc.co.uk/news/health-61157121>

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#### 2022-02629

**COVID-19 Vaccine Acceptability Among Pregnant Women in Northern Nigeria.** Iliyasu Z, Perkins JM, Tsiga-Ahmed FI, et al (2022), JOGC [Journal of Obstetrics and Gynaecology Canada] vol 44, no 4, April 2022, pp 349-350.e1

Research letter assessing COVID-19 vaccine acceptability among pregnant women at Aminu Kano Teaching Hospital in Nigeria. Results show that 59.1% believed the COVID-19 vaccination would reduce the risk of contracting the virus and 55.6% believed the vaccine would reduce the risks to their unborn babies. (LDO)

**Full URL:** <https://doi.org/10.1016/j.jogc.2022.01.002>

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#### 2022-02589

**Association of BNT162b2 COVID-19 Vaccination During Pregnancy With Neonatal and Early Infant Outcomes.** Goldshtein I, Steinberg DM, Kuint J, et al (2022), JAMA Pediatrics 10 February 2022, online

**Importance** Pregnant women were excluded from the BNT162b2 messenger RNA (mRNA) COVID-19 vaccine (Pfizer-BioNTech) preauthorization trial. Therefore, observational data on vaccine safety for prenatally exposed newborns are critical to inform recommendations on maternal immunization.

**Objective** To examine whether BNT162b2 mRNA vaccination during pregnancy is associated with adverse neonatal and early infant outcomes among the newborns.

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**Design, Setting, and Participants** Population-based cohort study comprising all singleton live births in March through September 2021, within a large state-mandated health care organization in Israel, followed up until October 31, 2021.

**Exposure** Maternal BNT162b2 mRNA vaccination during pregnancy.

**Main Outcomes and Measures** Risk ratios (RR) of preterm birth, small birth weight for gestational age (SGA), congenital malformations, all-cause hospitalizations, and infant death. Stabilized inverse probability weighting was used to adjust for maternal age, timing of conception, parity, socioeconomic status, population subgroup, and maternal influenza immunization status.

**Results** The cohort included 24 288 eligible newborns (49% female, 96% born at  $\geq 37$  weeks' gestation), of whom 16 697 were exposed ( $n = 2134$  and  $n = 9364$  in the first and second trimesters, respectively) to maternal vaccination in utero. Median (IQR) follow-up after birth was 126 days (76-179) among exposed and 152 days (88-209) among unexposed newborns. No substantial differences were observed in preterm birth rates between exposed and unexposed newborns (RR = 0.95; 95% CI, 0.83-1.10) or SGA (RR = 0.97; 95% CI, 0.87-1.08). No significant differences were observed in the incidence of all-cause neonatal hospitalizations (RR = 0.99; 95% CI, 0.88-1.12), postneonatal hospitalizations after birth (RR = 0.95; 95% CI, 0.84-1.07), congenital anomalies (RR = 0.69; 95% CI, 0.44-1.04), or infant mortality over the study period (RR = 0.84; 95% CI, 0.43-1.72).

**Conclusions and Relevance** This large population-based study found no evident differences between newborns of women who received BNT162b2 mRNA vaccination during pregnancy, vs those of women who were not vaccinated, and contributes to current evidence in establishing the safety of prenatal vaccine exposure to the newborns.

Interpretation of study findings is limited by the observational design. (Author)

**Full URL:** <https://doi.org/10.1001/jamapediatrics.2022.0001>

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#### 2022-02474

**Vaccine Update.** Public Health England (2021), London: PHE no 316, January 2021

This special edition of Vaccine Update includes information on the safety of COVID-19 vaccination for pregnant and breastfeeding women. Also includes guidance on COVID-19 vaccination for health and social care workers. (LDO)

**Full URL:** <https://www.gov.uk/government/publications/vaccine-update-issue-316-january-2021-covid-19-special-edition/vaccine-update-issue-316-january-2021-covid-19-special-edition>

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#### 2022-02465

**Vaccine Update.** Public Health England (2020), London: PHE no 315, December 2020

This special edition of Vaccine Update includes resources and leaflets on COVID-19 vaccination for pregnant or breastfeeding women. (LDO)

**Full URL:** <https://www.gov.uk/government/publications/vaccine-update-issue-315-december-2020-covid-19-special-edition/vaccine-update-issue-315-december-2020-covid-19-special-edition>

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#### 2022-02215

**Antibodies Against SARS-CoV-2 in Human Breast Milk After Vaccination: A Systematic Review and Meta-Analysis.**

Whited N, Cervantes J (2022), Breastfeeding Medicine vol 17, no 6, June 2022, pp 475-483

**Background:** CDC guidelines have recommended coronavirus disease-19 (COVID-19) vaccination for all people 5 years and older, including people who are breastfeeding. Breast milk has shown to be a valuable source of protection for immune-immature neonates. It has been shown that breast milk from mothers who have received vaccinations can transfer antibodies.

**Aim/Objective:** This systematic review and meta-analysis investigate the presence of antibodies to SARS-CoV-2 in human breast milk after vaccination.

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**Methods:** Studies that evaluated immunoglobulins in breast milk of women receiving a SARS-CoV-2 vaccination were included. PubMed, Embase, Web of Science were searched for articles published between December 1, 2019 and September 30, 2021. Data from relevant articles were extracted manually or by WebPlotDigitizer version 4.1 to obtain the numeric values of antibody levels on peak days and the peak day then condensed into Excel. Additional raw data and information were supplied by corresponding authors.

**Results:** One hundred ninety-two articles were obtained from the search. After excluding duplicates, screening titles and abstracts, 18 cohort studies were identified. For the rate of SARS-CoV-2 antibodies in breast milk after the first vaccine dose but before the second vaccine dose, we found 64% (95% CI 51–78%) were positive for IgA and 30% (95% CI 13.1–46%) were positive for IgG. For the rate for SARS-CoV-2 antibodies in breast milk after the second vaccine dose, we found 70% (95% CI 55–86%) were positive for IgA and 91% (95% CI 80–103%) were positive for IgG.

**Conclusions:** Our analysis of the data published worldwide showed high rates of positivity for antibodies in breast milk following COVID-19 immunizations. Further research is necessary to find if the rate of positivity of IgA and IgG against SARS-CoV-2 in breast milk persists months after the full immunization, and their impact on the prevention of SARS-CoV-2 infection in infants. (Author)

**Full URL:** <https://doi.org/10.1089/bfm.2021.0353>

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## 2022-02206

**Evaluation of Adverse Effects in Nursing Mothers and Their Infants After COVID-19 mRNA Vaccination.** Ramírez DSR, Hernández MIS, Vilar AMF, et al (2022), Breastfeeding Medicine vol 17, no 5, May 2022, pp 412-421

**Background and Objectives:** Breastfeeding women are generally excluded from clinical trials with new vaccines. The objective of the study was to explore whether the BNT162b2 mRNA and mRNA-1273 COVID-19 vaccines are safe for breastfeeding mothers and their breastfed infants.

**Methods:** A convenience sample prospective cohort single institution study was performed on breastfeeding health care professionals, who were exposed to second dose of SARS-CoV2 vaccine at the beginning of the study period. They and their breastfed children's symptoms were followed up through online questionnaires for 14 days.

**Results:** Of the 95 finally included participants, only 1 was lost to follow-up on day 7. Mean age of the mothers was  $35.9 \pm 3.9$  years and that of their infants was  $14.6 \pm 12.1$  months. At least one adverse event was reported by 85% (95% confidence interval [CI]: 76–91.5%) of the mothers. The most frequent was injection site pain in 81% of cases. Moreover, 31% (95% CI: 22–41%) observed some event in their breastfed children. Most frequently, 19% (95% CI: 13–30%) of the children were irritable. During the 14 days of follow-up, 36% of the children (95% CI: 27–46%) were diagnosed with respiratory infection.

**Conclusions:** Most mothers' reactions were mild and transitory, generally limited to the first 3 days after vaccination. Many children's events were associated with concomitant infectious processes and we did not detect a notable peak on any particular day of follow-up. Neither mothers nor their infants developed serious adverse events nor were they diagnosed with COVID-19 within the study period. (Author)

**Full URL:** <https://doi.org/10.1089/bfm.2021.0256>

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## 2022-02128

**COVID-19 Vaccination among Pregnant People in the U.S.: A Systematic Review.** Pharm SR, Tackett RL, Stone RH, et al (2022), American Journal of Obstetrics & Gynecology MFM 10 March 2022, online

**Objectives:** Pregnant people are at increased risk of COVID-19 related morbidity and mortality, and vaccination presents an important strategy to prevent negative outcomes. However, pregnant people were not included in vaccine trials, and there is limited data on COVID-19 vaccines during pregnancy. The objectives of this systematic

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review were to identify the safety, immunogenicity, effectiveness, and acceptance of COVID-19 vaccination among pregnant people in the U.S.

Data Sources: Four databases (PubMed, Web of Science, CINAHL, and Google Scholar) were used to identify eligible studies published from January 01, 2020, through February 06, 2022.

Study Eligibility Criteria: Inclusion criteria were peer-reviewed empirical research conducted in the U.S., published in English, and addressed one of the following topics: safety, immunogenicity, effectiveness, and acceptance of COVID-19 vaccination among pregnant people.

Study Appraisal and Synthesis Methods: A narrative synthesis approach was used to synthesize findings. Critical appraisal was done using the Joanna Briggs Institute (JBI) tool.

Results: Thirty-two studies were identified. The majority of studies (n = 25) reported the use of Pfizer and Moderna COVID-19 vaccines among pregnant people; only six reported the Janssen vaccine. Of the 32 studies, 11 examined COVID-19 vaccine safety, 10 investigated immunogenicity and effectiveness, and 11 assessed vaccine acceptance among pregnant people. Injection site pain and fatigue were the most common adverse events. One case study reported immune thrombocytopenia (ITP). COVID-19 vaccination did not increase the risk of adverse pregnancy or neonatal outcomes in comparison to unvaccinated pregnant people. After COVID-19 vaccination, pregnant people elicited a robust immune response, and vaccinations conferred protective immunity to newborns through breast milk and the placental transfer. COVID-19 vaccine acceptance was low among pregnant people in the U.S. African American race, Hispanic ethnicity, younger age, low education, prior refusal of the influenza vaccine, and lack of provider counseling were associated with low vaccine acceptance.

Conclusions: Peer-reviewed studies support COVID-19 vaccine safety and protective effects on pregnant people and their newborns. Future studies that use rigorous methodologies and include diverse populations are needed to confirm current findings. In addition, targeted and tailored strategies are needed to improve vaccine acceptance especially among minorities. (Author)

Full URL: <https://doi.org/10.1016/j.ajogmf.2022.100616>

## 2022-01922

**Association of SARS-CoV-2 Vaccination During Pregnancy With Pregnancy Outcomes.** Magnus MC, Örtqvist AK, Dahlqvist E, et al (2022), JAMA (Journal of the American Medical Association) vol 327, no 15, 19 April 2022, pp 1469-1477

Importance Data about the safety of vaccines against SARS-CoV-2 during pregnancy are limited.

Objective To examine the risk of adverse pregnancy outcomes after vaccination against SARS-CoV-2 during pregnancy.

Design, Setting, and Participants This registry-based retrospective cohort study included 157 521 singleton pregnancies ending after 22 gestational weeks from January 1, 2021, until January 12, 2022 (Sweden), or January 15, 2022 (Norway). The Pregnancy Register in Sweden and the Medical Birth Registry of Norway were linked to vaccination and other registries for identification of exposure and background characteristics.

Exposures Data on mRNA vaccines—BNT162b2 (Pfizer-BioNTech) and mRNA-1273 (Moderna)—and 1 viral vector vaccine—AZD1222 (AstraZeneca)—were collected from national vaccination registries.

Main Outcomes and Measures The risk of preterm birth and stillbirth was evaluated using Cox regression models, with gestational day as the time metric and vaccination as a time-dependent exposure variable. The risk of small for gestational age, low Apgar score, and neonatal care admission was evaluated using logistic regression. Random-effects meta-analysis was used to combine results between countries.

Results Among the 157 521 singleton births included in the study (103 409 in Sweden and 54 112 in Norway), the mean maternal age at the time of delivery was 31 years, and 28 506 (18%) were vaccinated against SARS-CoV-2 (12.9% with BNT162b2, 4.8% with mRNA-1273, and 0.3% with AZD1222) while pregnant. A total of 0.7%, 8.3%, and 9.1% of individuals delivering were vaccinated during the first, second, and third trimester, respectively. Vaccination against SARS-CoV-2 was not significantly associated with increased risk of preterm birth (6.2 vs 4.9 per 10 000 pregnancy days;

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adjusted hazard ratio [aHR], 0.98 [95% CI, 0.91 to 1.05]; I<sup>2</sup> = 0%; P for heterogeneity = .60), stillbirth (2.1 vs 2.4 per 100 000 pregnancy days; aHR, 0.86 [95% CI, 0.63 to 1.17]), small for gestational age (7.8% vs 8.5%; difference, -0.6% [95% CI, -1.3% to 0.2%]; adjusted OR [aOR], 0.97 [95% CI, 0.90 to 1.04]), low Apgar score (1.5% vs 1.6%; difference, -0.05% [95% CI, -0.3% to 0.1%]; aOR, 0.97 [95% CI, 0.87 to 1.08]), or neonatal care admission (8.5% vs 8.5%; difference, 0.003% [95% CI, -0.9% to 0.9%]; aOR, 0.97 [95% CI, 0.86 to 1.10]).

**Conclusions and Relevance** In this population-based study conducted in Sweden and Norway, vaccination against SARS-CoV-2 during pregnancy, compared with no SARS-CoV-2 vaccination during pregnancy, was not significantly associated with an increased risk of adverse pregnancy outcomes. The majority of the vaccinations were with mRNA vaccines during the second and third trimesters of pregnancy, which should be considered in interpreting the findings.

(Author)

**Full URL:** <https://doi.org/10.1001/jama.2022.3271>

## 2022-01921

**Association of COVID-19 Vaccination in Pregnancy With Adverse Peripartum Outcomes.** Fell DB, Dhinsa T, Alton GD, et al (2022), JAMA (Journal of the American Medical Association) vol 327, no 15, 19 April 2022, pp 1478-1487

**Importance** There is limited comparative epidemiological evidence on outcomes associated with COVID-19 vaccination during pregnancy; monitoring pregnancy outcomes in large populations is required.

**Objective** To evaluate peripartum outcomes following COVID-19 vaccination during pregnancy.

**Design, Setting, and Participants** Population-based retrospective cohort study in Ontario, Canada, using a birth registry linked with the provincial COVID-19 immunization database. All births between December 14, 2020, and September 30, 2021, were included.

**Exposures** COVID-19 vaccination during pregnancy, COVID-19 vaccination after pregnancy, and no vaccination.

**Main Outcomes and Measures** Postpartum hemorrhage, chorioamnionitis, cesarean delivery (overall and emergency cesarean delivery), admission to neonatal intensive care unit (NICU), and low newborn 5-minute Apgar score (<7). Linear and robust Poisson regression was used to generate adjusted risk differences (aRDs) and risk ratios (aRRs), respectively, comparing cumulative incidence of outcomes in those who received COVID-19 vaccination during pregnancy with those vaccinated after pregnancy and those with no record of COVID-19 vaccination at any point. Inverse probability of treatment weights were used to adjust for confounding.

**Results** Among 97 590 individuals (mean [SD] age, 31.9 [4.9] years), 22 660 (23%) received at least 1 dose of COVID-19 vaccine during pregnancy (63.6% received dose 1 in the third trimester; 99.8% received an mRNA vaccine). Comparing those vaccinated during vs after pregnancy (n = 44 815), there were no significantly increased risks of postpartum hemorrhage (incidence: 3.0% vs 3.0%; aRD, -0.28 per 100 individuals [95% CI, -0.59 to 0.03]; aRR, 0.91 [95% CI, 0.82-1.02]), chorioamnionitis (0.5% vs 0.5%; aRD, -0.04 per 100 individuals [95% CI, -0.17 to 0.09]; aRR, 0.92 [95% CI, 0.70-1.21]), cesarean delivery (30.8% vs 32.2%; aRD, -2.73 per 100 individuals [95% CI, -3.59 to -1.88]; aRR, 0.92 [95% CI, 0.89-0.95]), NICU admission (11.0% vs 13.3%; aRD, -1.89 per 100 newborns [95% CI, -2.49 to -1.30]; aRR, 0.85 [95% CI, 0.80-0.90]), or low Apgar score (1.8% vs 2.0%; aRD, -0.31 per 100 newborns [95% CI, -0.56 to -0.06]; aRR, 0.84 [95% CI, 0.73-0.97]). Findings were qualitatively similar when compared with individuals who did not receive COVID-19 vaccination at any point (n = 30 115).

**Conclusions and Relevance** In this population-based cohort study in Ontario, Canada, COVID-19 vaccination during pregnancy, compared with vaccination after pregnancy and with no vaccination, was not significantly associated with increased risk of adverse peripartum outcomes. Study interpretation should consider that the vaccinations received during pregnancy were primarily mRNA vaccines administered in the second and third trimester. (Author)

**Full URL:** <https://doi.org/10.1001/jama.2022.4255>

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**2022-01885**

**Effects of Covid-19 fear on the attitudes toward Covid-19 vaccination in reproductive women.** Tarus HA, Ölmez Yalazı R, Öz T, et al (2022), Health Care for Women International vol 43, no 4, 2022, pp 398-412

This research aimed to determine the effect of Covid-19 fears on attitudes of women of reproductive age toward Covid-19 vaccination. This descriptive cross-sectional study was conducted with 413 women aged 18–49. “Participant Identification Form,” “Fear of Covid-19 Scale (FCV-19S)” and “Attitudes Towards Covid-19 Vaccine Scale (ATV-Covid-19)” were used to collect data. Kruskal Wallis test, Man Whitney U test and Spearman correlation test were used to evaluate the data. The mean FCV-19S total score of the women within the scope of the study was  $18.70 \pm 5.34$ . The mean score of the positive attitude sub-dimension of ATV-Covid-19 of women was  $14.09 \pm 3.80$ , the mean score of the negative attitude sub-dimension was  $16.21 \pm 3.26$ . A positive, weak and statistically significant correlation was found between FCV-19S total score and ATV-Covid-19 positive attitude sub-dimension mean score ( $p < 0.05$ ). It was determined that the women within the scope of the study had a moderate fear of Covid-19. However, more women had positive than negative attitudes toward Covid-19 vaccines. In addition, as the level of fear of Covid-19 increases, positive attitudes toward the Covid-19 vaccines increase. (Author)

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**2022-01265**

**Maternity Services: Coronavirus [written answer].** House of Commons (2022), Hansard Written question 117054, 2 February 2022

Maria Caulfield responds to a written question asked by Annelise Dodds to the Secretary of State for Health and Social Care regarding how many NHS Trust maternity services offer pregnant women vaccinations in their antenatal clinics; and whether the NHS has plans to roll this out to all maternity services. (MB)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2022-02-02/117054>

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**2022-01134**

**COVID-19 vaccine in pregnancy: don't forget pregnant women and people seeking asylum.** Zaidi F (2022), The Practising Midwife vol 25, no 3, March 2022, pp 20-24

Pregnant women and people are at an increased risk of severe disease and pregnancy complications if they contract severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). In April 2021, the Joint Committee on Vaccination and Immunisation (JCVI) advised this group to take the Pfizer/BioNTech or Moderna COVID-19 vaccines; however, recent data from Public Health England (PHE) indicate that this population are vaccine-hesitant. As midwives urge this cohort to get vaccinated, consideration should be given to pregnant women and people seeking asylum so that they are not left out. This population experience significant health and social inequalities, which place them at a higher risk of developing serious illness from COVID-19. This article considers the risk factors for infection, and the barriers and facilitators for COVID-19 vaccines in pregnancy. This article uses the term 'pregnant women and people seeking asylum' as it focuses on the people seeking asylum and not their status. (Author)

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**2022-01040**

**Characteristics and perceptions associated with COVID-19 vaccination hesitancy among pregnant and postpartum**

**individuals: A cross-sectional study.** Kiefer MK, Mehl RR, Costantine MM, et al (2022), BJOG: An International Journal of Obstetrics and Gynaecology vol 129, no 8, July 2022, pp 1342-1351

Objective

To assess the frequency and associated characteristics of COVID-19 vaccine hesitancy among pregnant and postpartum individuals.

Design

Cross-sectional study.

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## Setting

Prenatal care at a single academic tertiary care centre.

## Population

Pregnant and postpartum individuals enrolled in prenatal care at a single academic tertiary care centre from 22 March 2021 to 2 April 2021, concurrent with state guidelines recommending COVID-19 vaccination in pregnancy.

## Methods

We used logistic regression to identify characteristics associated with COVID-19 vaccine hesitancy, and adjusted for: age, parity, race, trimester of pregnancy, and chronic comorbidities.

## Main outcome measures

COVID-19 vaccine hesitancy, defined as uncertainty or refusal of the vaccine, despite the availability of vaccine services, in accordance with the World Health Organization (WHO) Strategic Advisory Group of Experts (SAGE) on vaccine hesitancy.

## Results

Of the 485 individuals screened and approached, 456 (94%) enrolled and completed the survey (435/456, 95% pregnant). The frequency of COVID-19 vaccine hesitancy was 46% (95% CI 41%–51%). Sociodemographic characteristics, including non-Hispanic Black race, younger age, lower education, public health insurance receipt, parity >1, and reported substance use, were associated with a higher odds of COVID-19 vaccine hesitancy, but not clinical risk conditions. Individuals who had a family or friend vaccinated for COVID-19, prior or planned vaccination for tetanus, diphtheria and acellular pertussis (Tdap) and/or influenza, and who perceived that vaccination benefited the baby were less likely to express COVID-19 vaccine hesitancy.

## Conclusions

COVID-19 vaccine hesitancy was frequent among pregnant and postpartum individuals. Those who may face barriers to accessing healthcare services were more likely to report vaccine hesitancy. These results can inform interventions to increase COVID-19 vaccine uptake in pregnancy. (Author)

Full URL: <https://doi.org/10.1111/1471-0528.17110>

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## 2022-01005

**Safety of SARS-CoV-2 vaccination during pregnancy- obstetric outcomes from a large cohort study.** Dick A, Rosenbloom JI, Gutman-Ido E, et al (2022), BMC Pregnancy and Childbirth vol 22, no 166, 28 February 2022

## Background

COVID-19 during pregnancy is associated with adverse outcomes for mother and fetus. SARS-CoV-2 vaccination has significantly reduced the risk of symptomatic disease. Several small studies have reported the safety of SARS-CoV-2 vaccination during pregnancy, with no adverse effect on obstetric outcomes.

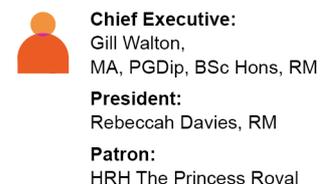
## Objective

To examine the association between SARS-CoV-2 vaccination during pregnancy and maternal and neonatal outcomes in a large cohort study. Furthermore, to evaluate if timing of vaccination during pregnancy is related to adverse outcomes.

## Methods

A retrospective cohort study of women who delivered between December 2020 and July 2021 at a large tertiary medical center. Excluded were women with multiple pregnancy, vaccination prior to pregnancy, COVID-19 infection during or before pregnancy, or unknown timing of vaccination. Primary outcomes were the incidence of preterm labor and of small for gestational age. Secondary outcomes were other maternal and neonatal complications. A secondary analysis investigating the association between time of vaccination and outcomes was also performed. Multivariable

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logistic regression models were used to adjust for potential confounders.

## Results

There were 5618 women who met the inclusion criteria: 2,305 (41%) women were vaccinated and 3,313 (59%) were unvaccinated. There were no differences between vaccinated and non-vaccinated patients with respect to primary outcomes. The rate of preterm birth was 5.5% in the vaccinated group compared to 6.2% in the unvaccinated group ( $p = 0.31$ ). Likewise, the rates of small for gestational age were comparable between the two groups (6.2% vs. 7.0% respectively,  $p = 0.2$ ).

In a secondary analysis focusing on time of vaccination and its relationship with outcomes, patients vaccinated in the second trimester ( $n = 964$ ) and in the third trimester ( $n = 1329$ ) were independently compared to their unvaccinated counterparts. Women who were vaccinated in the second trimester were more likely to have a preterm birth (8.1% vs. 6.2%,  $p < 0.001$ ). This association persisted after adjusting for potential confounders (adjusted odds ratio 1.49, 95%CI 1.11, 2.01).

## Conclusions

SARS-CoV-2 vaccine appears to be safe during pregnancy with no increase in incidence of preterm labor and small for gestational age compared to unvaccinated women. However, in women vaccinated during the second trimester there may be an increase in the rate of preterm birth. (Author)

**Full URL:** <https://doi.org/10.1186/s12884-022-04505-5>

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## 2022-00907

**Prioritise research on vaccines for pregnant and breastfeeding women.** Manca T, Baylis F, Munoz FM, et al (2022), The Lancet vol 399, no 10328, 5 March 2022, pp 890-893

The authors highlight the importance of including pregnant and breastfeeding women in vaccine research, and discuss the recommendation that pregnant and breastfeeding women receive the COVID-19 vaccine despite the absence of clinical trial data. (LDO)

**Full URL:** [https://doi.org/10.1016/S0140-6736\(22\)00379-8](https://doi.org/10.1016/S0140-6736(22)00379-8)

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## 2022-00799

**COVID-19 Vaccine in Pregnancy: Vaccine Hesitancy Among Obstetricians and Midwives.** O'Neill AM, O'Riordan SL, Yuddandi V (2022), Irish Medical Journal vol 115, no 2, February 2022, P552

Correspondence piece presenting a study on vaccine hesitancy among obstetricians and midwives in one unit in Ireland. Results show that 71% and 91% of respondents would recommend the COVID-19 vaccine to pregnant women in the first and second surveys respectively. (LDO)

**Full URL:** <http://imj.ie/covid-19-vaccine-in-pregnancy-vaccine-hesitancy-among-obstetricians-and-midwives/>

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## 2022-00639

**Durability of Anti-Spike Antibodies in Infants After Maternal COVID-19 Vaccination or Natural Infection.** Shook LL, Atyeo CG, Yonker LM, et al (2022), JAMA (Journal of the American Medical Association) vol 327, no 11, 15 March 2022, pp 1087-1089

This study compared the persistence anti-Spike IgG titers in infants of vaccinated mothers vs mothers who had been naturally infected with COVID-19. (Author)

**Full URL:** <https://doi.org/10.1001/jama.2022.1206>

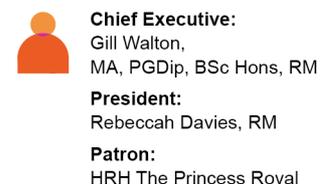
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## 2022-00568

**Acceptance and willingness to pay for COVID-19 vaccines among pregnant women in Vietnam.** Nguyen LH, Bruyn E, Webster R, et al (2021), Tropical Medicine & International Health vol 26, no 10, October 2021, pp 1303-1313

Objectives

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The aim of this study was to assess acceptance of COVID-19 vaccination and the willingness to pay (WTP) for it, and investigate associated factors among pregnant women in Vietnam.

#### Methods

Cross-sectional survey of pregnant women in two obstetric hospitals in Hanoi and Ca Mau provinces, Vietnam. Data on acceptance and WTP for COVID-19, demographic characteristics, maternal characteristics, and risk perceptions toward COVID-19 were collected. Multivariate logistic and linear regression models were performed to identify factors associated with the acceptance and WTP for the vaccine.

#### Results

Of 651 pregnant women, 60.4% accepted to receive the vaccine, and 82.6% of the total pregnant women were willing to pay for a COVID-19 vaccine with the mean amount of WTP of USD 15.2 (SD ± 27.4). The most common reason for refusing vaccination was “Worry about the safety of the vaccine” (66.9%) in Hanoi and “The preventive effect of COVID-19 is low” (45.2%) in Ca Mau. A higher income, having children, self-perceived risk of COVID-19 infection, and perceived risk to friends were associated with a higher likelihood of acceptance and WTP for the vaccine.

#### Conclusions

Implementing COVID-19 vaccination and resource mobilisation among pregnant women in Vietnam is feasible, although communication programmes to improve risk perception and awareness about vaccine should be developed for facilitating acceptance of the vaccine. (Author)

Full URL: <https://doi.org/10.1111/tmi.13666>

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#### 2022-00223

**Covid vaccine: Pregnant women urged not to delay getting jab.** Morton B (2021), BBC News 10 January 2021

Pregnant women are being urged not to delay getting their Covid jab or booster in a government campaign. (Author)

Full URL: [https://www.bbc.co.uk/news/uk-59930786?at\\_medium=RSS&at\\_campaign=KARANGA](https://www.bbc.co.uk/news/uk-59930786?at_medium=RSS&at_campaign=KARANGA)

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#### 2022-00159

**Scientific Evidence Supporting Coronavirus Disease 2019 (COVID-19) Vaccine Efficacy and Safety in People Planning to Conceive or Who Are Pregnant or Lactating.** Girardi G, Bremer AA (2022), *Obstetrics & Gynecology* vol 139, no 1, January 2022, pp 3-8

Three coronavirus disease 2019 (COVID-19) vaccines have been authorized for use in the United States; specifically, the Pfizer–BioNTech, Moderna, and Johnson & Johnson–Janssen COVID-19 vaccines were granted emergency use authorization by the U.S. Food and Drug Administration in late 2020 and early 2021. Vaccination coverage and intent among adults are lowest among those aged 18–39 years and among females in particular. In females of reproductive age, enthusiasm for receiving a COVID-19 vaccine may be negatively affected by claims currently circulating widely on diverse social media platforms regarding the vaccines adversely affecting fertility and pregnancy. Yet it is important to note that these claims are anecdotal in nature and not supported by the available scientific evidence. It is also imperative that the effects of COVID-19 vaccine on reproductive health are clarified. Herein, we discuss the existing scientific data supporting COVID-19 vaccine safety and efficacy in people who are planning to conceive or who are pregnant or lactating and highlight the importance of COVID-19 vaccination in females of reproductive age. (Author)

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#### 2022-00158

**COVID-19 and novel mRNA vaccines in pregnancy: an updated literature review.** Joubert E, Kekeh AC, Amin CN (2022), *BJOG: An International Journal of Obstetrics and Gynaecology* vol 129, no 1, January 2022, pp 21-28

The novel coronavirus, SARS-CoV-2, or COVID-19, has affected the world on a pandemic scale resulting in catastrophic outcomes and deaths. Currently, there is limited safety data specific to mRNA vaccine use in pregnant or lactating individuals and the potential risks to a pregnant individual and the fetus are unknown. We report an updated literature review of current information and evidence available to aid in the decision whether to vaccinate against

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COVID-19 currently being made by pregnant individuals and their healthcare providers so that they are able to make a well-informed recommendation and decision. (Author)

Full URL: <https://doi.org/10.1111/1471-0528.16973>

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#### 2022-00142

**Maternal Outcomes After Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Infection in Vaccinated Compared With Unvaccinated Pregnant Patients.** Morgan JA, Biggio JR, Martin JK, et al (2022), *Obstetrics & Gynecology* vol 139, no 1, January 2022, pp 107-109

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) vaccination is associated with lower odds of severe or critical coronavirus disease 2019 (COVID-19) or COVID-19 of any severity in pregnant patients during the Delta-predominant fourth SARS-CoV-2 surge. (Author)

Full URL: [https://journals.lww.com/greenjournal/fulltext/9900/maternal\\_outcomes\\_after\\_severe\\_acute\\_respiratory.320.aspx](https://journals.lww.com/greenjournal/fulltext/9900/maternal_outcomes_after_severe_acute_respiratory.320.aspx)

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#### 2022-00028

**Monitoring the safety of COVID-19 vaccination in pregnancy in the UK: A national study using the UK Obstetric Surveillance System (UKOSS), UK Teratology Information Service (UKTIS) and Vaccination in Pregnancy (VIP) safety monitoring systems.** Richardson JL, Stephens S, Chappell LC, et al (2023), *Obstetric Medicine* vol 16, no 1, March 2023, pp 40-47

##### Background

COVID-19 vaccines are protective against disease. Pregnant women benefit from vaccination as they are at higher risk of poor maternal and neonatal outcomes following infection.

##### Methods

Following regulatory approval of two COVID-19 vaccines in the United Kingdom, a rapid national study of vaccination in pregnancy was instituted using three existing safety surveillance platforms: UKOSS, UKTIS and VIP. This preliminary report describes the data collected up to the 15th June 2021.

##### Results

There were 971 reports of COVID-19 vaccination in the UKOSS/UKTIS (n = 493) and VIP (n = 478) monitoring systems describing 908 individual pregnancies. Pfizer-BioNTech mRNA vaccination was most common (n = 501, 55.2%), most women were vaccinated in their second or third trimester (n = 566, 62.3%), and were mainly vaccinated due to occupational infection risk (n = 577, 63.5%).

##### Conclusion

Obstetric outcome data will be obtained by December 2021. However, women should not delay vaccination whilst awaiting further safety data to emerge. (Author)

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#### 2022-00011

**In Vitro Fertilization and Early Pregnancy Outcomes After Coronavirus Disease 2019 (COVID-19) Vaccination.** Aharon D, Lederman M, Ghofranian A, et al (2022), *Obstetrics & Gynecology* vol 139, no 4, April 2022, pp 490-497

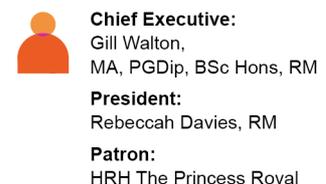
##### OBJECTIVE:

To assess whether coronavirus disease 2019 (COVID-19) mRNA vaccination is associated with controlled ovarian hyperstimulation or early pregnancy outcomes.

##### METHODS:

This retrospective cohort study included patients who underwent controlled ovarian hyperstimulation or single euploid frozen-thawed embryo transfer at a single academic center. Patients fully vaccinated with a COVID-19 mRNA vaccine were compared with unvaccinated patients who cycled during the same time period. The primary outcome was the fertilization rate for controlled ovarian hyperstimulation and the clinical pregnancy rate for frozen-thawed embryo transfer. Secondary outcomes for controlled ovarian hyperstimulation included eggs retrieved, mature

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oocytes retrieved, mature oocytes ratio, blastulation rate, and euploid rate. Secondary outcomes for frozen-thawed embryo transfer included pregnancy rate, ongoing pregnancy rate, biochemical pregnancy loss rate, and clinical pregnancy loss rate.

#### RESULTS:

Among 222 vaccinated patients and 983 unvaccinated patients who underwent controlled ovarian hyperstimulation cycles between February and September 2021, there was no association on adjusted analysis between COVID-19 vaccination and fertilization rate ( $\beta=0.02\pm 0.02$ ,  $P=.20$ ) or any of the secondary outcomes assessed: eggs retrieved ( $\beta=0.01\pm 0.57$ ,  $P=.99$ ), mature oocytes retrieved ( $\beta=0.26\pm 0.47$ ,  $P=.58$ ), mature oocytes ratio ( $\beta=0.02\pm 0.01$ ,  $P=.12$ ), blastulation rate ( $\beta=0.02\pm 0.02$ ,  $P=.27$ ), or euploid rate ( $\beta=0.05\pm 0.03$ ,  $P=.08$ ). Among 214 vaccinated patients and 733 unvaccinated patients undergoing single euploid frozen-thawed embryo transfer, adjusted analysis demonstrated no significant association between vaccination and clinical pregnancy (adjusted odds ratio [aOR] 0.79, 95% CI 0.54–1.16) or any of the secondary outcomes: pregnancy (aOR 0.88, 95% CI 0.58–1.33), ongoing pregnancy (aOR 0.90, 95% CI 0.61–1.31), biochemical pregnancy loss (aOR 1.21, 95% CI 0.69–2.14), or clinical pregnancy loss (aOR 1.02, 95% CI 0.51–2.06).

#### CONCLUSION:

Administration of COVID-19 mRNA vaccines was not associated with an adverse effect on stimulation or early pregnancy outcomes after IVF. Our findings contribute to the growing body of evidence regarding the safety of COVID-19 vaccination in women who are trying to conceive. (Author)

Full URL: <https://doi.org/10.1097/AOG.0000000000004713>

### 2021-14573

**Short-term outcome of pregnant women vaccinated with BNT162b2 mRNA COVID-19 vaccine.** Bookstein Peretz S, Regev N, Novick L, et al (2021), *Ultrasound in Obstetrics and Gynecology* vol 58, no 3, September 2021, pp 450-456

#### Objectives

To determine the immunogenicity and reactogenicity of the Pfizer/BioNTech BNT162b2 mRNA coronavirus disease 2019 (COVID-19) vaccine among pregnant women compared with non-pregnant women, and to evaluate obstetric outcome following vaccination.

#### Methods

This was an observational case-control study of pregnant women who were vaccinated with a two-dose regimen of the BNT162b2 vaccine during gestation between January and February 2021 (study group) and age-matched non-pregnant women who received the vaccine during the same time period (control group). Participants received a digital questionnaire 1–4 weeks after the second dose and were asked to provide information regarding demographics, medication, medical history, history of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, timing of COVID-19 vaccine doses and side effects after each vaccine dose. A second digital questionnaire, regarding current pregnancy and delivery outcomes, was sent to patients in the study group after the calculated due date. All recruited women were offered a serology blood test for SARS-CoV-2 immunoglobulin G (IgG) following the second vaccination dose and SARS-CoV-2 IgG levels were compared between the two groups.

#### Results

Of 539 pregnant women who were recruited after completion of the two-dose regimen of the vaccine, 390 returned the digital questionnaire and were included in the study group and compared to 260 age-matched non-pregnant vaccinated women. The rates of rash, fever and severe fatigue following vaccination among pregnant women were comparable to those in non-pregnant women. Myalgia, arthralgia and headache were significantly less common among pregnant women after each dose, local pain or swelling and axillary lymphadenopathy were significantly less common among pregnant women after the first and second doses, respectively, while paresthesia was significantly more common among the pregnant population after the second dose. Among pregnant women, there were no significant differences in the rates of side effects according to whether the vaccine was administered during the first,

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second or third trimester of pregnancy, except for local pain/swelling, which was significantly less common after the first dose when administered during the third trimester, and uterine contractions, which were significantly more common after the second dose when administered during the third trimester. The rates of obstetric complications, including uterine contractions (1.3% after the first dose and 6.4% after the second dose), vaginal bleeding (0.3% after the first dose and 1.5% after the second dose) and prelabor rupture of membranes (0% after the first dose and 0.8% after the second dose), were very low following vaccination. All serum samples in both groups were positive for SARS-CoV-2 IgG. However, pregnant women had significantly lower serum SARS-CoV-2 IgG levels compared to non-pregnant women (signal-to-cut-off ratio, 27.03 vs 34.35, respectively;  $P < 0.001$ ). Among the 57 pregnant women who delivered during the study period and who completed the second questionnaire, median gestational age at delivery was 39.5 (interquartile range, 38.7–40.0) weeks, with no cases of preterm birth  $< 37$  weeks, no cases of fetal or neonatal death and two (3.5%) cases of admission to the neonatal intensive care unit for respiratory support.

## Conclusions

The adverse-effect profile and short-term obstetric and neonatal outcomes among pregnant women who were vaccinated with the BNT162b2 vaccine at any stage of pregnancy do not indicate any safety concerns. The vaccine is effective in generating a humoral immune response in pregnant women, although SARS-CoV-2 IgG levels were lower than those observed in non-pregnant vaccinated women. © 2021 International Society of Ultrasound in Obstetrics and Gynecology. (Author)

Full URL: <https://doi.org/10.1002/uog.23729>

## 2021-13932

**Association of Gestational Age at Coronavirus Disease 2019 (COVID-19) Vaccination, History of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Infection, and a Vaccine Booster Dose With Maternal and Umbilical Cord Antibody Levels at Delivery.** Yang YJ, Murphy EA, Singh S, et al (2022), *Obstetrics & Gynecology* vol 139, no 3, March 2022, pp 373-380

### OBJECTIVE:

To describe maternal and umbilical cord blood anti-spike immunoglobulin (Ig)G levels at delivery with coronavirus disease 2019 (COVID-19) vaccination before and during pregnancy and to assess the association of prior severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection and a vaccine booster dose with anti-spike maternal and umbilical cord IgG levels.

### METHODS:

We conducted a retrospective cohort study of women with self-reported COVID-19 vaccination (Pfizer-BioNTech, Moderna, or Johnson & Johnson/Janssen), including a booster dose, during or before pregnancy, who delivered at 34 weeks of gestation or more. Maternal and umbilical cord blood samples at delivery were analyzed for semi-quantitative anti-spike IgG. We examined the association between timing of maternal vaccination and maternal and umbilical cord anti-spike levels using a rank sum test. The relationships between a prior history of SARS-CoV-2 infection and maternal and umbilical cord anti-spike IgG levels, and between a booster dose and maternal and umbilical cord anti-spike levels, were also evaluated using a rank sum test.

### RESULTS:

We included data from 1,359 vaccinated pregnant women, including 20 women who received a booster dose, and 1,362 umbilical cord samples. Maternal anti-spike IgG levels were detectable at delivery regardless of timing of vaccination throughout pregnancy among fully vaccinated women; however, early third-trimester vaccination was associated with the highest anti-spike IgG levels in maternal and umbilical cord blood. Among women with a history of SARS-CoV-2 infection, maternal and cord blood antibody response achieved with vaccination in early pregnancy was comparable with third-trimester vaccination in pregnant women without a history of SARS-CoV-2 infection. A booster dose in the third trimester was associated with maternal anti-spike IgG levels greater than third-trimester vaccination in women with or without a history of SARS-CoV-2 infection.

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## DISCUSSION:

Vaccination against COVID-19 before and throughout pregnancy was associated with detectable maternal anti-spike IgG levels at delivery. A complete vaccination course, prior history of SARS-CoV-2 infection, and a third-trimester booster dose were associated with the highest maternal and umbilical cord antibody levels. (Author)

**Full URL:** <https://doi.org/10.1097/AOG.0000000000004693>

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## 2021-13850

### **Guidance for design and analysis of observational studies of fetal and newborn outcomes following COVID-19 vaccination during pregnancy.**

Fell DB, Dimitris MC, Hutcheon JA, et al (2021), Vaccine vol 39, no 14, 1 April 2021, pp 1882-1886

COVID-19 vaccines are now being deployed as essential tools in the public health response to the global SARS-CoV-2 pandemic. Pregnant individuals are a unique subgroup of the population with distinctive considerations regarding risk and benefit that extend beyond themselves to their fetus/newborn. As a complement to traditional pharmacovigilance and clinical studies, evidence to comprehensively assess COVID-19 vaccine safety in pregnancy will need to be generated through observational epidemiologic studies in large populations. However, there are several unique methodological challenges that face observational assessments of vaccination during pregnancy, some of which may be more pronounced for COVID-19 studies. In this contribution, we discuss the most critical study design, data collection, and analytical issues likely to arise. We offer brief guidance to optimize the quality of such studies to ensure their maximum value for informing public health decision-making. (Author)

**Full URL:** <https://doi.org/10.1016/j.vaccine.2021.02.070>

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## 2021-13841

### **Early exploration of COVID-19 vaccination safety and effectiveness during pregnancy: interim descriptive data from a prospective observational study.**

Bleicher I, Kadour-Peero E, Sagi-Dain L, et al (2021), Vaccine vol 39, no 44, 22 October 2021, pp 6535-6538

#### Objective

During December 2020, a massive vaccination program was introduced in our country. The Pfizer-BioNTech, BNT162b2 vaccine was first offered exclusively to high-risk population, such as medical personnel (including pregnant women). In this study we compare short term outcomes in vaccinated vs. non-vaccinated pregnant women.

#### Methods

In this prospective observational cohort study, vaccinated and non-vaccinated pregnant women were recruited using an online Google forms questionnaire targeting medical groups on Facebook and WhatsApp. A second questionnaire was sent one month after the first one for interim analysis. Our primary outcome was composite complications in vaccinated and non-vaccinated groups, considered any of the following: vaginal bleeding, pregnancy loss, hypertension, gestational diabetes, and preterm birth. Secondary outcomes included: vaccine side effects, diagnosis of COVID-19 since the last questionnaire, prevalence of vaccinated participants, and reasons for refusal to be vaccinated.

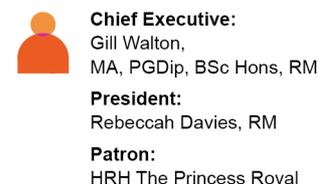
#### Results

Overall, 432 women answered the first questionnaire, of which 326 responses were received to the second questionnaire. Vaccination rate increased from 25.5% to 62% within a month. Maternal age, gestational age at enrollment, nulliparity and number of children were similar in both groups. The rate of composite pregnancy complications was similar between vaccinated and non-vaccinated group (15.8% vs 20.1%,  $p = 0.37$ ), respectively. The risk for COVID-19 infection was significantly lower in the vaccinated group (1.5% vs 6.5%,  $p = 0.024$ , Odds Ratio: 4.5, 95% confidence interval 1.19–17.6).

#### Conclusions

mRNA vaccine during pregnancy does not seem to increase the rate of pregnancy complications and is effective in prevention of COVID-19 infection. (Author)

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## 2021-13840

**Prenatal maternal COVID-19 vaccination and pregnancy outcomes.** Wainstock T, Yoles I, Sergienko R, et al (2021), Vaccine vol 39, no 41, 1 October 2021, pp 6037-6040

### Background

Prenatal maternal physiological changes may cause severe COVID-19 among pregnant women. The Pfizer-BioNTech COVID-19 vaccine (BNT162b2 mRNA) has been shown to be highly effective and it is recommended for individuals aged  $\geq 16$  years, including pregnant women, although the vaccine has not been tested on the latter.

### Objective

To study the association between prenatal Pfizer-BioNTech COVID-19 vaccination, pregnancy course and outcomes.

### Study design

A retrospective cohort study was performed, including all women who delivered between January and June 2021 at Soroka University Medical Center, the largest birth center in Israel. Excluded were women diagnosed with COVID-19 in the past, multiple gestations or unknown vaccination status. Pregnancy, delivery and newborn complications were compared between women who received 1 or 2-dose vaccines during pregnancy and unvaccinated women. Multivariable models were used to adjust for background characteristics.

### Results

A total of 4,399 women participated in this study, 913 (20.8%) of which were vaccinated during pregnancy. All vaccinations occurred during second or third trimesters. As compared to the unvaccinated women, vaccinated women were older, more likely to conceive following fertility treatments, to have sufficient prenatal care, and of higher socioeconomic position. In both crude and multivariable analyses, no differences were found between the groups in pregnancy, delivery and newborn complications, including gestational age at delivery, incidence of small for gestational age and newborn respiratory complications.

### Conclusions

Prenatal maternal COVID-19 vaccine has no adverse effects on pregnancy course and outcomes. These findings may help pregnant women and health care providers to make informed decision regarding vaccination. (Author)

Full URL: <https://doi.org/10.1016/j.vaccine.2021.09.012>

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## 2021-13710

**NHSE warns of significant variation in pregnant women's vaccination uptake.** Trivedi SS (2022), Health Service Journal 26 January 2022

An NHS England letter has warned of "significant variation" in the uptake of the covid-19 vaccine amongst pregnant women, and called on systems to enable more "spontaneous" antenatal vaccination. (Author)

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## 2021-13698

**Severe COVID-19 in pregnancy is almost exclusively limited to unvaccinated women – time for policies to change.**

Engjom H, van den Akker T, Aabakke A, et al (2022), The Lancet Regional Health - Europe 26 January 2022, online Commentary piece analysing data from the International Network of Obstetric Survey Systems (INOSS) collected in the United Kingdom (UK), the Netherlands, Norway, Denmark, Finland and Italy between May and December 2021. Results show that at least 80% of pregnant women admitted to critical care with COVID-19 were unvaccinated across the six countries, including 98% of pregnant women in the UK. (LDO)

Full URL: <https://doi.org/10.1016/j.lanep.2022.100313>

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**2021-13690**

**Women's views on accepting COVID-19 vaccination during and after pregnancy, and for their babies: a multi-methods study in the UK.** Skirrow H, Barnett S, Bell S, et al (2022), BMC Pregnancy and Childbirth vol 22, no 33, 14 January 2022

Background

COVID-19 vaccines are advised for pregnant women in the United Kingdom (UK) however COVID-19 vaccine uptake among pregnant women is inadequate.

Methods

An online survey and semi-structured interviews were used to investigate pregnant women's views on COVID-19 vaccine acceptability for themselves when pregnant, not pregnant and for their babies. One thousand one hundred eighty-one women, aged over 16 years, who had been pregnant since 23rd March 2020, were surveyed between 3rd August–11th October 2020. Ten women were interviewed.

Results

The majority of women surveyed (81.2%) reported that they would 'definitely' or were 'leaning towards' accepting a COVID-19 vaccine when not pregnant. COVID-19 vaccine acceptance was significantly lower during pregnancy (62.1%,  $p < 0.005$ ) and for their babies (69.9%,  $p < 0.005$ ). Ethnic minority women were twice as likely to reject a COVID-19 vaccine for themselves when not pregnant, pregnant and for their babies compared to women from White ethnic groups ( $p < 0.005$ ). Women from lower-income households, aged under 25-years, and from some geographic regions were more likely to reject a COVID-19 vaccine when not pregnant, pregnant and for their babies. Multivariate analysis revealed that income and ethnicity were the main drivers of the observed age and regional differences. Women unvaccinated against pertussis in pregnancy were over four times more likely to reject COVID-19 vaccines when not pregnant, pregnant and for their babies. Thematic analysis of the survey freetext responses and interviews found safety concerns about COVID-19 vaccines were common though wider mistrust in vaccines was also expressed. Trust in vaccines and the health system were also reasons women gave for accepting COVID-19 vaccines.

Conclusion

Safety information on COVID-19 vaccines must be clearly communicated to pregnant women to provide reassurance and facilitate informed pregnancy vaccine decisions. Targeted interventions to promote COVID-19 vaccine uptake among ethnic minority and lower-income women may be needed. (Author)

Full URL: <https://doi.org/10.1186/s12884-021-04321-3>

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**2021-13679**

**COVID-19: latest safety data provide reassurance about use of mRNA vaccines during pregnancy.** European Medicines Agency (2022), Amsterdam: European Medicines Agency 18 January 2022

Summarises the findings of a review of approximately 65,000 pregnancies at different stages, conducted by the European Medicines Agency's COVID-19 task force (ETF), which concluded that pregnancy complications are not increased by the administration of mRNA vaccines. Studies also showed that vaccination is as effective at reducing hospitalisation and death in the pregnant population as it is in the non pregnant population, and side effects from COVID-19 vaccines are the same in both groups. These include pain, redness or swelling at the injection site, fatigue, muscle pain and chills, all of which usually subside in a few days. States that most of the information involves mRNA vaccines (Comirnaty and Spikevax) but the EMA intends to review data from other authorised COVID-19 vaccines when they become available. (JSM)

Full URL: <https://www.ema.europa.eu/en/news/covid-19-latest-safety-data-provide-reassurance-about-use-mrna-vaccines-during-pregnancy>

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**2021-13520**

**Covid-19: Severe complications during pregnancy are more common in unvaccinated women, study finds.** Mahase E (2022), BMJ vol 376, no 8322, 17 January 2022, o117

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Unvaccinated women accounted for 77% of SARS-CoV-2 infections that have occurred during pregnancy in Scotland and 98% of infections that led to a critical care admission, a study has found (1).

1. Stock SJ et al. Nature Medicine, 13 January 2022, online. <https://doi.org/10.1038/s41591-021-01666-2>.

(Author, edited)

Full URL: <https://doi.org/10.1136/bmj.o117>

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#### 2021-13519

**Covid-19: Vaccination during pregnancy is safe, finds large US study.** Hopkins Tanne J (2022), BMJ vol 376, 7 January 2022, o27

A US study (1) of 46 079 pregnancies has found that vaccination against covid-19 was safe and did not increase the risk of preterm birth or small for gestational age babies.

1. Lipkind HS et al. Morbidity and Mortality Weekly Report (MMWR), vol 71, no 1, January 2022, pp 26-30.

<https://doi.org/10.15585/mmwr.mm7101e1> pmid:34990445.

(Author, edited)

Full URL: <https://doi.org/10.1136/bmj.o27>

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#### 2021-13518

**Receipt of COVID-19 Vaccine During Pregnancy and Preterm or Small-for-Gestational-Age at Birth - Eight Integrated Health Care Organizations, United States, December 15, 2020-July 22, 2021.** Lipkind HS, Vazquez-Benitez G, DeSilva M, et al (2022), Morbidity and Mortality Weekly Report (MMWR) vol 71, no 1, 7 January 2022, pp 26-30

What is already known about this topic?

Pregnant women with COVID-19 are at increased risk for severe illness and adverse birth outcomes, yet many remain reluctant to be vaccinated.

What is added by this report?

In a retrospective cohort of >40,000 pregnant women, COVID-19 vaccination during pregnancy was not associated with preterm birth or small-for-gestational-age at birth overall, stratified by trimester of vaccination, or number of vaccine doses received during pregnancy, compared with unvaccinated pregnant women.

What are the implications for public health practice?

These data support the safety of COVID-19 vaccination during pregnancy. CDC recommends COVID-19 vaccination for women who are pregnant, recently pregnant, who are trying to become pregnant now, or who might become pregnant in the future. (Author)

Full URL: <http://dx.doi.org/10.15585/mmwr.mm7101e1>

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#### 2021-13460

**Covid coma pregnancy: Wolverhampton mum 'devastated' to lose son.** BBC News (2021), BBC News 15 January 2022

A woman has spoken of her "devastation" after losing a baby delivered while she was in an induced coma with Covid.

(Author)

Full URL: [https://www.bbc.co.uk/news/uk-england-birmingham-59996683?at\\_medium=RSS&at\\_campaign=KARANGA](https://www.bbc.co.uk/news/uk-england-birmingham-59996683?at_medium=RSS&at_campaign=KARANGA)

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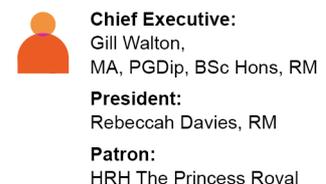
#### 2021-13441

**Covid in pregnancy linked to birth-related complications.** Anon (2022), BBC News 13 January 2022

A new study (1) has linked Covid-19 to complications during pregnancy.

1. Stock SJ. Nature Medicine, 13 January 2022, online. <https://doi.org/10.1038/s41591-021-01666-2>.

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(Author, edited)

Full URL: <https://www.bbc.co.uk/news/uk-scotland-59986452>

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## 2021-13440

**SARS-CoV-2 infection and COVID-19 vaccination rates in pregnant women in Scotland.** Stock SJ, Carruthers J, Calvert C, et al (2022), Nature Medicine 13 January 2022, online

Population-level data on COVID-19 vaccine uptake in pregnancy and SARS-CoV-2 infection outcomes are lacking. We describe COVID-19 vaccine uptake and SARS-CoV-2 infection in pregnant women in Scotland, using whole-population data from a national, prospective cohort. Between the start of a COVID-19 vaccine program in Scotland, on 8 December 2020 and 31 October 2021, 25,917 COVID-19 vaccinations were given to 18,457 pregnant women. Vaccine coverage was substantially lower in pregnant women than in the general female population of 18–44 years; 32.3% of women giving birth in October 2021 had two doses of vaccine compared to 77.4% in all women. The extended perinatal mortality rate for women who gave birth within 28 d of a COVID-19 diagnosis was 22.6 per 1,000 births (95% CI 12.9–38.5; pandemic background rate 5.6 per 1,000 births; 452 out of 80,456; 95% CI 5.1–6.2). Overall, 77.4% (3,833 out of 4,950; 95% CI 76.2–78.6) of SARS-CoV-2 infections, 90.9% (748 out of 823; 95% CI 88.7–92.7) of SARS-CoV-2 associated with hospital admission and 98% (102 out of 104; 95% CI 92.5–99.7) of SARS-CoV-2 associated with critical care admission, as well as all baby deaths, occurred in pregnant women who were unvaccinated at the time of COVID-19 diagnosis. Addressing low vaccine uptake rates in pregnant women is imperative to protect the health of women and babies in the ongoing pandemic. (Author)

Full URL: <https://doi.org/10.1038/s41591-021-01666-2>

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## 2021-13208

**Developing a fast-track COVID-19 vaccination clinic for pregnant people.** Cater K, Yazbek J, Morris P, et al (2022), British Journal of Midwifery vol 30, no 1, January 2022, pp 41-46

A pilot fast-track COVID-19 vaccination clinic was created in the east of England to provide expert advice, education and support for pregnant people. As the COVID-19 pandemic has progressed, it is clear that pregnant people are at high risk of becoming seriously unwell with the COVID-19 virus. Establishment of the clinic led to a 20% increase in COVID-19 vaccine uptake in this group, with 211 vaccinations between 28 June and 30 September 2021. Almost two-thirds (59%) of pregnant people reported they would not have taken up the vaccination if they had not discussed it as part of this service. Over half of those attending (50.2%) reside within the index of multiple deprivation levels 1–4, the most severely deprived areas. This article explores the development of the fast-track vaccination service and seeks to support others wishing to replicate its delivery in their areas. (Author)

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## 2021-13167

**Characterizing initial COVID-19 vaccine attitudes among pregnancy-capable healthcare workers.** Perez MJ, Paul R, Raghuraman N, et al (2022), American Journal of Obstetrics & Gynecology MFM vol 4, no 2, March 2022, 100557

### Background

Healthcare workers were prioritized for COVID-19 vaccination roll-out due to high occupational risk. Vaccine trials excluded individuals who were trying to conceive, pregnant, and lactating necessitating vaccine decision-making in the absence of data specific to this population.

### Objective

To determine initial attitudes about COVID-19 vaccination in pregnancy-capable healthcare workers by reproductive status and occupational exposure.

### Study Design

We performed a structured survey distributed via social media of US-based healthcare workers involved in patient care since March 2020 who were pregnancy-capable (biological female sex without history of sterilization or hysterectomy) from January 8th to 31st, 2021. Participants were asked about their desire to receive the COVID-19

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vaccine and perceived safety for the COVID-19 vaccine using five-point Likert items with “1” being “I strongly don't want the vaccine”/“very unsafe for me” and “5” being “I strongly want the vaccine”/“very safe for me.” We categorized participants into two groups: 1) reproductive intent (preventing pregnancy vs. attempting pregnancy, currently pregnant, or currently lactating), and 2) perceived COVID-19 occupational risk (high vs. low). We used descriptive statistics to characterize the respondents and their attitudes about the vaccine. Comparisons between reproductive and COVID-19 risk groups were conducted using Mann Whitney U.

## Results

Our survey included 11,405 pregnancy-capable healthcare workers: 51.3% were preventing pregnancy (n=5,846) and 48.7% (n=5,559) were attempting pregnancy, currently pregnant, and/or lactating. Most respondents (n=8,394, 73.6%) had received a vaccine dose at the time of survey completion. Most participants strongly desired vaccination (75.3%) and very few were strongly averse (1.5%). While the distribution of responses was significantly different between respondents attempting conception, pregnant, and/or lactating versus those preventing pregnancy and respondents with high versus lower occupational risk of COVID-19, the effect sizes were small and the distribution was the same for each group (median, interquartile range: 5 [4-5]).

## Conclusions

The majority of healthcare workers desired vaccination. Negative feelings toward vaccination were uncommon but were significantly higher in those attempting pregnancy, pregnant, and lactating and with lower perceived occupational risk of acquiring COVID-19, though the effect size was small. Understanding healthcare workers' attitudes toward vaccination may help guide interventions to improve vaccine education and uptake in the general population.

(Author)

Full URL: <https://doi.org/10.1016/j.ajogmf.2021.100557>

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## 2021-13065

**Coronavirus: Vaccination [written answer].** House of Commons (2021), Hansard Written question 92886, 14 December 2021  
Maggie Throup responds to a written question from Bob Blackman to the Secretary of State for Health and Social Care, regarding what steps his Department is taking to increase the uptake of the covid-19 vaccine among pregnant women. (JSM)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2021-12-14/92886>

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## 2021-13031

**Coronavirus: Vaccination [written answer].** House of Commons (2021), Hansard Written question 90872, 10 December 2021  
Maggie Throup responds to a written question from Stella Creasy to the Secretary of State for Health and Social Care, regarding which hospital trusts are providing covid-19 vaccinations at antenatal clinics; and from what date each of those clinics began providing those vaccinations. (MB)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2021-12-10/90872>

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## 2021-12970

**Coronavirus: Vaccination [written answer].** House of Commons (2021), Hansard Written question 82127, 25 November 2021  
Maggie Throup responds to a written question from Kim Leadbeater to the Secretary of State for Health and Social Care, regarding whether he plans to take steps to help ensure that pregnant women of all ages have access to covid-19 booster vaccinations. (JSM)

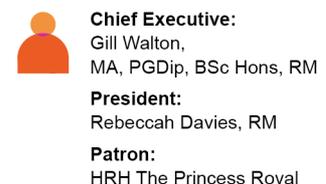
Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2021-11-25/82127>

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## 2021-12793

**Maternity Royal Colleges welcome prioritisation of pregnant women for COVID-19 vaccination.** Royal College of Obstetricians and Gynaecologists (2021), London: RCOG 16 December 2021

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Press release stating that the Royal College of Obstetricians and Gynaecologists (RCOG) and the Royal College of Midwives (RCM) has welcomed the decision from the Joint Committee on Vaccination and Immunisation (JCVI) that pregnant women are to be given priority for receiving covid vaccinations.

**Full URL:** <https://www.rcog.org.uk/en/news/maternity-royal-colleges-welcome-prioritisation-of-pregnant-women-for-covid-19-vaccination/>

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#### 2021-12792

**Pregnant women put on UK's priority Covid vaccine list.** Anon (2021), BBC News 16 December 2021

Reports that pregnant women are to be given priority status for COVID-19 vaccinations and boosters. States that some women have died in pregnancy after contracting coronavirus and there is evidence of a higher risk of premature birth. (JSM)

**Full URL:** [https://www.bbc.co.uk/news/health-59684926?at\\_medium=RSS&at\\_campaign=KARANGA](https://www.bbc.co.uk/news/health-59684926?at_medium=RSS&at_campaign=KARANGA)

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#### 2021-12765

**Coronavirus: Vaccination [written answer].** House of Commons (2021), Hansard Written question 90872, 10 December 2021

Maggie Throup responds to a written question asked by Stella Creasy to the Secretary of State for Health and Social Care, regarding which hospital trusts are providing COVID-19 vaccinations at antenatal clinics; and from what date each of those clinics began providing those vaccinations. (LDO)

**Full URL:** <https://questions-statements.parliament.uk/written-questions/detail/2021-12-10/90872>

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#### 2021-12757

**The association of maternal SARS-CoV-2 vaccination-to-delivery interval and the levels of maternal and cord blood antibodies.** Bashi TB-M, Amikam U, Ashwal E, et al (2022), International Journal of Gynecology & Obstetrics vol 156, no 3, March 2022, pp 436-443

Objective

To evaluate the correlation of maternal and cord blood levels of SARS-CoV-2 antibodies in pregnant women immunized against COVID-19.

Methods

A prospective cohort study was performed of pregnant women who delivered at a single university affiliated tertiary medical center. Women who received the COVID-19 vaccine (BNT162b2 Pfizer®) were approached. The correlation between levels of maternal sera and umbilical cord SARS-CoV-2 specific IgG was assessed.

Results

Overall, 58 women were included; of them, 19 had received a single dose and 39 received two doses of the COVID-19 vaccine. Positive levels of umbilical cord IgG were found in 13/19 (68.4%) and 38/39 (97.4%) women after the administration of a single dose and two doses of the vaccine, respectively. The levels of SARS-CoV-2 IgG antibodies in the maternal sera of vaccinated women were positively correlated to their respective concentrations in cord blood sera ( $\rho = 0.857$ ;  $R^2$  linear = 0.719;  $P < 0.001$ ). Thirteen days after vaccination, the ratio of maternal-to-umbilical cord anti Spike IgG antibodies was approximately 1, indicating relatively similar levels in maternal and cord sera.

Conclusion

After the SARS-CoV-2 vaccine, levels of maternal and cord blood antibodies were positively correlated, especially when tested after 13 days following administration of the first dose of the vaccine. (Author)

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#### 2021-12704

**Worldwide beliefs among pregnant women on SARS-CoV-2 vaccine: a systematic review.** Carbone L, Di Girolamo R, Mappa I, et al (2022), European Journal of Obstetrics & Gynecology and Reproductive Biology vol 268, January 2022, pp 144-164

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## Background

SARS-CoV-2 vaccine has been recommended to pregnant women, but survey studies showed contrasting findings worldwide in relation to the willingness to accept vaccination during pregnancy.

## Objective

To evaluate the evidence from the literature regarding the acceptance rate of the SARS-CoV-2 vaccine in pregnant and breastfeeding women.

## Study design

We performed a systematic review on the main databases (MEDLINE (PubMed), Scopus, ISI Web of Science) searching for all the peer-reviewed survey studies analyzing the eventual acceptance rate of the SARS-CoV-2 vaccine among pregnant and breastfeeding women. To combine data meta-analyses of proportions and pooled proportions with their 95% confidence intervals (CI) were calculated.

## Results

15 studies including 25,839 women were included in the analysis. The proportion of women actually willing to be vaccinated during pregnancy is 49.1% (95% CI, 42.3–56.0), and the proportion of breastfeeding women is 61.6% (95% CI, 50.0–75.0).

## Conclusion

The cumulative SARS-CoV-2 vaccine acceptance rate among pregnant women appears still low. Vaccinal campaign are urgently needed to drive more confidence into the vaccine to help reducing the spread of the infection and the possible consequences during pregnancy. (Author)

**Full URL:** <https://doi.org/10.1016/j.ejogrb.2021.12.003>

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## 2021-12655

**Coronavirus: Vaccination [written answer].** House of Commons (2021), Hansard Written question 84387, 30 November 2021  
Maggie Throup responds to a written question from Thangam Debbonaire to the Secretary of State for Health and Social Care, regarding what steps the Government is taking to prioritise pregnant women for the covid-19 booster vaccine. (MB)

**Full URL:** <https://questions-statements.parliament.uk/written-questions/detail/2021-11-30/84387>

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## 2021-12653

**Coronavirus: Vaccination [written answer].** House of Commons (2021), Hansard Written question 84388, 30 November 2021  
Maggie Throup responds to a written question from Thangam Debbonaire to the Secretary of State for Health and Social Care, regarding what steps the Government is taking to encourage uptake of the covid-19 vaccine among pregnant women. (MB)

**Full URL:** <https://questions-statements.parliament.uk/written-questions/detail/2021-11-30/84388>

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## 2021-12613

**Trust's midwives hosting drop-in sessions on Covid-19 vaccination.** Howarth G (2021), Nursing Times 2 December 2021  
Midwives will be on-hand during special drop-in sessions to answer people's questions about Covid-19 vaccination, in a partnership between North Tees and Hartlepool NHS Foundation Trust and Hartlepool Borough Council. (Author)

**Full URL:** <https://www.nursingtimes.net/roles/midwives-and-neonatal-nurses/trusts-midwives-hosting-drop-in-sessions-on-covid-19-vaccination-02-12-2021/>

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## 2021-12598

**Unvaccinated mothers urge pregnant women to get jabbed.** Department of Health and Social Care (2021), London: DHSC 4 December 2021

Powerful new video shows their experiences of severe COVID-19 during pregnancy. (Author)

**Full URL:** <https://www.gov.uk/government/news/unvaccinated-mothers-urge-pregnant-women-to-get-jabbed>

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## 2021-12534

**Coronavirus (COVID-19) Infection in Pregnancy: Information for healthcare professionals [Version 14.2].** Royal College of Obstetricians and Gynaecologists, Royal College of Midwives, Royal College of Paediatrics and Child Health, et al (2021), London: RCOG 6 December 2021, 131 pages

NB: This document supersedes Version 14, 25 August 2021.

This document aims to provide guidance to healthcare professionals who care for pregnant women during the COVID-19 pandemic. It is not intended to replace existing clinical guidelines, but to act as a supplement with additional advice on how to implement standard practice during this time.

The advice in this document is provided as a resource for UK healthcare professionals based on a combination of available evidence, good practice and expert consensus opinion. The guidance may also be relevant to other healthcare systems but may need to be adapted for the local environment. The priorities are:

- (i) The reduction of transmission of SARS-CoV-2 to pregnant women, their family members and healthcare workers.
- (ii) The provision of safe, personalised and woman-centred care during pregnancy, birth and the early postnatal period, during the COVID-19 pandemic.
- (iii) The provision of safe, personalised and woman-centred care to pregnant and postnatal women with suspected or confirmed COVID-19.

This guidance is under regular review and updated as new information and evidence emerges.

Owing to the changing prevalence of COVID-19 infections in the UK, changes in care should be proportionate to the background prevalence at a given time. Decision-making around care and discussions about risks and benefits will depend on the background prevalence of the COVID-19 viral infection and the vaccination status of the woman. Updated advice and information will be published in the Coronavirus (COVID-19), pregnancy and women's health section of the Royal College of Obstetricians and Gynaecologists (RCOG) website.

Information for pregnant women and their families is available in question and answer format, with accompanying videos in some cases, on the RCOG and Royal College of Midwives (RCM) COVID-19 hubs.

This guidance uses the terms 'woman' or 'mother' throughout, and 'female' where this has been specifically stated in the published study. These should be taken to include people who do not identify as women but are pregnant or have given birth. (Author)

**Full URL:** <https://www.rcog.org.uk/globalassets/documents/guidelines/2021-12-06-coronavirus-covid-19-infection-in-pregnancy-v14.2.pdf>

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## 2021-12445

**Covid-19: Mums who were severely ill urge pregnant women to get jabs.** Meierhans J (2021), BBC News 7 May 2021

Unvaccinated women who gave birth while severely ill with Covid-19 have shared their stories to encourage pregnant women to get jabbed. (Author)

**Full URL:** [https://www.bbc.co.uk/news/uk-59530976?at\\_medium=RSS&at\\_campaign=KARANGA](https://www.bbc.co.uk/news/uk-59530976?at_medium=RSS&at_campaign=KARANGA)

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## 2021-12354

**Covid-19: Vaccine uptake during pregnancy has increased but deprived areas lag behind, data show.** Mahase E (2021), BMJ vol 375, 26 November 2021, n2932

No fully vaccinated pregnant women were admitted to intensive care with covid-19 in England between February and the end of September 2021, the UK Health Security Agency (UKHSA) has reported (1).

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1. UK Health Security Agency (UKHSA) (2021). COVID-19 vaccine surveillance report: week 47. London: UKHSA.  
[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1036047/Vaccine\\_surveillance\\_report\\_-\\_week\\_47.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1036047/Vaccine_surveillance_report_-_week_47.pdf).

(Author, edited)

Full URL: <https://doi.org/10.1136/bmj.n2932>

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#### 2021-12342

**Covid-19 and pregnancy: vaccine hesitancy and how to overcome it.** Iacobucci G (2021), BMJ vol 375, no 8316, 22 November 2021, n2862

News item discussing COVID-19 vaccine hesitancy among pregnant women in the United Kingdom. Highlights the impact of vaccine hesitancy on hospital admissions and the role of clinicians in emphasising the benefits of vaccination. (LDO)

Full URL: <https://doi.org/10.1136/bmj.n2862>

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#### 2021-12260

**Clinical briefing: Vaccinations for members [Reviewed April 2021].** Royal College of Midwives (2021), London: RCM April 2021. 8 pages

Briefing paper from the Royal College of Midwives (RCM) summarising current guidelines on coronavirus vaccination and outlining the RCM's advice to its members. (MB)

Full URL: <https://www.rcm.org.uk/media/5406/cb-vaccines-for-members.pdf>

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#### 2021-12247

**Examining the relationship between pregnant women more likely to be affected by severe COVID-19 and uptake of vaccination in pregnancy in the United Kingdom.** Allen A (2021), MIDIRS Midwifery Digest vol 31, no 4, December 2021, pp 443-453

This paper examines the relationship between pregnant women being more likely to be affected by severe COVID-19 and their attitude to, and uptake of, the COVID-19 vaccination in the United Kingdom (UK). (Author, edited)

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#### 2021-12188

**Pregnant women urged to get COVID-19 vaccine following new UK safety data.** Department of Health and Social Care (2021), London: DHSC 25 November 2021

Press release from the Department of Health and Social Care warning that catching COVID-19 carries far higher risk than having the vaccine, and raising concern that only 22% of women who gave birth in August had been vaccinated. (JSM)

Full URL: <https://www.gov.uk/government/news/pregnant-women-urged-to-get-covid-19-vaccine-following-new-uk-safety-data>

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#### 2021-12187

**Covid vaccines safe in pregnancy, data shows.** Mundasad S (2021), BBC News 25 November 2021

Reports that the UK's Health Security Agency has declared covid vaccines safe for use in pregnancy, following an analysis of English data. States that similar rates of stillbirth and preterm birth were recorded for vaccinated and unvaccinated mothers. Researchers are encouraging women to get vaccinated and they say they should feel confident of the protection the vaccines will give them. (JSM)

Full URL: [https://www.bbc.co.uk/news/health-59417509?at\\_medium=RSS&at\\_campaign=KARANGA](https://www.bbc.co.uk/news/health-59417509?at_medium=RSS&at_campaign=KARANGA)

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#### 2021-12147

**Covid-19 Vaccination during Pregnancy and First-Trimester Miscarriage.** Magnus MC, Gjessing HK, Eide HN, et al (2021), The New England Journal of Medicine vol 385, no 21, 18 November 2021, pp 2008-2010

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Correspondence piece using a case control study to examine first trimester miscarriage among those receiving the COVID-19 vaccine. Results indicate that there is no evidence of increased risk of early pregnancy loss after vaccination. (LDO)

Full URL: <https://doi.org/10.1056/NEJMc2114466>

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## 2021-11922

**Systematic review of the safety, immunogenicity, and effectiveness of COVID-19 vaccines in pregnant and lactating individuals and their infants.** Fu W, Sivajohan B, McClymont E, et al (2022), International Journal of Gynecology & Obstetrics vol 156, no 3, March 2022, pp 406-417

### Background

There is significant risk of complications and vulnerability to severe COVID-19 disease in pregnancy, yet hesitancy exists around COVID-19 vaccination during pregnancy and lactation.

### Objective

To summarize the safety, immunogenicity, and effectiveness of COVID-19 vaccines in pregnancy and lactation.

### Search strategy

A systematic search of MEDLINE, Embase, PubMed, medRxiv, and bioRxiv.

### Selection criteria

Identified original studies published on pregnant and/or lactating individuals who received one or more doses of a COVID-19 vaccine.

### Data collection and analysis

A descriptive summary organized by safety, immunogenicity, and effectiveness outcomes of COVID-19 vaccination in pregnancy and lactation.

### Main results

In total, 23 studies were identified. Humoral response and functional immunity were interrogated and found. Increasing placental transfer ratios in cord blood were associated with increasing time from the first vaccine dose to delivery. Safety data indicated that pregnant and lactating populations experienced vaccine-related reactions at similar rates to the general population. No increased risk of adverse obstetrical or neonatal outcomes were reported. One study demonstrated that pregnant individuals were less likely to experience COVID-19 when vaccinated.

### Conclusion

COVID-19 vaccination in pregnant and lactating individuals is immunogenic, does not cause significant vaccine-related adverse events or obstetrical and neonatal outcomes, and is effective in preventing COVID-19 disease.

### Synopsis

The present systematic review found that COVID-19 vaccines are safe, immunogenic, and effective during pregnancy and lactation. (Author)

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## 2021-11893

**Coronavirus: Vaccination in Pregnancy [written answer].** Scottish Parliament (2021), Official Report Written question S6W-04224, 8 November 2021

Humza Yousaf responds to a written question from Sandesh Gulhane to the Scottish Government, regarding what percentage of pregnant women have been fully vaccinated against COVID-19. (JSM)

Full URL: <https://archive2021.parliament.scot/parliamentarybusiness/28877.aspx?SearchType=Advance&ReferenceNumbers=S6W-04224>

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## 2021-11892

**Coronavirus: Vaccination in Pregnancy [written answer].** Scottish Parliament (2021), Official Report Written question S6W-04229

Humza Yousaf responds to a written question from Sandesh Gulhane to the Scottish Government, regarding what steps it will take to increase the uptake of the COVID-19 vaccination by pregnant women. (JSM)

**Full URL:** <https://archive2021.parliament.scot/parliamentarybusiness/28877.aspx?SearchType=Advance&ReferenceNumbers=S6W-04229>

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## 2021-11685

**Covid-19 treatments and vaccines must be evaluated in pregnancy.** Abbas-Hanif A, Modi N, Smith SK, et al (2021), BMJ vol 375, no 8313, 14 October 2021, n2377

Pregnant women should be included in drug and vaccine development from the outset. (Author)

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## 2021-11581

**Pregnant and breastfeeding women's attitudes and fears regarding the COVID-19 vaccination.** Schaal NK, Zöllkau J, Hepp P, et al (2022), Archives of Gynecology and Obstetrics vol 306, no 2, August 2022, pp 365-372

### Purpose

The COVID-19 vaccination is probably the most important source to fight the COVID-19 pandemic. However, recommendations and possibilities for vaccination for pregnant and breastfeeding women are inconsistent and dynamically changing.

### Methods

An anonymous, online, cross-sectional survey was conducted among pregnant and breastfeeding women in Germany between 30th March and 19th April 2021 addressing COVID-19 vaccination attitudes including the underlying reasons for their decision. Additionally, anxiety regarding a SARS-CoV-2 infection and a symptomatic course of the infection were evaluated.

### Results

In total, 2339 women (n = 1043 pregnant and n = 1296 breastfeeding) completed the survey. During pregnancy the majority (57.4%) are not in favour of receiving the vaccine, 28.8% are unsure and only 13.8% would get vaccinated at the time of the survey. In contrast, 47.2% would be in favour to receive the vaccine, if more scientific evidence on the safety of the vaccination during pregnancy would be available. Breastfeeding women show higher vaccination willingness (39.5% are in favour, 28.1% are unsure and 32.5% not in favour). The willingness to be vaccinated is significantly related to the women's anxiety levels of getting infected and to develop disease symptoms. Main reasons for vaccination hesitancy are the women's perception of limited vaccination-specific information, limited scientific evidence on vaccination safety and the fear to harm the fetus or infant.

### Conclusions

The results provide important implications for obstetrical care during the pandemic as well as for official recommendations and information strategies regarding the COVID-19 vaccination. (Author)

**Full URL:** <https://doi.org/10.1007/s00404-021-06297-z>

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## 2021-11527

**Coronavirus: Vaccination [written answer].** House of Lords (2021), Hansard Written question HL3504, 27 October 2021

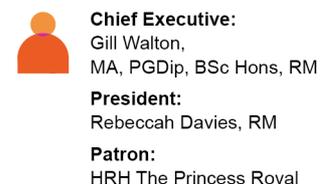
Lord Kamall responds to a written question asked by Lord Taylor of Warwick to Her Majesty's Government, regarding what steps they are taking to provide clearer messaging on the safety of COVID-19 vaccines for pregnant women.

(LDO)

**Full URL:** <https://questions-statements.parliament.uk/written-questions/detail/2021-10-27/hl3504>

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## 2021-11522

**Reversing Physician Hesitancy to Recommend COVID-19 Vaccination for Pregnant Patients.** Chervenak FA, McCullough LB, Grünebaum A (2022), American Journal of Obstetrics & Gynecology (AJOG) vol 226, no 6, June 2022, pp 805-812

Obstetricians and those in leadership positions must end physician hesitancy about COVID-19 vaccination of pregnant women by reversing three root causes of physician hesitancy. (Author)

**Full URL:** <https://doi.org/10.1016/j.ajog.2021.11.017>

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## 2021-11361

**Covid-19 vaccination during the third trimester of pregnancy: rate of vaccination and maternal and neonatal outcomes, a multicentre retrospective cohort study.** Rottenstreich M, Sela HY, Rotem R, et al (2022), BJOG: An International Journal of Obstetrics and Gynaecology vol 129, no 2, January 2022, pp 248-255

### Objective

To evaluate the impact of Covid-19 vaccination (Pfizer–BioNTech BNT162b2) during the third trimester of pregnancy on maternal and neonatal outcomes.

### Design

A multicentre, retrospective computerised database.

### Population

Women who gave birth at >24 weeks of gestation in Israel, between January and April 2021, with full records of Covid-19 disease and vaccination status.

### Methods

Women who received two doses of the vaccine were compared with unvaccinated women. Women who were recorded as having disease or a positive Covid-19 polymerase chain reaction (PCR) swab during pregnancy or delivery were excluded from both study groups. Univariate analysis was followed by multivariate logistic regression.

### Main outcome measures

Composite adverse maternal outcomes. Secondary outcomes were vaccination rate and composite adverse neonatal outcomes.

### Results

The overall uptake of one or both vaccines was 40.2%; 712 women who received two doses of the Covid-19 vaccine were compared with 1063 unvaccinated women. Maternal composite outcomes were comparable between the groups; however, women who received the vaccine had higher rates of elective caesarean deliveries (CDs) and lower rates of vacuum deliveries. An adjusted multivariable logistic regression analysis demonstrated that Covid-19 vaccination was not associated with maternal composite adverse outcome (aOR 0.8, 95% CI 0.61–1.03); a significant reduction in the risk for neonatal composite adverse outcomes was observed (aOR 0.5, 95% CI 0.36–0.74).

### Conclusions

In a motivated population covered by a National Health Insurance Plan, we found a 40.2% rate of vaccination for the Covid-19 vaccine during the third trimester of pregnancy, which was not associated with adverse maternal outcomes and, moreover, decreased the risk for neonatal adverse outcomes.

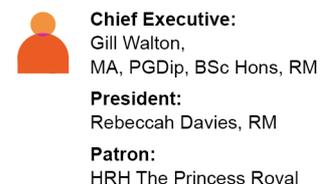
### Tweetable abstract

Covid-19 vaccine during pregnancy is safe for both mother and fetus. (Author)

**Full URL:** <https://doi.org/10.1111/1471-0528.16941>

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## 2021-11203

**Alignment of national COVID-19 vaccine recommendations for pregnant and lactating women.** Giles ML, Gunatilaka A, Palmer K, et al (2021), Bulletin of the World Health Organization vol 99, no 10, October 2021, pp 739-746

The rapid development and roll-out of coronavirus disease 2019 (COVID-19) vaccines is providing hope for a way to control the pandemic. As pregnant and lactating women are generally excluded from clinical trials, the vaccination programme was launched without adequate safety and efficacy data for pregnant women. Yet many professional organizations have recognized the need for administration of COVID-19 vaccines in pregnancy and have issued their own set of recommendations. The lack of evidence, however, has often led to confused messaging, inconsistent language and differing recommendations across organizations, potentially contributing to delay or refusal to accept vaccination by pregnant women. We summarize those differences and recommend that leaders collaborate at a country level to produce joint recommendations. We use the example of Australia, where two professional authorities along with the government and partners in New Zealand worked towards one message, consistent language and a unified recommendation. The aim was to help health professionals and women who are planning pregnancy or who are currently pregnant or breastfeeding to make an informed decision about COVID-19 vaccination. National advisory groups for immunization, professional obstetric organizations and government bodies should be encouraged to coordinate their statements on COVID-19 vaccination for pregnant and lactating women and to use similar language and phrasing for greater clarity. (Author)

**Full URL:** <https://dx.doi.org/10.2471%2FBLT.21.286644>

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## 2021-11117

**Fertility rates and birth outcomes after ChAdOx1 nCoV-19 (AZD1222) vaccination.** Hillson K, Clemens SC, Madhi SA, et al (2021), The Lancet vol 398, no 10312, 6 November 2021, pp 1683-1684

Correspondence piece discussing fertility rates and birth outcomes after ChAdOx1 nCoV-19 vaccination. The authors find no evidence between vaccination and reduced fertility or increased risk of miscarriage or stillbirth. (LDO)

**Full URL:** [https://doi.org/10.1016/S0140-6736\(21\)02282-0](https://doi.org/10.1016/S0140-6736(21)02282-0)

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## 2021-11050

**Breastfeeding Mother and Child Clinical Outcomes After COVID-19 Vaccination.** Low JM, Lee LY, Ng YPM, et al (2022), Journal of Human Lactation vol 38, no 1, February 2022, pp 37-42

**Background:**

Pre-approval clinical trials of the Pfizer/BioNTech messenger RNA COVID-19 vaccine, BNT162b2 did not include participants who were breastfeeding. Therefore, there is limited evidence about outcomes of breastfeeding mother–child dyads and effects on breastfeeding after vaccination.

**Research Aims:**

To determine: (1) solicited adverse effects (e.g., axillary lymphadenopathy, mastitis, and breast engorgement), which are unique to lactating individuals; and (2) systemic and local adverse effects of COVID-19 mRNA vaccine on mothers and potential effects on their breastfed infants.

**Method:**

This was a prospective cohort study of lactating healthcare workers (N = 88) in Singapore who received two doses of BNT162b2 vaccination (Pfizer/BioNTech). The outcomes of mother–child dyads within 28 days after the second vaccine dose were determined through a participant-completed questionnaire.

**Results:**

Minimal effects related to breastfeeding were reported by this cohort; three of 88 (3.4%) participants had mastitis, one (1.1%) participant experienced breast engorgement, five of 88 (5.7%) participants reported cervical or axillary lymphadenopathy. There was no change in human milk supply after vaccination. The most common side effect was pain/redness/swelling at the injection site, which was experienced by 57 (64.8%) participants. There were no serious

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adverse events of anaphylaxis or hospital admissions. There were no short-term adverse effects reported in the infants of 67 lactating participants who breastfed within 72 hr after BNT162b2 vaccination.

**Conclusions:**

BNT162b2 vaccination was well tolerated in lactating participants and was not associated with short-term adverse effects in their breastfed infants.

**Study Protocol Registration:**

The study protocol was registered at [clinicaltrials.gov](https://clinicaltrials.gov) (NCT04802278). (Author)

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**2021-10850**

**Pregnancy: Coronavirus [written answer].** House of Commons (2021), Hansard Written question 60412, 21 October 2021

Maggie Throup responds to a written question from Jim Shannon to the Secretary of State for Health and Social Care, regarding whether he has made a recent assessment of the impact of covid-19 on pregnant women; and if he will make a statement on pregnancy and the covid-19 vaccine. (JSM)

**Full URL:** <https://questions-statements.parliament.uk/written-questions/detail/2021-10-21/60412>

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**2021-10840**

**The historical aspects of vaccination in pregnancy.** Mackin DW, Walker SP (2021), Best Practice & Research: Clinical Obstetrics and Gynaecology vol 76, October 2021, pp 13-22

As we live through the history-making pandemic of coronavirus disease 2019 (COVID-19), it is timely to consider the lessons that history has taught us about vaccine-preventable disease in pregnancy. Vaccinations have earned an established place in pregnancy care to prevent communicable disease in the mother, fetus and newborn. The improvements in maternal and perinatal outcome have been achieved through the evolution and application of new knowledge in many areas. These include recognition of the unique pathogenic consequences of diseases in pregnancy; improved understanding of the maternal immune system and its interplay with the fetus; optimizing safe vaccine development; ensuring pregnant women are included in appropriately designed trials of efficacy, and public health engagement to optimize uptake. As the world eagerly awaits an effective vaccine for COVID 19, these lessons of history help signpost the way, to ensure the potential of vaccinations to reduce morbidity for pregnant women and their newborns is fully realized. (Author)

**Full URL:** <https://doi.org/10.1016/j.bpobgyn.2020.09.005>

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**2021-10627**

**Maternity Colleges urge pregnant women to have flu vaccine and COVID-19 vaccine this winter.** Royal College of Obstetricians and Gynaecologists (2021), London: RCOG 22 October 2021

The Royal College of Obstetricians and Gynaecologists (RCOG) and the Royal College of Midwives (RCM) are urging pregnant women to have the flu vaccine alongside the COVID-19 vaccine this winter to protect themselves and their babies from complications caused by the viruses. (Author)

**Full URL:** <https://www.rcog.org.uk/en/news/maternity-colleges-urge-pregnant-women-to-have-flu-vaccine-and-covid-19-vaccine-this-winter/>

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**2021-10586**

**Newborns' passive humoral SARS-CoV-2 immunity following heterologous vaccination of the mother during pregnancy.** Gloeckner S, Hornung F, Heimann Y, et al (2022), American Journal of Obstetrics & Gynecology (AJOG) vol 226, no 2, February 2022, pp 261-262

Research letter aiming to evaluate cord blood and antibody kinetics following a heterologous vaccination regimen in pregnant women. Results show vaccine-induced SARS-CoV-2 Spike Immunoglobulin (IgG) antibodies in all participants. (LDO)

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#### 2021-10517

**COVID-19 Vaccination Patterns and Attitudes Among American Pregnant Individuals.** Huddleston HG, Jaswa EG, Lindquist KJ, et al (2022), American Journal of Obstetrics & Gynecology MFM vol 4, no 1, January 2022, 100507

Research letter utilising a nationwide prospective study of pregnant persons to examine vaccination rates and acceptance during the first six months of COVID-19 vaccine rollout. Results show vaccine hesitancy among respondents, with race, education, and living in a metropolitan area being strong predictors of vaccination status. (LDO)

Full URL: <https://doi.org/10.1016/j.ajogmf.2021.100507>

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#### 2021-09953

**Key information on COVID-19 in pregnancy.** National Perinatal Epidemiology Unit (2021), Oxford: NPEU 11 October 2021

The latest information from the UKOSS study of COVID-19 in pregnancy, released as part of an infographic summary, shows clear evidence of the real world effectiveness of vaccination against covid in pregnancy. More than 98% of women admitted with symptomatic covid-19 in pregnancy were unvaccinated. Of 235 women admitted to intensive care, only 3 had received a single dose of vaccine, and none had received both doses. Data from MBRRACE-UK also shows that maternal deaths from COVID-19 continue to occur, with more deaths in the third (Delta) wave of infection than either of the two previous waves, again with most women unvaccinated. All pregnant women are recommended to have a covid vaccine by the Royal College of Midwives and the Royal College of Obstetricians and Gynaecologists.

(Author)

Full URL: <https://www.npeu.ox.ac.uk/news/2171-covid-19-in-pregnancy-2>

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#### 2021-09952

**NHS encourages pregnant women to get COVID-19 vaccine.** NHS England London: NHS England 11 October 2021, online

The NHS is encouraging pregnant women to get the COVID-19 vaccine as new data shows that nearly 20 per cent of the most critically ill COVID patients are pregnant women who have not been vaccinated. (Author)

Full URL: <https://www.england.nhs.uk/2021/10/nhs-encourages-pregnant-women-to-get-covid-19-vaccine/>

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#### 2021-09951

**RCOG supports calls from NHS to pregnant women to get vaccinated against COVID-19.** Royal College of Obstetricians and Gynaecologists London: RCOG 11 October 2021, online

The Royal College of Obstetricians and Gynaecologists (RCOG) supports calls from the NHS, encouraging pregnant women to get the COVID-19 vaccine as new data shows that nearly 20% of the most critically ill COVID-19 patients are pregnant women who have not been vaccinated. (Author)

Full URL: <https://www.rcog.org.uk/en/news/rcog-supports-calls-from-nhs-to-pregnant-women-to-get-vaccinated-against-covid-19/>

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#### 2021-09950

**Pregnant women urged to get Covid vaccine by NHS England.** Anon BBC News 11 October 2021, online

Pregnant women are being urged to get the Covid vaccine, following concerns about the growing number with the virus needing the most serious treatment in critical care.

The call has come from NHS England and the Royal College of Obstetricians and Gynaecologists.

Sultana Ashiq caught Covid-19 when she was nearly 31 weeks pregnant and was in intensive care for 46 days battling the disease. Sultana was treated at the Royal Papworth Hospital in Cambridge and Luton and Dunstable University Hospital. Her twins were born by Caesarean section while she was in a coma.

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She was ineligible for the vaccine at the time, but is calling on expectant mothers to get vaccinated against coronavirus. (Author)

Full URL: <https://www.bbc.co.uk/news/av/health-58834524>

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#### 2021-09916

##### **Vaccination of pregnant women against COVID-19 in India and Indonesia: Moving beyond the opt-in to the opt-out**

**option.** Sarwal Y, Sarwal T, Sarwal R (2021), International Journal of Gynecology & Obstetrics vol 155, no 3, December 2021, pp 549-550

In view of the continued threat of COVID-19, and to synergize with routine antenatal care, COVID-19 vaccination should become a default part of routine antenatal care with an opt-out option. (Author)

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#### 2021-09872

##### **Attitudes Toward COVID-19 Illness and COVID-19 Vaccination among Pregnant Women: A Cross-Sectional Multicenter**

**Study during August–December 2020.** Battarbee AN, Stockwell MS, Varner M, et al (2022), American Journal of Perinatology vol 39, no 1, January 2022, pp 75-83

**Objective** The aim of the study was to evaluate pregnant women's attitudes toward COVID-19 illness and vaccination and identify factors associated with vaccine acceptability.

**Study Design** This was a cross-sectional survey among pregnant women enrolled in a prospective COVID-19 cohort study in Salt Lake City, UT, Birmingham, AL, and New York, NY, from August 9 to December 10, 2020. Women were eligible if they were 18 to 50 years old and <28 weeks of gestation. Upon enrollment, women completed surveys regarding concerns about COVID-19 illness and likelihood of getting COVID-19 vaccine if one were available during pregnancy. Vaccine acceptability was defined as a response of “very likely” or “somewhat likely” on a 4-point Likert scale. Factors associated with vaccine acceptability were assessed with multivariable logistic regression.

**Results** Of 939 pregnant women eligible for the main cohort study, 915 (97%) consented to participate. Among these 915 women, 39% self-identified as White, 23% Black, 33% Hispanic, and 4% Other. Sixty-two percent received an influenza vaccine last season. Seventy-two percent worried about getting sick with COVID-19. If they were to get sick, 92% worried about harm to their pregnancy and 80% about harm to themselves. Only 41% reported they would get a vaccine. Of women who were unlikely to get vaccinated, the most frequently cited concern was vaccine safety for their pregnancy (82%). Non-Hispanic Black and Hispanic women had lower odds of accepting a vaccine compared with non-Hispanic White women (adjusted odds ratios [aOR] 0.4, 95% CI 0.2–0.6 for both). Receipt of influenza vaccine during the previous season was associated with higher odds of vaccine acceptability (aOR 2.1, 95% CI 1.5–3.0).

**Conclusion** Although most pregnant women worried about COVID-19 illness, <50% were willing to get vaccinated during pregnancy. Racial and ethnic disparities in plans to accept COVID-19 vaccine highlight the need to prioritize strategies to address perceived barriers among groups at high risk for COVID-19. (Author)

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#### 2021-09584

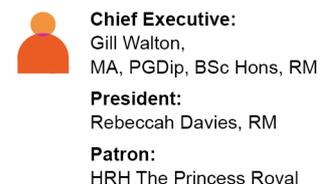
##### **Maternal and Child Outcomes Reported by Breastfeeding Women Following Messenger RNA COVID-19 Vaccination.**

Bertrand K, Honerkamp-Smith G, Chambers CD (2021), Breastfeeding Medicine vol 16, no 9, September 2021, pp 697-701

**Background:** In December 2020, two novel messenger RNA (mRNA) vaccines for severe acute respiratory syndrome coronavirus-2 received emergency use authorization from the U.S. Food and Drug Administration; however, the early trials excluded lactating women.

**Methods:** Breastfeeding women residing in the United States who received either of the two mRNA vaccines were enrolled into the Mommy's Milk Human Milk Research Biorepository at the University of California, San Diego. From December 14, 2020 to February 1, 2021, 180 women who received two doses of either mRNA vaccine were recruited

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into the study.

**Results:** Similar proportions of women reported any one or more symptoms following vaccination with either mRNA vaccine. In addition, the frequency by specific type of symptom did not differ by brand. However, following the second dose of vaccine, women who received the Moderna brand were significantly more likely to report symptoms. A small proportion of women following the first dose of either vaccine brand reported a reduction in milk supply, and significantly, more women reported a reduction in milk supply following the second dose of Moderna. Few infant events were reported for either vaccine brand following either dose, and no serious adverse events were reported.

**Conclusions:** These data are reassuring regarding the safety of vaccination in breastfeeding women and their breastfed children with either of the mRNA COVID-19 vaccines. (Author)

**Full URL:** <https://doi.org/10.1089/bfm.2021.0169>

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## 2021-09570

**Maternal-neonatal transfer of SARS-CoV-2 immunoglobulin G antibodies among parturient women treated with BNT162b2 messenger RNA vaccine during pregnancy.** Nir O, Schwartz A, Toussia-Cohen S, et al (2022), American Journal of Obstetrics & Gynecology MFM vol 4, no 1, January 2022, 100492

### Background

The exclusion of pregnant women from COVID-19 mRNA vaccine trials raised hesitancy regarding the benefit of vaccination of pregnant women, hence little is known about the vaccine's efficacy in this population.

### Objective

To determine the maternal-neonatal transplacental transfer of SARS CoV-2 antibodies among vaccinated parturient women. A control group of COVID 19 recovered patients was included in order to compare IgG levels between vaccinated and recovered patients.

### Study Design

A prospective cohort study in a single tertiary medical center in Israel between February and March 2021; parturient women who had been vaccinated with BNT162B2 mRNA vaccine during pregnancy were included and compared to COVID-19 recovered parturient women. SARS CoV-2 IgG antibodies were measured in maternal and cord sera, dried blood spot samples taken from newborns, and breast-milk samples. The primary outcome was to determine whether neonatal cord and dried blood spot samples were positive for SARS CoV-2 antibodies and to evaluate transfer ratio defined as cord blood IgG divided by maternal IgG levels.

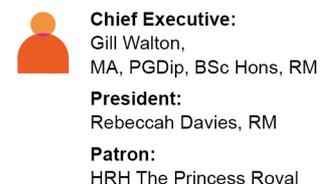
### Results

The study included 64 vaccinated parturient women and 11 parturient women who had COVID-19 disease during pregnancy. All maternal blood sera samples and 98.3% of cord blood sera samples were positive for SARS Cov-2 IgG with median concentrations of 26.1 (IQR 22.0;39.7) and 20.2 (IQR 12.7;29.0) respectively. Similarly, 96.4% of neonatal blood spot samples and all breast milk samples were positive for SARS CoV-2 IgG with median concentrations of 11.0 (IQR 7.2;12.8) and 4.9 (IQR 3.8;6.0), respectively. There was a significant positive correlation between maternal serum levels of SARS Cov-2 IgG and cord blood ( $R=0.483$ ,  $p=0.0001$ ), neonatal blood spot ( $R=0.515$ ,  $p=0.004$ ), and breast milk levels ( $R=0.396$ ,  $p=0.005$ ) of SARS CoV-2 IgG. The median placental transfer ratio of SARS-COV-2 IgG was 0.77. Comparison of vaccinated with recovered COVID-19 patients revealed significantly higher SARS CoV-2 IgG levels in maternal serum and cord blood among vaccinated women ( $p<0.0001$ ).

### Conclusion(s)

Our study demonstrated efficient transfer of SARS CoV-2 IgG across the placenta from women vaccinated with BNT162b2 mRNA vaccine during pregnancy to their neonates with positive correlation between maternal serum and cord blood antibody concentrations. In addition to maternal protection against COVID-19, the vaccine may also provide neonatal humoral immunity. (Author)

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**2021-09569**

**High antibody levels in cord blood from pregnant women vaccinated against COVID-19.** Trostle ME, Aguero-Rosenfeld ME, Roman AS (2021), American Journal of Obstetrics & Gynecology MFM vol 3, no 6, November 2021, 100481

This study aimed to determine the presence of transplacental antibody transmission and the levels of detectable antibodies in cord blood in women vaccinated against COVID-19 during pregnancy. (Author, edited)

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**2021-09407**

**COVID-19 mRNA vaccine and antibody response in lactating women: a prospective cohort study.** Charepe N, Gonçalves JL, Juliano AM, et al (2021), BMC Pregnancy and Childbirth vol 21, no 632, 17 September 2021

**Background**

Immunological protection via breastfeeding is well known. The immunological profile of human milk changes during lactation. No clinical trials have been conducted in lactating women with the newest mRNA vaccines against SARS-CoV-2. A Few studies have shown the presence of antibodies in breastmilk after vaccination. The aim of this work is to study possible antibodies transfer via breastmilk and also the immunological characteristics of lactating women compared to non-lactating women, after using the BNT162b2 Pfizer vaccine.

**Methods**

This is a prospective cohort study with a convenience homogenous sample of 24 healthcare workers (14 lactating and 10 non-lactating women) enrolled at the time of COVID-19 vaccination. Clinical data was registered in a questionnaire. Titers of SARS-CoV-2 spike IgG, IgA and IgM were quantified in post vaccination blood and human milk. Antibody quantification was performed by an in-house ELISA to SARS-CoV-2 trimeric spike protein.

**Results**

All women showed immunity after vaccination with positive antibodies for IgM, IgA and IgG antibodies. The dominant serum antibody response was IgG. Modest levels of antibodies in breastmilk of lactating mothers were observed in this study, especially IgG in 42.9%. There was a moderate association between higher titers of IgG and a longer duration of breastfeeding ( $R= 0.55, p=0.041$ ).

**Conclusions**

Evidence of antibody transfer in human milk after COVID-19 vaccination is scarce. The presence of antibodies in human milk is reported, but immunization through breastfeeding is still to be established. (Author)

**Full URL:** <https://doi.org/10.1186/s12884-021-04051-6>

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**2021-09398**

**Increasing severity of COVID-19 in pregnancy with Delta (B.1.617.2) variant surge.** Adhikari EH, SoRelle JA, McIntire DD, et al (2022), American Journal of Obstetrics & Gynecology (AJOG) vol 226, no 1, January 2022, pp 149-151

Research letter reporting trends in illness severity among obstetric patients with COVID-19 in the context of the Delta variant. Results indicate increasing rates of hospitalisation and morbidity and highlight the need for prevention measures such as vaccination. (LDO)

**Full URL:** <https://doi.org/10.1016/j.ajog.2021.09.008>

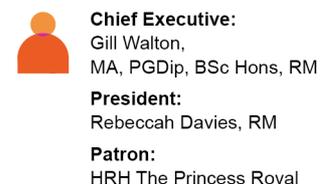
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**2021-09379**

**Offering onsite COVID-19 vaccination to high-risk obstetrical patients: initial findings.** Hirshberg JS, Huysman BC, Oakes MC, et al (2021), American Journal of Obstetrics & Gynecology MFM vol 3, no 6, November 2021, 100478

Research report detailing a quality improvement project to offer onsite COVID-19 vaccination to high-risk obstetric patients. Results show that 3% of eligible women who had been seen and counselled prior to vaccine availability proceeded with offsite vaccination. Among those who had been seen and counselled after onsite vaccine availability,

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a further 3% proceeded with onsite vaccination and 7% proceeded with offsite vaccination. Research suggests that vaccine hesitancy, rather than availability, is the main driver of low uptake. (LDO)

Full URL: <https://doi.org/10.1016/j.ajogmf.2021.100478>

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#### 2021-09375

**Perspectives on administration of COVID-19 vaccine to pregnant and lactating women: a challenge for low- and middle-income countries.** Duarte G, Coutinho CM, Rolnik DL, et al (2021), AJOG Global Reports vol 1, no 4, November 2021, 100020

Women in the pregnancy-puerperal cycle or those who are lactating have been deliberately excluded from participating in COVID-19 vaccine clinical trials that aimed to evaluate either the efficacy in inducing the formation of neutralizing antibodies or the investigational products' safety profile. Exclusion of pregnant and lactating women from such studies still certainly inequitably deny these women access to COVID-19 vaccines since these products' availability became increasingly available to non-pregnant people and even during pregnancy in high-income settings. In this clinical opinion article, we discuss aspects of the prolonged pandemic, the emergence of viral variants, the risks of severe complications of COVID-19 in pregnant women, and the disproportionate impact on low- and middle-income countries. We argue that the decision to receive the COVID-19 vaccine should be a joint decision between the pregnant or lactating women and the healthcare providers while considering the available data on vaccine efficacy, safety, the risks of SARS-CoV-2 infection in pregnant women, and the woman's individual risk for infection and serious illness. The various types of vaccines already in use and their safety and effectiveness, and the potential risks and benefits of their administration to pregnant or lactating women are reviewed. (Author)

Full URL: <https://doi.org/10.1016/j.xagr.2021.100020>

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#### 2021-09225

**Administration of the Coronavirus Disease 2019 (COVID-19) Vaccine to Hospitalized Postpartum Patients.** Perez MJ, Paul R, Hirshberg JS, et al (2021), Obstetrics & Gynecology vol 138, no 6, December 2021, pp 885-887

Inpatient administration of coronavirus disease 2019 (COVID-19) vaccines during obstetric hospitalization is feasible and an opportunity to increase health equity. (Author)

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#### 2021-09210

**Pregnancy: Coronavirus [written answer].** House of Commons (2021), Hansard Written question 44412, on 7 September 2021  
Nadhim Zahawi responds to a written question from Helen Hayes to the Secretary of State for Health and Social Care, regarding what assessment his Department has made of the potential merits of bringing forward pregnant women's second doses of the covid-19 vaccine before their third trimester. (MB)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2021-09-07/44412>

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#### 2021-09033

**Pregnant women eligible for the COVID-19 booster vaccine urged to take up offer.** Royal College of Obstetricians and Gynaecologists (2021), London: RCOG 16 September 2021

The Royal College of Obstetricians and Gynaecologists (RCOG) is urging all pregnant women eligible for the COVID-19 booster vaccine to take up the offer. It comes as Public Health England announce a further 20,000 pregnant women have been vaccinated against COVID-19. (Author)

Full URL: <https://www.rcog.org.uk/en/news/pregnant-women-eligible-for-the-covid-19-booster-vaccine-urged-to-take-up-offer/>

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#### 2021-08970

**Short-term Reactions Among Pregnant and Lactating Individuals in the First Wave of the COVID-19 Vaccine Rollout.**

Kachikis A, Englund JA, Singleton M, et al (2021), JAMA Network Open vol 4, no 8, August 2021, e2121310

This cohort study investigates short-term reactions associated with COVID-19 vaccines among pregnant and lactating individuals vs individuals neither pregnant nor lactating but planning pregnancy. (Author)

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## 2021-08969

**Quantification of Specific Antibodies Against SARS-CoV-2 in Breast Milk of Lactating Women Vaccinated With an mRNA Vaccine.** Esteve-Palau E, Gonzalez-Cuevas A, Guerrero ME, et al (2021), JAMA Network Open vol 4, no 8, August 2021, e2120575

This cohort study assesses the concentration of SARS-CoV-2 antibodies in the breast milk of women who received vaccines for COVID-19 and their correlation with serum antibody levels. (Author) (Author)

Full URL: <https://doi.org/10.1001/jamanetworkopen.2021.20575>

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## 2021-08876

**Ethnic differences in SARS-CoV-2 vaccine hesitancy in United Kingdom healthcare workers.** Woolf K, McManus IC, Martin CA, et al (2021), The Lancet Regional Health - Europe 19 July 2021, online

### Background

In most countries, healthcare workers (HCWs) represent a priority group for vaccination against severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) due to their elevated risk of COVID-19 and potential contribution to nosocomial SARS-CoV-2 transmission. Concerns have been raised that HCWs from ethnic minority groups are more likely to be vaccine hesitant (defined by the World Health Organisation as refusing or delaying a vaccination) than those of White ethnicity, but there are limited data on SARS-CoV-2 vaccine hesitancy and its predictors in UK HCWs.

### Methods

Nationwide prospective cohort study and qualitative study in a multi-ethnic cohort of clinical and non-clinical UK HCWs. We analysed ethnic differences in SARS-CoV-2 vaccine hesitancy adjusting for demographics, vaccine trust, and perceived risk of COVID-19. We explored reasons for hesitancy in qualitative data using a framework analysis.

### Findings

11,584 HCWs were included in the cohort analysis. 23% (2704) reported vaccine hesitancy. Compared to White British HCWs (21.3% hesitant), HCWs from Black Caribbean (54.2%), Mixed White and Black Caribbean (38.1%), Black African (34.4%), Chinese (33.1%), Pakistani (30.4%), and White Other (28.7%) ethnic groups were significantly more likely to be hesitant. In adjusted analysis, Black Caribbean (aOR 3.37, 95% CI 2.11 - 5.37), Black African (aOR 2.05, 95% CI 1.49 - 2.82), White Other ethnic groups (aOR 1.48, 95% CI 1.19 - 1.84) were significantly more likely to be hesitant. Other independent predictors of hesitancy were younger age, female sex, higher score on a COVID-19 conspiracy beliefs scale, lower trust in employer, lack of influenza vaccine uptake in the previous season, previous COVID-19, and pregnancy. Qualitative data from 99 participants identified the following contributors to hesitancy: lack of trust in government and employers, safety concerns due to the speed of vaccine development, lack of ethnic diversity in vaccine studies, and confusing and conflicting information. Participants felt uptake in ethnic minority communities might be improved through inclusive communication, involving HCWs in the vaccine rollout, and promoting vaccination through trusted networks.

### Interpretation

Despite increased risk of COVID-19, HCWs from some ethnic minority groups are more likely to be vaccine hesitant than their White British colleagues. Strategies to build trust and dispel myths surrounding the COVID-19 vaccine in these communities are urgently required. Emphasis should be placed on the safety and benefit of SARS-CoV-2 vaccination in pregnancy and in those with previous COVID-19. Public health communications should be inclusive, non-stigmatising and utilise trusted networks.

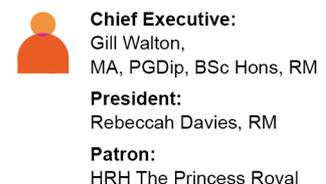
### Funding

UKRI-MRC and NIHR. (Author)

Full URL: <https://www.sciencedirect.com/science/article/pii/S2666776221001575>

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## 2021-08788

**Spontaneous Abortion Following COVID-19 Vaccination During Pregnancy.** Kharbanda EO, Haapala J, DeSilva M, et al (2021), JAMA (Journal of the American Medical Association) vol 326, no 16, 26 October 2021, pp 1629-1631

This study presents findings from case-control surveillance of COVID-19 vaccination during pregnancy and spontaneous abortion. (Author) [Erratum: JAMA, vol 326, no 13, 5 October 2021, p 1331.

<https://doi.org/10.1001/jama.2021.16235>

Full URL: <https://doi.org/10.1001/jama.2021.15494>

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## 2021-08787

**Association Between BNT162b2 Vaccination and Incidence of SARS-CoV-2 Infection in Pregnant Women.** Goldshtein I, Nevo D, Steinberg DM, et al (2021), JAMA (Journal of the American Medical Association) vol 326, no 8, 24 August 2021, pp 728-735

Importance: Data on BNT162b2 messenger RNA (mRNA) vaccine (Pfizer-BioNTech) effectiveness and safety in pregnancy are currently lacking because pregnant women were excluded from the phase 3 trial.

Objective: To assess the association between receipt of BNT162b2 mRNA vaccine and risk of SARS-CoV-2 infection among pregnant women.

Design, Setting, and Participants: This was a retrospective cohort study within the pregnancy registry of a large state-mandated health care organization in Israel. Pregnant women vaccinated with a first dose from December 19, 2020, through February 28, 2021, were 1:1 matched to unvaccinated women by age, gestational age, residential area, population subgroup, parity, and influenza immunization status. Follow-up ended on April 11, 2021.

Exposures: Exposure was defined by receipt of the BNT162b2 mRNA vaccine. To maintain comparability, nonexposed women who were subsequently vaccinated were censored 10 days after their exposure, along with their matched pair.

Main Outcomes and Measures: The primary outcome was polymerase chain reaction–validated SARS-CoV-2 infection at 28 days or more after the first vaccine dose.

Results: The cohort included 7530 vaccinated and 7530 matched unvaccinated women, 46% and 33% in the second and third trimester, respectively, with a mean age of 31.1 years (SD, 4.9 years). The median follow-up for the primary outcome was 37 days (interquartile range, 21-54 days; range, 0-70). There were 118 SARS-CoV-2 infections in the vaccinated group and 202 in the unvaccinated group. Among infected women, 88 of 105 (83.8%) were symptomatic in the vaccinated group vs 149 of 179 (83.2%) in the unvaccinated group ( $P \geq .99$ ). During 28 to 70 days of follow-up, there were 10 infections in the vaccinated group and 46 in the unvaccinated group. The hazards of infection were 0.33% vs 1.64% in the vaccinated and unvaccinated groups, respectively, representing an absolute difference of 1.31% (95% CI, 0.89%-1.74%), with an adjusted hazard ratio of 0.22 (95% CI, 0.11-0.43). Vaccine-related adverse events were reported by 68 patients; none was severe. The most commonly reported symptoms were headache ( $n = 10$ , 0.1%), general weakness ( $n = 8$ , 0.1%), nonspecified pain ( $n = 6$ , <0.1%), and stomachache ( $n = 5$ , <0.1%).

Conclusions and Relevance: In this retrospective cohort study of pregnant women, BNT162b2 mRNA vaccination compared with no vaccination was associated with a significantly lower risk of SARS-CoV-2 infection. Interpretation of study findings is limited by the observational design. (Author)

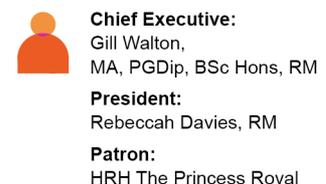
Full URL: <https://doi.org/10.1001/jama.2021.11035>

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## 2021-08777

**Pregnancy: Coronavirus [written answer].** House of Commons (2021), Hansard Written question 44411, on 7 September 2021  
Nadhim Zahawi responds to a written question from Helen Hayes to the Secretary of State for Health and Social Care,

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regarding what assessment he has made of the risk covid-19 poses to unvaccinated pregnant women; and what steps he is taking to ensure pregnant women receive both doses of the vaccine before their third trimester. (JSM)

**Full URL:** <https://questions-statements.parliament.uk/written-questions/detail/2021-09-07/44411>

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#### 2021-08701

##### **Presence of SARS-CoV-2 antibodies in lactating women and their infants following BNT162b2 messenger RNA vaccine.**

Schwartz A, Nir O, Toussia-Cohen S, et al (2021), American Journal of Obstetrics & Gynecology (AJOG) vol 225, no 5, November 2021, pp 577-579

Research letter aiming to assess whether SARS-CoV-2 immunoglobulins can be detected in breast milk samples of lactating women and in the serum and oral mucosal secretions of breastfed infants following maternal vaccination.

Results show that SARS-CoV-2 immunoglobulins were found in breast milk samples, and antibodies were found in the oral mucosa in 60% of the infant samples, but were not found in their circulation. (LDO)

**Full URL:** <https://doi.org/10.1016/j.ajog.2021.07.016>

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#### 2021-08686

**COVID-19 Vaccine Hesitancy: A Midwifery Survey Into Attitudes Towards the COVID-19 Vaccine.** Odejinmi F, Mallick R, Neophytou C, et al (2021), BMC Public Health 3 September 2021, online

Background: Ethnic minority populations have been disproportionately affected by the COVID-19 pandemic. Emerging evidence suggests a lower uptake of the vaccine in ethnic minority populations, particularly Black females of reproductive age. Midwives are the principal healthcare professionals responsible for counselling the pregnant population on decisions relating to vaccine uptake. The aim of this study was to explore midwifery uptake of and attitudes towards the COVID-19 vaccine in two ethnically diverse areas.

Methods: A 45-point questionnaire was circulated over a six-week period to midwives employed in two teaching hospitals in England; London (Barts Health NHS Trust) and Sussex (Brighton and Sussex University Hospitals NHS Trust (BSUH)). A total of 278 out of 868 midwives responded. Results were analysed to determine vaccine uptake as well as factors influencing vaccine hesitancy and decision-making between the two trusts and ethnic groups. Thematic analysis was also undertaken.

Results: Midwives of black ethnicity were over 4-times less likely to have received a COVID-19 vaccine compared to white ethnicity midwives (52% vs 85%, OR=0.22, p<0.001). Overall, there were no significant differences between trusts in receipt of the COVID-19 vaccine (p=0.13). Midwives at Barts Health were significantly more likely to have tested positive for COVID-19 compared to midwives at BSUH (OR=2.47, p=0.01). There was no statistical difference between ethnicities in testing positive for COVID-19 (p=0.86). Midwives at Barts Health had a higher occurrence of concerns relating to the vaccine being developed too fast (OR=2.06, p=0.01), allowing the government to track individuals (OR=9.13, p=0.001), interfering with fertility (OR=2.02, p=0.03), or transmitting the virus (OR=7.22, p=0.006), compared to BSUH. Black midwives had a higher occurrence of all concerns examined compared to white midwives; the most pronounced difference was in concerns relating to the long-term effects of the vaccine (adjusted OR=4.97, p<0.001), concerns relating to the speed in which the vaccine was developed (adjusted OR=5.59, p<0.001) and concerns regarding the vaccine containing meat products (adjusted OR=6.31, p<0.001).

Conclusion: This study highlights the significantly higher level of vaccine hesitancy amongst black ethnicity midwives and offer insights into midwives' views and concerns to facilitate future targeted public health interventions for the COVID-19 pandemic. (Author)

**Full URL:** <https://www.researchsquare.com/article/rs-646142/v1>

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#### 2021-08374

**Pregnancy and birth outcomes after SARS-CoV-2 vaccination in pregnancy.** Theiler RN, Wick M, Mehta R, et al (2021), American Journal of Obstetrics & Gynecology MFM vol 3, no 6, November 2021, 100467

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## Background

: SARS-CoV-2 infection during pregnancy is associated with significant maternal morbidity and increased rates of preterm birth. For this reason, COVID-19 vaccine administration in pregnancy has been endorsed by multiple professional societies including ACOG and SMFM despite exclusion of pregnant women from initial clinical trials of vaccine safety and efficacy. However, to date little data exists regarding outcomes after COVID-19 vaccination of pregnant patients.

## Study Design

: A comprehensive vaccine registry was combined with a delivery database for an integrated healthcare system to create a delivery cohort including vaccinated patients. Maternal sociodemographic data were examined to identify factors associated with COVID-19 vaccination. Pregnancy and birth outcomes were analyzed, including a composite measure of maternal and neonatal pregnancy complications, the Adverse Outcome Index.

## Results

: Of 2002 patients in the delivery cohort, 140 (7.0%) received a COVID-19 vaccination during pregnancy and 212 (10.6%) experienced a COVID-19 infection during pregnancy. The median gestational age at first vaccination was 32 weeks (range 13 6/7-40 4/7), and patients vaccinated during pregnancy were less likely than unvaccinated patients to experience COVID-19 infection prior to delivery (1.4% (2/140) vs. 11.3% (210/1862),  $P < 0.001$ ). No maternal COVID-19 infections occurred after vaccination during pregnancy. Factors significantly associated with increased likelihood of vaccination in a multivariable logistic regression model included older age, higher level of maternal education, being a non-smoker, use of infertility treatment for the current pregnancy, and lower gravidity. No significant difference in the composite adverse outcome (5.0% (7/140) vs. 4.9% (91/1862),  $P = 0.95$ ) or other maternal or neonatal complications, including thromboembolic events and preterm birth, was observed in vaccinated compared to unvaccinated patients.

## Conclusions

: Vaccinated pregnant women in this birth cohort were less likely to experience COVID-19 infection compared to unvaccinated pregnant patients, and COVID-19 vaccination during pregnancy was not associated with increased pregnancy or delivery complications. The cohort was skewed toward late pregnancy vaccination, and thus findings may not be generalizable to vaccination during early pregnancy. (Author)

**Full URL:** <https://doi.org/10.1016/j.ajogmf.2021.100467>

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## 2021-08265

### Impact of SARS-CoV-2 variant on the severity of maternal infection and perinatal outcomes: Data from the UK

**Obstetric Surveillance System national cohort.** Vousden N, Ramakrishnan R, Bunch K, et al (2021), MedRxiv 25 July 2021, online

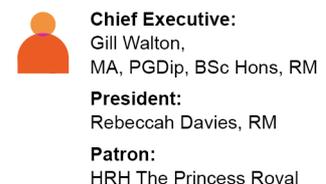
[This article is a preprint and has not been peer-reviewed. It reports new medical research that has yet to be evaluated and so should not be used to guide clinical practice]

**Background** In the UK, the Alpha variant of SARS-CoV-2 became dominant in late 2020, rapidly succeeded by the Delta variant in May 2021. The aim of this study was to compare the impact of these variants on severity of maternal infection and perinatal outcomes within the time-periods in which they predominated.

**Methods** This national, prospective cohort study collated data on hospitalised pregnant women with symptoms of confirmed SARS-CoV-2 infection and compared the severity of infection and perinatal outcomes across the Wildtype (01/03/20-30/11/20), Alpha (01/12/20-15/05/21) and Delta dominant periods (16/05/21-11/07/21), using multivariable logistic regression.

**Findings** Of 3371 pregnant women, the proportion that experienced moderate to severe infection significantly increased between Wildtype and Alpha periods (24.4% vs. 35.8%; aOR1.75 95%CI 1.48-2.06), and between Alpha and Delta periods (35.8% vs. 45.0%; aOR1.53, 95%CI 1.07-2.17). Compared to the Wildtype period, symptomatic women admitted in the Alpha period were more likely to require respiratory support (27.2% vs. 20.3%, aOR1.39, 95%CI

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1.13-1.78), have pneumonia (27.5% vs. 19.1%, aOR1.65, 95%CI 1.38-1.98) and be admitted to intensive care (11.3% vs. 7.7%, aOR1.61, 95%CI 1.24-2.10). Women admitted during the Delta period had further increased risk of pneumonia (36.8% vs. 27.5%, aOR1.64 95%CI 1.14-2.35). No fully vaccinated pregnant women were admitted between 01/02/2021 when vaccination data collection commenced and 11/07/2021. The proportion of women receiving pharmacological therapies for SARS-CoV-2 management was low, even in those critically ill.

Interpretation SARS-CoV-2 infection during Alpha and Delta dominant periods was associated with more severe infection and worse pregnancy outcomes compared to the Wildtype infection, which itself increased risk compared to women without SARS-CoV-2 infection.1 Clinicians need to be aware and implement COVID-specific therapies in keeping with national guidance. Urgent action to tackle vaccine misinformation and policy change to prioritise uptake in pregnancy is essential. (Author)

Full URL: <https://doi.org/10.1101/2021.07.22.21261000>

## 2021-08186

**COVID-19 Vaccination During Pregnancy: Coverage and Safety.** Blakeway H, Prasad S, Kalafat E, et al (2022), American Journal of Obstetrics & Gynecology (AJOG) vol 226, no 2, February 2022, pp 236.e1-236.e14

### Background

Concerns have been raised regarding a potential surge of COVID-19 in pregnancy, secondary to rising numbers of COVID-19 in the community, easing of societal restrictions, and vaccine hesitancy. Even though COVID-19 vaccination is now offered to all pregnant women in the UK, there are limited data on its uptake and safety.

### Objectives and study design

This was a cohort study of pregnant women who gave birth at St George's University Hospitals NHS Foundation Trust, London, UK, between March 1st and July 4th 2021. The primary outcome was uptake of COVID-19 vaccination and its determinants. The secondary outcomes were perinatal safety outcomes. Data were collected on COVID-19 vaccination uptake, vaccination type, gestational age at vaccination, as well as maternal characteristics including age, parity, ethnicity, index of multiple deprivation score and co-morbidities. Further data were collected on perinatal outcomes including stillbirth (fetal death  $\geq 24$  weeks' gestation), preterm birth, fetal/congenital abnormalities and intrapartum complications. Pregnant women who received the vaccine were compared with a matched cohort of propensity balanced pregnant women to compare outcomes. Effect magnitudes of vaccination on perinatal outcomes were reported as mean differences or odds ratios with 95% confidence intervals. Factors associated with antenatal vaccination were assessed with logistic regression analysis.

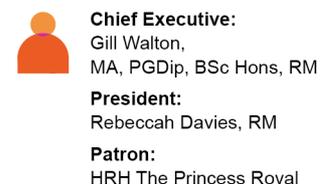
### Results

Data were available for 1328 pregnant women of whom 141 received at least one dose of vaccine before giving birth and 1187 women who did not; 85.8% of those vaccinated received their vaccine in the third trimester and 14.2% in the second trimester. Of those vaccinated, 128 (90.8%) received an mRNA vaccine and 13 (9.2%) a viral vector vaccine. There was evidence of reduced vaccine uptake in younger women ( $P=0.002$ ), those with high levels of deprivation (i.e., fifth quintile of Index of Multiple Deprivation,  $P=0.008$ ) and women of Afro-Caribbean or Asian ethnicity, compared to Caucasian ethnicity ( $P<0.001$ ). Women with pre-pregnancy diabetes had increased vaccine uptake ( $P=0.008$ ). In the multivariable model adjusting for variables that had a significant effect according to the univariable analysis, fifth deprivation quintile (most deprived) was significantly associated with lower antenatal vaccine uptake (adjusted OR 0.09, 95% CI 0.02–0.39,  $P=0.002$ ), while pre-pregnancy diabetes was significantly associated with higher antenatal vaccine uptake (adjusted OR 11.1, 95% CI 2.01–81.6,  $P=0.008$ ).

In a propensity score matched cohort, compared with non-vaccinated pregnant women, 133 women who received at least one dose of the COVID-19 vaccine in pregnancy (vs. those unvaccinated) had similar rates of adverse pregnancy outcomes ( $P>0.05$  for all): stillbirth (0.0% vs 0.3%), fetal abnormalities (2.2% vs 2.7%), intrapartum pyrexia (3.7% vs 1.5%), postpartum hemorrhage (9.8% vs 9.5%), cesarean section (30.8% vs 30.6%), small for gestational age (12.0% vs 15.8%), maternal high dependency unit or intensive care admission (6.0% vs 3.5%) or neonatal intensive care unit admission (5.3% vs 5.4%). Mixed-effects Cox regression showed that vaccination was not significantly associated with birth  $<40$  weeks' gestation (hazard ratio 0.93, 95% CI 0.71–1.23,  $P=0.630$ ).

### Conclusions

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Of pregnant women eligible for COVID-19 vaccination, less than one third accepted COVID-19 vaccination during pregnancy and they experienced similar pregnancy outcomes. There was lower uptake among younger women, non-white ethnicity, and lower socioeconomic background. This study contributes to the body of evidence that having COVID-19 vaccination in pregnancy does not alter perinatal outcomes. Clear communication to improve awareness among pregnant women and healthcare professionals on vaccine safety is needed, alongside strategies to address vaccine hesitancy. This includes post-vaccination surveillance to gather further data on pregnancy outcomes, particularly after first trimester vaccination, as well as long-term infant follow-up. (Author)

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#### 2021-08125

##### **Detection of SARS-CoV-2-Specific IgA in the Human Milk of COVID-19 Vaccinated Lactating Health Care Workers.**

Valcarce V, Stewart Stafford L, Neu J, et al (2021), *Breastfeeding Medicine* vol 16, no 12, December 2021, pp 1004-1009

**Background:** In 2019, a deadly virus known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), responsible for coronavirus disease 2019 (COVID-19), emerged. In December 2020, two mRNA-based COVID-19 vaccines were approved for use in the United States, which provide immunity to those receiving the vaccine. Maternally derived antibodies are a key element of infants' immunity. Certain vaccines given to pregnant and lactating mothers provide immunity to infants through transmission across the placenta, umbilical cord (IgG), and human milk (IgA). Human milk produced by mothers with a history of COVID-19 infection contains SARS-CoV-2 IgA and IgG. The purpose of this study is to determine whether SARS-CoV-2-specific immunoglobulins are found in human milk after the COVID-19 vaccination, and to characterize the types of immunoglobulins present.

**Methods:** This is a prospective observational study conducted at Shands Hospital, University of Florida, from December 2020 to March 2021. Twenty-two lactating health care workers who received the SARS-CoV-2 mRNA vaccine (Pfizer/BioNTech or Moderna) made up the sample group. Plasma and human milk were collected at three time points (prevaccination, post-first vaccine dose, and post-second vaccine dose). SARS-CoV-2-specific IgA and IgG in human milk and in plasma were measured by enzyme-linked immunosorbent assay (ELISA). Maternal demographics were compiled.

**Results:** We found significant secretion of SARS-CoV-2-specific IgA and IgG in human milk and plasma after SARS-CoV-2 vaccination.

**Conclusions:** Our results show that the mRNA-based COVID-19 vaccines induce SARS-CoV-2-specific IgA and IgG secretion in human milk. Further studies are needed to determine the duration of this immune response, its capacity to neutralize the COVID-19 virus, the transfer of passive immunity to breastfeeding infants, and the potential therapeutic use of human milk IgA to combat SARS-CoV-2 infections and COVID-19. (Author)

**Full URL:** <https://doi.org/10.1089/bfm.2021.0122>

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#### 2021-08033

**Prioritizing pregnant women for COVID-19 vaccination.** Sarwal Y, Sarwal T, Sarwal R (2021), *International Journal of Gynecology & Obstetrics* vol 155, no 1, October 2021, pp 57-63

Despite emerging evidence on safety and efficacy, most countries do not offer COVID-19 vaccines to pregnant women even though they are at higher risk of complications from COVID-19. We performed a web search of COVID-19 vaccination policies for pregnant women under two categories: countries bearing a high burden of COVID-19 cases and countries with a high burden of maternal and under-five mortality. Of the top 20 countries affected by COVID-19, 11 allow vaccination of pregnant women, of which two have deemed it safe to vaccinate pregnant women as a high-risk group. In contrast, only five of the 20 countries with high under-five mortality and maternal mortality allow vaccination of pregnant women and none of these countries has included them as part of a high-risk group that should be vaccinated. India and Indonesia, with one-fifth of the world's population, fall under both categories but do not include pregnant women as a priority group for COVID-19 vaccination. To prevent COVID-19 from further aggravating the already heavy burden of maternal and under-five mortality, there is a strong case for including

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pregnant women as a high- priority group for COVID- 19 vaccination. We recommend including COVID- 19 vaccination in routine antenatal care in all countries, particularly India and Indonesia in view of their high dual burden. (Author)

Full URL: <https://doi.org/10.1002/ijgo.13816>

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#### 2021-08030

**The COVID-19 vaccination for women who are pregnant, planning pregnancy or breastfeeding.** Royal College of Midwives (2021), London: RCM June 2021. 4 pages

This clinical briefing provides information about the coronavirus vaccine for those who are planning a pregnancy, are pregnant and/or breastfeeding. (Author)

Full URL: <https://www.rcm.org.uk/media/5090/covid-19-vaccination-clinical-briefing-publisehd-2021.pdf>

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#### 2021-08028

**Pregnancy, breastfeeding, fertility and coronavirus (COVID-19) vaccination [Last updated 27 January 2022].** NHS (2021), London: NHS 19 August 2021

Consumer information from the NHS on vaccination against coronavirus (COVID-19), for pregnant and breastfeeding women and those considering pregnancy . (JSM)

Full URL: <https://www.nhs.uk/conditions/coronavirus-covid-19/coronavirus-vaccination/pregnancy-breastfeeding-fertility-and-coronavirus-covid-19-vaccination/>

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#### 2021-08015

**Successful vertical transmission of SARS-CoV-2 antibodies after maternal vaccination.** Mehaffey JH, Arnold M, Huffstetler E, et al (2021), Birth vol 48, no 4, December 2021, pp 451-452

Letter to the editor presenting a case of vertical transmission of Immunoglobulin G SARS-CoV-2 antibodies from a vaccinated mother to her son with no evidence of prior infection. (LDO)

Full URL: <https://doi.org/10.1111/birt.12582>

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#### 2021-08005

**JCVI issues new advice on COVID-19 vaccination for pregnant women.** Public Health England (2021), London: PHE 16 April 2021

The JCVI has advised that pregnant women should be offered the COVID-19 vaccine at the same time as the rest of the population, based on their age and clinical risk group. (Author)

Full URL: <https://www.gov.uk/government/news/jcvi-issues-new-advice-on-covid-19-vaccination-for-pregnant-women>

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#### 2021-08004

**COVID-19 vaccination in pregnancy: early experience from a single institution.** Trostle ME, Limaye MA, Avtushka V, et al (2021), American Journal of Obstetrics & Gynecology MFM vol 3, no 6, November 2021, 100464

Research letter exploring maternal, neonatal and obstetrical outcomes of pregnant women who received an mRNA COVID-19 vaccine in the first four months of its availability. Results indicate no concerning trends and rates of miscarriage and premature birth were within the normal ranges. (LDO)

Full URL: <https://doi.org/10.1016/j.ajogmf.2021.100464>

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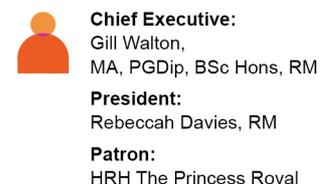
#### 2021-07970

**Covid: 'I'm pregnant, should I have the vaccine?'**. Various (2021), BBC News 18 August 2021

Vaccine uptake by pregnant women is causing concern among doctors and midwives, as 98% of pregnant women in hospital with Covid-19 are unvaccinated, according to NHS England.

BBC London reporter Victoria Cook is pregnant and has reservations about getting the Covid vaccination.

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She met other expectant mums who say mixed messaging from doctors and politicians has left them feeling unsure about how best to protect their babies.

Victoria also spoke to experts who told her why pregnant women are now being encouraged to have the jab.

During the course of filming, Victoria contracted Covid-19. (Author)

Full URL: <https://www.bbc.co.uk/news/av/uk-england-london-58089039>

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#### 2021-07922

**COVID-19 vaccines, pregnancy and breastfeeding FAQs [Last updated 13 May 2022].** Royal College of Obstetricians and Gynaecologists (2021), London: RCOG 2021

These Q&As were updated on Friday 13 May 2022 and will be reviewed as new information and advice emerges. For general information on pregnancy and COVID-19 visit our main Q&A page. (Author)

Full URL: <https://www.rcog.org.uk/en/guidelines-research-services/coronavirus-covid-19-pregnancy-and-womens-health/covid-19-vaccines-and-pregnancy/covid-19-vaccines-pregnancy-and-breastfeeding>

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#### 2021-07914

**Should I get a vaccine?.** Royal College of Midwives (2021), London: RCM August 2021, 1 page

A downloadable information sheet for women that answers the most frequently asked questions concerning the COVID-19 vaccination in pregnancy. (JSM)

Full URL: <https://www.rcm.org.uk/media/5225/should-i-get-a-vaccine.pdf>

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#### 2021-07913

**Association Between BNT162b2 Vaccination and Incidence of SARS-CoV-2 Infection in Pregnant Women.** Goldshtein I, Nevo D, Steinberg DM, et al (2021), JAMA (Journal of the American Medical Association) 12 July 2021, online

Importance Data on BNT162b2 messenger RNA (mRNA) vaccine (Pfizer-BioNTech) effectiveness and safety in pregnancy are currently lacking because pregnant women were excluded from the phase 3 trial.

Objective To assess the association between receipt of BNT162b2 mRNA vaccine and risk of SARS-CoV-2 infection among pregnant women.

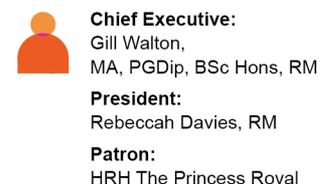
Design, Setting, and Participants This was a retrospective cohort study within the pregnancy registry of a large state-mandated health care organization in Israel. Pregnant women vaccinated with a first dose from December 19, 2020, through February 28, 2021, were 1:1 matched to unvaccinated women by age, gestational age, residential area, population subgroup, parity, and influenza immunization status. Follow-up ended on April 11, 2021.

Exposures Exposure was defined by receipt of the BNT162b2 mRNA vaccine. To maintain comparability, nonexposed women who were subsequently vaccinated were censored 10 days after their exposure, along with their matched pair.

Main Outcomes and Measures The primary outcome was polymerase chain reaction–validated SARS-CoV-2 infection at 28 days or more after the first vaccine dose.

Results The cohort included 7530 vaccinated and 7530 matched unvaccinated women, 46% and 33% in the second and third trimester, respectively, with a mean age of 31.1 years (SD, 4.9 years). The median follow-up for the primary outcome was 37 days (interquartile range, 21–54 days; range, 0–70). There were 118 SARS-CoV-2 infections in the vaccinated group and 202 in the unvaccinated group. Among infected women, 88 of 105 (83.8%) were symptomatic in the vaccinated group vs 149 of 179 (83.2%) in the unvaccinated group ( $P \geq .99$ ). During 28 to 70 days of follow-up, there were 10 infections in the vaccinated group and 46 in the unvaccinated group. The hazards of infection were 0.33% vs

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1.64% in the vaccinated and unvaccinated groups, respectively, representing an absolute difference of 1.31% (95% CI, 0.89%-1.74%), with an adjusted hazard ratio of 0.22 (95% CI, 0.11-0.43). Vaccine-related adverse events were reported by 68 patients; none was severe. The most commonly reported symptoms were headache (n = 10, 0.1%), general weakness (n = 8, 0.1%), nonspecified pain (n = 6, <0.1%), and stomachache (n = 5, <0.1%).

**Conclusions and Relevance** In this retrospective cohort study of pregnant women, BNT162b2 mRNA vaccination compared with no vaccination was associated with a significantly lower risk of SARS-CoV-2 infection. Interpretation of study findings is limited by the observational design. (Author)

**Full URL:** <https://doi.org/10.1001/jama.2021.11035>

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#### 2021-07911

**COVID-19 vaccine webinar.** Royal College of Midwives (2021), London: RCM 11 June 2021: 1hr, 17 mins

Webinar recorded on 11 June 2021 to assist midwives advising women on whether or not to have the COVID-19 vaccine in pregnancy. Dr. Mary Ross Davie, Director for Professional Midwifery at the Royal College of Midwives (RCM) introduces presentations from Pat O' Brien, Consultant Obstetrician with the Royal College of Obstetricians and Gynaecologists (RCOG); Jenny Hall from NHS England; Clare Livingstone, RCM Professional Advisor; Consultant midwife, Dr. Angela Kerrigan and MVP Chair Victoria Walsh from the Wirral. (JSM)

**Full URL:** [https://www.rcm.org.uk/vaccines-maternity-staff-pregnant-women/?dm\\_i=4YCH,JWOO,3PNLW0,2DN10,1](https://www.rcm.org.uk/vaccines-maternity-staff-pregnant-women/?dm_i=4YCH,JWOO,3PNLW0,2DN10,1)

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#### 2021-07897

**Talking to women about the COVID-19 vaccine.** Royal College of Midwives (2021), London: RCM August 2021. 1 page

An information sheet for midwives, to help guide a conversation with women around vaccination against coronavirus (COVID-19) in pregnancy. (JSM)

**Full URL:** <https://www.rcm.org.uk/media/5228/talking-to-women-about-the-vaccine.pdf>

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#### 2021-07889

**Midwives urged to encourage pregnant women to get Covid-19 jab.** Ford M (2021), Nursing Times 30 July 2021

Midwives and primary care nurses have been urged to ramp up efforts to encourage pregnant women to have the Covid-19 vaccine, following the release of concerning new data. (Author)

**Full URL:** <https://www.nursingtimes.net/news/coronavirus/midwives-urged-to-encourage-pregnant-women-to-get-covid-19-jab-30-07-2021/>

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#### 2021-07863

**COVID-19 vaccines: updates for August 2021.** Medicines and Healthcare Products Regulatory Agency (2021), Drug Safety Update vol 15, no 1, August 2021

Recent information relating to COVID-19 vaccines that has been published since the July 2021 issue of Drug Safety Update. Includes a section on vaccination in pregnancy. (Author, edited)

**Full URL:** <https://www.gov.uk/drug-safety-update/covid-19-vaccines-updates-for-august-2021>

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#### 2021-07739

**Covid vaccine: Fertility and miscarriage claims fact-checked.** Schraer R (2021), BBC News 11 August 2021

False and misleading claims that Covid-19 vaccines harm fertility and cause miscarriages are still circulating online, against all the evidence. (Author)

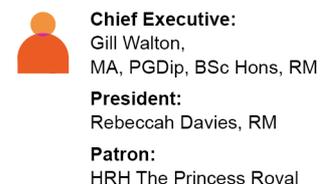
**Full URL:** <https://www.bbc.co.uk/news/health-57552527>

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#### 2021-07733

**SARS-CoV-2 Antibodies Detected in Mother's Milk Post-Vaccination.** Baird JK, Jensen SM, Urba WJ, et al (2021), Journal of

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## Background

The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) pandemic has infected over 127 million people worldwide, with almost 2.8 million deaths at the time of writing. Since no lactating individuals were included in initial trials of vaccine safety and efficacy, research on SARS-CoV-2 vaccination in lactating women and the potential transmission of passive immunity to the infant through mother's milk is needed to guide patients, clinicians, and policy makers on whether to recommend immunization during the worldwide effort to curb the spread of this virus.

## Research Aims

(1) To determine whether SARS-CoV-2 specific immunoglobins are found in human milk after vaccination, and (2) to characterize the time course and types of immunoglobulins present.

## Methods

A longitudinal cohort study of lactating women (N = 7) who planned to receive both doses of the Pfizer-BioNTech or Moderna SARS-CoV-2 vaccine between December 2020 and January 2021 provided milk samples. These were collected pre-vaccination and at 11 additional timepoints, with the last sample at 14 days after the second dose of vaccine. Samples were analyzed for levels of SARS-CoV-2 specific immunoglobulins A and G (IgA and IgG).

## Results

We observed significantly elevated levels of SARS-CoV-2 specific IgG and IgA antibodies in human milk beginning approximately 7 days after the initial vaccine dose, with an IgG-dominant response.

## Conclusions

Maternal vaccination results in SARS-CoV-2 specific immunoglobulins in human milk that may be protective for infants. (Author)

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### 2021-07462

**Acceptance of COVID-19 vaccination in pregnancy: a survey study.** Levy AT, Singh S, Riley LE, et al (2021), American Journal of Obstetrics & Gynecology MFM vol 3, no 5, September 2021, 100399

No abstract available.

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### 2021-07459

**Anti-severe acute respiratory syndrome coronavirus 2 antibodies induced in breast milk after Pfizer-BioNTech/BNT162b2 vaccination.** Kelly JC, Carter EB, Raghuraman N, et al (2021), American Journal of Obstetrics & Gynecology (AJOG) vol 225, no 1, July 2021, pp 101-103

Research letter exploring levels of SARS-CoV-2 antibodies in breast milk in lactating people undergoing COVID-19 vaccination. Results indicate sustained elevation of immunoglobulin G/immunoglobulin A levels in breast milk after Pfizer-BioNTech/BNT162b2 vaccination. (LDO)

Full URL: <https://doi.org/10.1016/j.ajog.2021.03.031>

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### 2021-07458

**Prioritization of pregnant individuals in state plans for coronavirus disease 2019 vaccination.** Crane MA, Jaffe E, Beigi RH, et al (2021), American Journal of Obstetrics & Gynecology (AJOG) vol 225, no 1, July 2021, pp 95-99

Research letter exploring the number of states that prioritise pregnant women for COVID-19 vaccination and assessing the overall current eligibility of pregnant women to receive COVID-19 vaccinations across the United States. Results show that most states classify pregnant women as a priority group and pregnant women are eligible to receive vaccines in 50% of the country. (LDO)

Full URL: <https://doi.org/10.1016/j.ajog.2021.03.015>

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2021-07456

**Adverse effects of COVID-19 messenger RNA vaccines among pregnant women: a cross-sectional study on healthcare workers with detailed self-reported symptoms.** Kadali RAK, Janagama R, Peruru SR, et al (2021), American Journal of Obstetrics & Gynecology (AJOG) vol 225, no 4, October 2021, pp 458-460

Research letter comparing the detailed side-effect profile of COVID-19 mRNA vaccines among pregnant and non-pregnant healthcare workers. Results indicate that side-effect profiles are similar between both groups and are non-life-threatening. (LDO)

Full URL: <https://doi.org/10.1016/j.ajog.2021.06.007>

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2021-07388

**NMC statement on new vaccination advice for pregnant women.** Nursing and Midwifery Council (2021), London: NMC 3 August 2021

Statement from the Chief Executive and Registrar for the Nursing and Midwifery Council (NMC) on current COVID-19 vaccination advice for pregnant women. (LDO)

Full URL: <https://www.nmc.org.uk/news/news-and-updates/nmc-statement-vaccine-midwifery/>

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2021-07385

**Cord blood antibodies following maternal coronavirus disease 2019 vaccination during pregnancy.** Mithal LB, Otero S, Shanes ED, et al (2021), American Journal of Obstetrics & Gynecology (AJOG) vol 225, no 2, August 2021, pp 192-194

Research letter investigating SARS-CoV-2 immunoglobulin G transfer from mothers to infants following COVID-19 vaccination during pregnancy. Results demonstrate that most pregnant women who received the vaccine in the third trimester had transplacental transfer of immunoglobulin G and antibody levels in the infant are equal to the mother. (LDO)

Full URL: <https://doi.org/10.1016/j.ajog.2021.03.035>

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2021-07327

**RCOG welcomes Chief Midwife's campaign encouraging pregnant women to get vaccinated.** Royal College of Obstetricians and Gynaecologists (2021), London: RCOG 30 July 2021

England's chief midwife is encouraging pregnant women to get vaccinated, as new data shows that the overwhelming majority of pregnant woman who are being hospitalised with COVID-19 have not been vaccinated. (Author)

Full URL: <https://www.rcog.org.uk/en/news/rcog-welcomes-chief-midwives-campaign-encouraging-pregnant-women-to-get-vaccinated/>

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2021-07324

**Pregnant women urged to get jab as majority unvaccinated.** Mundasad S (2021), BBC News 30 July 2021

England's chief midwife has stepped up her call for pregnant women to get the Covid jab as soon as possible. (Author)

Full URL: <https://www.bbc.co.uk/news/health-58014779>

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2021-07097

**Brazil: Why are so many pregnant women dying from Covid?.** BBC News (2021), BBC News 27 July 2021

Covid-19 has critically affected pregnant women in Brazil, with more than 1,000 deaths. One in five women that died from the virus didn't have access to an intensive care unit and one in three didn't have access to a ventilator.

So far Brazil has recorded more than 530,000 coronavirus related deaths and only 45% of the population has received at least one dose of the vaccine. (Author)

Full URL: <https://www.bbc.co.uk/news/av/world-latin-america-57974754>

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HRH The Princess Royal

2021-06976

**Coronavirus: Vaccination [written answer].** House of Commons (2021), Hansard Written question 35835, 19 July 2021

Nadhim Zahawi responds to a written question from Sarah Olney to the Secretary of State for Health and Social Care, regarding what the Government's guidance is on the number of weeks that should elapse between receipt of the first and second dose of the covid-19 vaccine for pregnant women; and what the evidence is behind that guidance. (JSM)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2021-07-19/35835>

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2021-06974

**Pregnancy: Coronavirus [written answer].** House of Commons (2021), Hansard Written question 34581, 16 July 2021

Nadhim Zahawi responds to a written question from Marsha De Cordova to the Secretary of State for Health and Social Care, with reference to the number of pregnant women yet to receive a single dose of the covid-19 vaccine, what steps he is taking to help ensure that pregnant women are kept safe as covid-19 (a) infection rates increase and (b) restrictions lift. (Author, edited)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2021-07-16/34581>

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2021-06957

**Health chiefs encourage more pregnant women to get their COVID-19 vaccine.** Public Health England (2021), London: PHE 22 July 2021

News item reporting that Health chiefs are encouraging more pregnant women to get their COVID-19 vaccine, as new data shows that 51,724 pregnant women in England have received at least one dose. (Author, edited)

Full URL: <https://www.gov.uk/government/news/health-chiefs-encourage-more-pregnant-women-to-get-their-covid-19-vaccine>

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2021-06952

**Pregnancy: Coronavirus [written answer].** House of Commons (2021), Hansard Written question 34580, 16 July 2021

Nadhim Zahawi responds to a written question from Marsha De Cordova to the Secretary of State for Health and Social Care, regarding the process for ensuring health professionals (a) are discussing with pregnant women the risks and benefits of the covid-19 vaccine and (b) have up to date information on the risks and benefits of the vaccine. (JSM)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2021-07-16/34580>

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2021-06946

**Pregnancy: Coronavirus [written answer].** House of Commons (2021), Hansard Written question 32510, 13 July 2021

Nadhim Zahawi responds to a written question from Marsha De Cordova to the Secretary of State for Health and Social Care, regarding whether he is collecting data on the number of pregnant women and new mothers being vaccinated against covid-19. (JSM)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2021-07-13/32510>

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2021-06837

**Pregnancy: Coronavirus [written answer].** House of Commons (2021), Hansard Written question 32512, 13 July 2021

Nadhim Zahawi responds to a written question from Marsha De Cordova to the Secretary of State for Health and Social Care, regarding what steps he is taking to (a) assess and (b) reduce covid-19 vaccine hesitancy among pregnant women. (JSM)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2021-07-13/32512>

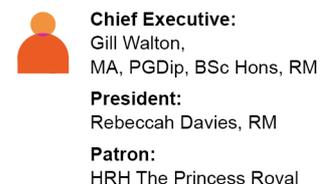
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2021-06554

**COVID unlocking will create 'perfect storm' for pregnant women, say maternity Colleges.** Royal College of Obstetricians and Gynaecologists (2021), London: RCOG 15 July 2021

The Royal College of Obstetricians and Gynaecologists (RCOG) and the Royal College of Midwives (RCM) are warning

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that the easing of COVID-19 restrictions, due to take place on 19th July 2021, could be very detrimental to pregnant women, who tend to experience very severe symptoms of the disease, especially during the late stages of pregnancy, and also suffer poorer pregnancy outcomes such as premature labour, emergency caesarean section, pre-eclampsia and stillbirth. Both colleges are urging women to get vaccinated against the disease. Includes comments from Dr Edward Morris, President at the Royal College of Obstetricians and Gynaecologists, Professor Marian Knight, Professor of Maternal and Child Population Health at the University of Oxford, and Gill Walton, Chief Executive of the Royal College of Midwives. (JSM)

**Full URL:** <https://www.rcog.org.uk/en/news/covid-unlocking-will-create-perfect-storm-for-pregnant-women-say-maternity-colleges/>

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#### 2021-06521

**Covid unlocking risk for pregnant women, say doctors.** Price E (2021), BBC News 15 July 2021

News item reporting that the lifting of restrictions put in place by the UK government because of the COVID-19 pandemic is causing concern among doctors and midwives, who fear there will be an increase in infection among pregnant women. States that the Royal College of Obstetricians and Gynaecologists (RCOG) and the Royal College of Midwives (RCM) have urged pregnant women to take up the offer of the vaccine, which is known to be safe in pregnancy, as the virus can be severe in the third trimester, owing partly to the increased pressure on the lungs by the growing fetus. Also states that the need for an emergency caesarean section is increased in women who give birth while infected, and the stillbirth rate, while still remaining low, is increased in this population group. (JSM)

**Full URL:** <https://www.bbc.co.uk/news/health-57840159>

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#### 2021-06399

**Pregnancy: Coronavirus [written answer].** House of Commons (2021), Hansard Written question 29137, 7 July 2021

Nadhim Zahawi responds to a written question asked by Marsha de Cordova, regarding whether he will publish data on the number of pregnant and breastfeeding women who have had covid-19 vaccinations. (MB)

**Full URL:** <https://questions-statements.parliament.uk/written-questions/detail/2021-07-07/29137>

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#### 2021-06255

**The Levels of SARS-CoV-2 Specific Antibodies in Human Milk Following Vaccination.** Juncker HG, Mulleners SJ, van Gils MJ, et al (2021), Journal of Human Lactation vol 37, no 3, August 2021, pp 477-484

##### Background

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) vaccines are being administered around the world; however, lactating women were excluded from SARS-CoV-2 vaccine trials. Therefore, knowledge about the effect of vaccination in this specific group is limited. This information is essential to empower lactating women to make a well-informed decision on their choice for vaccination. After natural infection, SARS-CoV-2 specific antibodies are present in human milk, which might offer protection for her newborn. The dynamics of these antibodies in human milk following vaccination remain to be elucidated.

##### Research Aim

To determine the effect of vaccination with BNT162b2 on the levels of SARS-CoV-2 specific IgA in human milk.

##### Methods

In this prospective longitudinal study, we included lactating women who received the BNT162b2 vaccine. Human milk samples were collected prior to vaccination and 3, 5, 7, 9, 11, 13, and 15 days after both vaccine doses. Samples were analyzed using enzyme-linked immunosorbent assay against the spike protein of SARS-CoV-2.

##### Results

In total, 366 human milk samples from 26 lactating women were analyzed. A biphasic response was observed, with SARS-CoV-2 specific immunoglobulin A (IgA) starting to increase between day 5 and 7 after the first dose of the vaccine. After the second dose, an accelerated IgA antibody response was observed.

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## Conclusion

After vaccination with the mRNA-based BNT162b2 vaccine, a SARS-CoV-2 specific antibody response was observed in human milk. The presence of SARS-CoV-2 specific IgA after vaccination is important as antibodies are transferred via human milk, and thereby might provide protection to infants against COVID-19. (Author)

Full URL: <https://doi.org/10.1177/08903344211027112>

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## 2021-06194

**COVID-19 Vaccination in Pregnancy: The Benefits Outweigh the Risks.** Chavan M, Qureshi H, Karnati S, et al (2021), JOGC [Journal of Obstetrics and Gynaecology Canada] vol 43, no 7, July 2021, pp 814-816

The rapid development of a vaccine to protect against SARS-CoV-2 infection and prevent coronavirus disease 2019 (COVID-19) has been a historic scientific achievement but has also raised many questions in the health care community about vaccine safety for patients who were not included in clinical trials. As mass immunization efforts have rapidly expanded, obstetricians across the globe now face the challenge of advising pregnant patients on whether they should receive the vaccine. (Author)

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## 2021-06147

**Coronavirus disease and vaccination during pregnancy and childbirth: a review of the Israeli perspective and experience.** Hadar E, Dollinger S, Wiznitzer A, et al (2022), Journal of Maternal-Fetal and Neonatal Medicine vol 35, no 25, 2022, pp 7794-7805

Purpose of the study: To discuss selected aspects of our local and national experience in treating and vaccinating pregnant women with SARS-CoV-2 infection and COVID-19 disease.

Materials and methods: A comprehensive, retrospective review of COVID-19 parturients in our center as well as a detailed literature review of several aspects from the groundbreaking research done in Israel to investigate the direct obstetrical impact of COVID-19, indirect effect of the lockdown measures and the vaccination effort among pregnant women.

Results: The study shows our local and national experience in treating COVID-19 in pregnancy and the maternal and neonatal impact of vaccination in nationwide scale. We treated our first COVID-19 pregnant patient on April 4th, 2020 reaching a total of 193 pregnant women, with PCR-positive SARS-CoV-2 by 8th March 2021. Several studies from Israel have evaluated pregnancy-related outcomes of COVID-19, be it maternal, obstetrical or neonatal complications. We suggest that only in a small subset of severely ill mothers, intubated and otherwise respiratory or hemodynamically unstable, an emergency cesarean delivery should be considered, factoring gestational age, in order to assist maternal ventilation and circulation, as well as to avoid possible secondary fetal compromise due the maternal deterioration.

In addition, there is conflicting evidence as to the price of lockdown on obstetrical outcomes, i.e., not the direct medical impact of the virus, but rather the impact of the measures to contain its spread - mainly lockdowns, which has been a major tool in Israel to combat COVID-19.

Finally, we demonstrate to overall safety and efficacy of vaccination pregnant women and the beneficial impact on pregnancy outcome and neonatal gain of protecting antibodies.

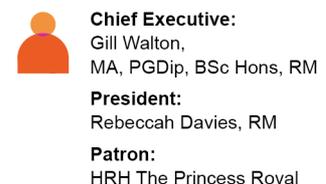
Conclusion: The data emerging from Israel is overall reassuring, as for the association of COVID-19 with adverse pregnancy outcome and the possible protective effect of the vaccinations. Further, long term studies, should be conducted to answer the long-term maternal outcomes, as well and neonatal prognosis. (Author)

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## 2021-05952

**Immunogenicity of COVID-19 mRNA Vaccines in Pregnant and Lactating Women.** Collier AY, McMahan K, Yu J, et al (2021),

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**Importance** Pregnant women are at increased risk of morbidity and mortality from COVID-19 but have been excluded from the phase 3 COVID-19 vaccine trials. Data on vaccine safety and immunogenicity in these populations are therefore limited.

**Objective** To evaluate the immunogenicity of COVID-19 messenger RNA (mRNA) vaccines in pregnant and lactating women, including against emerging SARS-CoV-2 variants of concern.

**Design, Setting, and Participants** An exploratory, descriptive, prospective cohort study enrolled 103 women who received a COVID-19 vaccine from December 2020 through March 2021 and 28 women who had confirmed SARS-CoV-2 infection from April 2020 through March 2021 (the last follow-up date was March 26, 2021). This study enrolled 30 pregnant, 16 lactating, and 57 neither pregnant nor lactating women who received either the mRNA-1273 (Moderna) or BNT162b2 (Pfizer-BioNTech) COVID-19 vaccines and 22 pregnant and 6 nonpregnant unvaccinated women with SARS-CoV-2 infection.

**Main Outcomes and Measures** SARS-CoV-2 receptor binding domain binding, neutralizing, and functional nonneutralizing antibody responses from pregnant, lactating, and nonpregnant women were assessed following vaccination. Spike-specific T-cell responses were evaluated using IFN- $\gamma$  enzyme-linked immunospot and multiparameter intracellular cytokine-staining assays. Humoral and cellular immune responses were determined against the original SARS-CoV-2 USA-WA1/2020 strain as well as against the B.1.1.7 and B.1.351 variants.

**Results** This study enrolled 103 women aged 18 to 45 years (66% non-Hispanic White) who received a COVID-19 mRNA vaccine. After the second vaccine dose, fever was reported in 4 pregnant women (14%; SD, 6%), 7 lactating women (44%; SD, 12%), and 27 nonpregnant women (52%; SD, 7%). Binding, neutralizing, and functional nonneutralizing antibody responses as well as CD4 and CD8 T-cell responses were present in pregnant, lactating, and nonpregnant women following vaccination. Binding and neutralizing antibodies were also observed in infant cord blood and breast milk. Binding and neutralizing antibody titers against the SARS-CoV-2 B.1.1.7 and B.1.351 variants of concern were reduced, but T-cell responses were preserved against viral variants.

**Conclusion and Relevance** In this exploratory analysis of a convenience sample, receipt of a COVID-19 mRNA vaccine was immunogenic in pregnant women, and vaccine-elicited antibodies were transported to infant cord blood and breast milk. Pregnant and nonpregnant women who were vaccinated developed cross-reactive antibody responses and T-cell responses against SARS-CoV-2 variants of concern. (Author)

**Full URL:** <https://doi.org/10.1001/jama.2021.7563>

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## 2021-05897

**Maternal and neonatal SARS-CoV-2 antibodies assessment after mRNA maternal vaccination in the third trimester of pregnancy.** Riviello C, Pontello V (2021), International Journal of Gynecology & Obstetrics vol 154, no 3, September 2021, pp 565-566

Brief report presenting the case of a healthy 42-year-old pregnant health care worker who received doses of the Pfizer vaccine at 31 and 34 weeks of gestation. The ratio between cord and maternal antibodies was 0.38 which may imply that placental transfer after vaccination is less efficient than in natural infection. (LDO)

**Full URL:** <https://doi.org/10.1002/ijgo.13783>

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## 2021-05896

**A forecast of maternal deaths with and without vaccination of pregnant women against COVID-19 in Mexico.**

Lumbreras-Marquez MI, Fields KG, Campos-Zamora M, et al (2021), International Journal of Gynecology & Obstetrics vol 154, no 3, September 2021, pp 566-567

Brief report forecasting excess maternal deaths for the second half of 2021 with and without vaccination of all pregnant women during May and June 2021. The authors predict that an 100% vaccination rate would result in the

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#### 2021-05804

**Maternal and Child Symptoms Following COVID-19 Vaccination Among Breastfeeding Mothers.** McLaurin-Jiang S, Garner CD, Krutsch K, et al (2021), Breastfeeding Medicine vol 16, no 9, September 2021, pp 702-709

Background: The impact of COVID-19 vaccination on breastfeeding is unknown. The primary aim of this study was to determine whether vaccine-related side effects following COVID-19 vaccination were associated with an adverse impact on breastfeeding. Secondly, we sought to determine perceived symptoms in breastfed children and maternal opinion about COVID-19 vaccination.

Materials and Methods: We conducted a cross-sectional survey of breastfeeding mothers who underwent COVID-19 vaccination >2 days before the survey. Subjects were recruited through social media and websites. Data included sociodemographic information, vaccine history, maternal and child symptoms, and impact on lactation/breastfeeding. Bivariate statistics (chi-square, Wilcoxon rank sum, and t tests) and multivariable logistic regression models examined the association of vaccine side effects with lactation, symptoms in breastfed children, and maternal opinion on vaccination.

Results: Analysis included 4,455 breastfeeding mothers. Maternal postvaccination symptoms were more common after the second dose ( $p < 0.001$ ). Overall, 77 (1.7%) respondents reported a negative impact on breastfeeding postvaccination, and these mothers were more likely to have experienced fatigue, headache, muscle pain, injection site pain, chills, fever, or allergic reactions. After adjusting for confounding variables, higher odds of an adverse impact on lactation were associated with lower breastfeeding intensity, dose of vaccine, and child symptoms. Even among mothers who reported an adverse impact on breastfeeding, maternal opinion about vaccination and confidence in their decision to receive the COVID-19 vaccine were high.

Conclusions: COVID-19 vaccination among breastfeeding mothers resulted in minimal disruption of lactation or adverse impact on the breastfed child. These findings may be considered in vaccination decision-making. (Author)

Full URL: <https://doi.org/10.1089/bfm.2021.0079>

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#### 2021-05751

**Coronavirus (COVID-19) Vaccination in Pregnancy. Information for healthcare professionals. Version 1.0.** Royal College of Obstetricians and Gynaecologists (2021), London: RCOG 30 June 2021, 19 pages

This document is intended as temporary guidance on COVID-19 vaccination in pregnancy. It aims to summarise, in a format useful for maternity care, the evidence presented in existing COVID-19 vaccination guidance from the Public Health England/Department of Health Green Book,<sup>1</sup> as well as leaflets and information from Public Health England and the NHS. The document will be incorporated into the next version of the Royal College of Obstetricians and Gynaecologists (RCOG) Coronavirus (COVID-19) Infection in Pregnancy guidance expected to be published in autumn 2021. (Author)

Full URL: <https://www.rcog.org.uk/globalassets/documents/guidelines/2021-06-30-coronavirus-covid-19-vaccination-in-pregnancy.pdf>

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#### 2021-05747

**Vaccine Update.** Public Health England (2021), London: PHE no 322, June 2021

This special edition of Vaccine Update focuses on the COVID-19 vaccination programme and includes information on vaccine uptake, mortality rates and side effects. (LDO)

Full URL: <https://www.gov.uk/government/publications/vaccine-update-issue-322-june-2021-covid-19-phase-2-special-edition/vaccine-update-issue-322-june-2021-covid-19-phase-2-special-edition>

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#### 2021-05702

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**Pregnancy: Coronavirus [written answer].** House of Commons (2021), Hansard Written question 22032, 24 June 2021

Nadhim Zahawi responds to a written question asked by Fleur Anderson to the Secretary of State for Health and Social Care, regarding the assessment he has made of the potential merits of reducing the time between COVID-19 vaccine doses for pregnant women in line with priority groups 1 to 9. (LDO)

**Full URL:** <https://questions-statements.parliament.uk/written-questions/detail/2021-06-24/22032>

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#### 2021-05661

**EBCOG position statement on COVID-19 vaccination for pregnant and breastfeeding women.** Martins I, Louwen F, Ayres-de-Campos D, et al (2021), European Journal of Obstetrics & Gynecology and Reproductive Biology vol 262, July 2021, pp 256-258

Covid 19 pandemic has led to significant mortality and long term morbidity globally. Pregnant women are at increased risk of severe illness from COVID 19 infection. There is an urgent need for all health authorities and Governments to offer vaccination to all pregnant women especially those with high risk pregnancy. (Author)

**Full URL:** <https://doi.org/10.1016/j.ejogrb.2021.05.021>

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#### 2021-05365

**Pregnancy: Coronavirus [written answer].** House of Lords (2021), Hansard Written question HL832, 8 June 2021

Lord Bethell responds to a written question from Lord Balfe to Her Majesty's Government, regarding what plans they have (1) to increase the opportunity for pregnant women to have two doses of vaccinations by the time their pregnancy is full term by ensuring that that the NHS vaccination booking system allows them to book a second dose of vaccine eight weeks after their first, and (2) to ensure that any NHS-supported applications used to enable such bookings reflect that opportunity. (JSM)

**Full URL:** <https://questions-statements.parliament.uk/written-questions/detail/2021-06-08/HL832>

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#### 2021-05348

**COVID-19 vaccine acceptance among pregnant, breastfeeding, and nonpregnant reproductive-aged women.** Sutton D, D'Alton M, Zhang Y, et al (2021), American Journal of Obstetrics & Gynecology MFM vol 3, no 5, September 2021, 100403

##### 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.

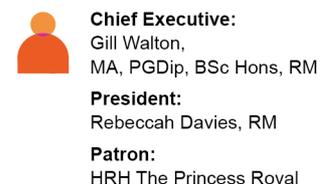
##### Methods

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

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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. (Author)

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#### 2021-05317

**COVID-19 Vaccine Considerations during Pregnancy and Lactation.** Blumberg D, Sridhar A, Lakshminrusimha S, et al (2021), American Journal of Perinatology vol 38, no 6, June 2021, pp 523-528

Editorial reviewing the published data and theoretical considerations of COVID-19 vaccination in pregnant and lactating women. Discusses the safety of mRNA and adenovirus DNA vaccines manufactured by Pfizer-BioNTech, Moderna and Janssen. (LDO)

Full URL: <https://doi.org/10.1055/s-0041-1726390>

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#### 2021-05276

**Coronavirus disease 2019 vaccine response in pregnant and lactating women: a cohort study.** Gray KJ, Bordt EA, Atyeo C, et al (2021), American Journal of Obstetrics & Gynecology (AJOG) vol 225, no 3, September 2021, pp 303.e1-303.e17

##### Background

Pregnant and lactating women were excluded from initial coronavirus disease 2019 vaccine trials; thus, data to guide vaccine decision making are lacking.

##### Objective

This study aimed to evaluate the immunogenicity and reactogenicity of coronavirus disease 2019 messenger RNA vaccination in pregnant and lactating women compared with: (1) nonpregnant controls and (2) natural coronavirus disease 2019 infection in pregnancy.

##### Study Design

A total of 131 reproductive-age vaccine recipients (84 pregnant, 31 lactating, and 16 nonpregnant women) were enrolled in a prospective cohort study at 2 academic medical centers. Titers of severe acute respiratory syndrome coronavirus 2 spike and receptor-binding domain immunoglobulin G, immunoglobulin A, and immunoglobulin M were quantified in participant sera ( $n=131$ ) and breastmilk ( $n=31$ ) at baseline, at the second vaccine dose, at 2 to 6 weeks after the second vaccine, and at delivery by Luminex. Umbilical cord sera ( $n=10$ ) titers were assessed at delivery. Titers were compared with those of pregnant women 4 to 12 weeks from the natural infection ( $n=37$ ) by enzyme-linked immunosorbent assay. A pseudovirus neutralization assay was used to quantify neutralizing antibody titers for the subset of women who delivered during the study period. Postvaccination symptoms were assessed via questionnaire. Kruskal-Wallis tests and a mixed-effects model, with correction for multiple comparisons, were used to assess differences among groups.

##### Results

Vaccine-induced antibody titers were equivalent in pregnant and lactating compared with nonpregnant women (pregnant, median, 5.59; interquartile range, 4.68–5.89; lactating, median, 5.74; interquartile range, 5.06–6.22;

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nonpregnant, median, 5.62; interquartile range, 4.77–5.98,  $P=$ .24). All titers were significantly higher than those induced by severe acute respiratory syndrome coronavirus 2 infection during pregnancy ( $P<$ .0001). Vaccine-generated antibodies were present in all umbilical cord blood and breastmilk samples. Neutralizing antibody titers were lower in umbilical cord than maternal sera, although this finding did not achieve statistical significance (maternal sera, median, 104.7; interquartile range, 61.2–188.2; cord sera, median, 52.3; interquartile range, 11.7–69.6;  $P=$ .05). The second vaccine dose (boost dose) increased severe acute respiratory syndrome coronavirus 2-specific immunoglobulin G, but not immunoglobulin A, in maternal blood and breastmilk. No differences were noted in reactogenicity across the groups.

## Conclusion

Coronavirus disease 2019 messenger RNA vaccines generated robust humoral immunity in pregnant and lactating women, with immunogenicity and reactogenicity similar to that observed in nonpregnant women. Vaccine-induced immune responses were statistically significantly greater than the response to natural infection. Immune transfer to neonates occurred via placenta and breastmilk. (Author)

**Full URL:** <https://doi.org/10.1016/j.ajog.2021.03.023>

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## 2021-05252

**Care strategies before entering pregnant mothers to the operating room and after birth during COVID-19.** Moghadam MY, Beigi-khoozani A, Merajikhah A (2021), British Journal of Midwifery vol 29, no 6, June 2021, pp 348-351

Provides an overview of care strategies for pregnant women in the perinatal period during the COVID-19 pandemic. Discusses vaccination and testing during pregnancy, isolation of the newborn baby and hygiene while breastfeeding. (LDO)

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## 2021-05211

**Preliminary Findings of mRNA Covid-19 Vaccine Safety in Pregnant Persons.** Shimabukuro TT, Kim SY, Myers TR, et al (2021), The New England Journal of Medicine vol 384, no 24, 17 June 2021, pp 2273-2282

### BACKGROUND

Many pregnant persons in the United States are receiving messenger RNA (mRNA) coronavirus disease 2019 (Covid-19) vaccines, but data are limited on their safety in pregnancy.

### METHODS

From December 14, 2020, to February 28, 2021, we used data from the “v-safe after vaccination health checker” surveillance system, the v-safe pregnancy registry, and the Vaccine Adverse Event Reporting System (VAERS) to characterize the initial safety of mRNA Covid-19 vaccines in pregnant persons.

### RESULTS

A total of 35,691 v-safe participants 16 to 54 years of age identified as pregnant. Injection-site pain was reported more frequently among pregnant persons than among nonpregnant women, whereas headache, myalgia, chills, and fever were reported less frequently. Among 3958 participants enrolled in the v-safe pregnancy registry, 827 had a completed pregnancy, of which 115 (13.9%) resulted in a pregnancy loss and 712 (86.1%) resulted in a live birth (mostly among participants with vaccination in the third trimester). Adverse neonatal outcomes included preterm birth (in 9.4%) and small size for gestational age (in 3.2%); no neonatal deaths were reported. Although not directly comparable, calculated proportions of adverse pregnancy and neonatal outcomes in persons vaccinated against Covid-19 who had a completed pregnancy were similar to incidences reported in studies involving pregnant women that were conducted before the Covid-19 pandemic. Among 221 pregnancy-related adverse events reported to the VAERS, the most frequently reported event was spontaneous abortion (46 cases).

### CONCLUSIONS

Preliminary findings did not show obvious safety signals among pregnant persons who received mRNA Covid-19

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vaccines. However, more longitudinal follow-up, including follow-up of large numbers of women vaccinated earlier in pregnancy, is necessary to inform maternal, pregnancy, and infant outcomes. (Author) [Erratum: The New England Journal of Medicine, vol 385, no 16, 14 October 2021, p 1536. <https://doi.org/10.1056/NEJMx210016>]

Full URL: <https://doi.org/10.1056/NEJMoa2104983>

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#### 2021-05210

**COVID-19 vaccination in pregnancy and postpartum.** Brillo E, Tosto V, Gerli S, et al (2022), Journal of Maternal-Fetal and Neonatal Medicine vol 35, no 25, 2022, pp 6727-6746

##### Aim

To identify whether COVID-19 vaccines should be administered in pregnant and breastfeeding women by reviewing the guidance and other evidence.

##### Methods

We reviewed the COVID-19 vaccination guidance for pregnant and breastfeeding women published to date and evidence from preclinical experimental and observational clinical studies, and discuss their implications.

##### Results

Pregnant women were excluded from the initial phase 3 clinical trials of COVID-19 vaccines resulting in limited data on their efficacy and safety during pregnancy and postpartum. As a result, since December 2020, there has been conflicting advice from public health, governmental, and professional authorities on this matter. From the end of 2020 up to now, some consensus guidance has been published with a prevalent precautionary approach on the administration of vaccines in pregnant women, in breastfeeding ones, or for those who are planning a pregnancy (either spontaneously or with assisted technologies). After the first few months of vaccine administration in some countries, more permissiveness seems to prevail, although with inconsistencies. At the moment, the results obtained by preclinical experimental and observational clinical studies suggest that the risks of the maternal COVID-19 outweigh the undocumented and hypothetical risks of the COVID-19 vaccines in pregnancy. Also, until two viral vector COVID-19 vaccines were associated with very rare thromboembolic events, all guidance had agreed that all approved COVID-19 vaccines could be administered in pregnancy. Actually, some concern has been expressed.

##### Conclusion

COVID-19 vaccines administered in pregnancy can reduce the risk of severe COVID-19 and their serious consequences for mothers and their offspring. However, many aspects remain to be clarified. (Author)

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#### 2021-05204

**SARS CoV-2 (COVID-19) Current Pharmacotherapy for Mother and Infant.** Thigpen J (2021), Neonatal Network: the Journal of Neonatal Nursing vol 40, no 3, May/June 2021, pp 175-182

The novel coronavirus disease 2019 (COVID-19), appeared in the United States over 1 year ago. This virus has a wide range of presentations, from being asymptomatic to causing severe acute respiratory syndrome, which can lead to death. It has led to a worldwide effort to find effective treatments, from repurposed medications to new discoveries, as well as the push to develop effective vaccines. As the race to fight this pandemic unfolds, this column provides what is currently available to combat this virus, how it has been utilized in the pregnant population, and what data have been made available about how these treatments affect fetal development and the neonate. (Author)

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#### 2021-05023

**Expecto Patronum! Leveraging the Positive Force of COVID-19 Vaccines for Pregnant and Lactating Individuals.**

Malinowski AK, Whittle W, Murphy K, et al (2021), JOGC [Journal of Obstetrics and Gynaecology Canada] vol 43, no 10, October 2021, pp 1184-1187

For over a year, the world has been gripped by the coronavirus disease 2019 (COVID-19) pandemic, which has had far-reaching effects on society. The integrity of national health care systems has also been challenged, owing to shifts

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in guidance and misinformation. Although initial reports suggested that pregnant people were not at increased risk of severe COVID-19, current data arising from the “third wave” paint a much more concerning picture. In addition, pregnant and lactating people were excluded from vaccine trials, which has hindered the ability of health care professionals to provide evidence-based counselling regarding the safety and efficacy of the available vaccines in these populations. This commentary reviews the current data on the safety of COVID-19 vaccines in pregnancy. The evidence is clear that the risks of hospitalization and severe maternal and potentially fetal morbidity from COVID-19 in pregnancy far outweigh the very minimal risks of COVID-19 vaccination in pregnancy. (Author)

Full URL: <https://doi.org/10.1016/j.jogc.2021.04.015>

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## 2021-04956

**Maternal vaccines during the Covid-19 pandemic: A qualitative interview study with UK pregnant women.** Brigden A, Davies A, Shepherd E, et al (2021), *Midwifery* vol 100, September 2021, 103062

### Background

There is suboptimal uptake of recommended maternal vaccines (pertussis and influenza) during pregnancy in the UK. The Covid-19 pandemic has impacted healthcare services, and potentially vaccine coverage, and brought the need for new vaccines to be tested and rolled out.

### Objectives

To explore: i) the impact of the Covid-19 pandemic on pregnant women's access to, and attitudes towards, routine maternal vaccines and; ii) women's attitudes towards testing Covid-19 vaccines on pregnant women and their personal willingness to take part in such a trial.

### Design

Qualitative interview study with pregnant women in the Bristol and surrounding area (UK).

### Methods

Semi-structured telephone/videoconference interviews were conducted (following a topic guide), transcribed verbatim and subjected to thematic analysis.

### Results

Thirty-one pregnant women (selected for demographic range) were interviewed in April/May 2020. Participants felt the pandemic had elevated the importance of routine maternal vaccines, though women were concerned about safety management around appointment attendance. Women were wary of receiving a new Covid-19 vaccine, with most perceiving it as riskier than Covid-19 itself.

### Conclusions

It is important to maximise the safety and efficiency of maternity appointments to encourage uptake of routine maternal vaccines, and to communicate this well. For pregnant women to gain a new vaccine or participate in a vaccine trial, they need to be convinced that the risk posed by the virus is greater than any risk of receiving a new vaccine. (Author)

Full URL: <https://doi.org/10.1016/j.midw.2021.103062>

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## 2021-04866

**Pregnant women's perspectives on severe acute respiratory syndrome coronavirus 2 vaccine.** Carbone L, Mappa I, Sirico A, et al (2021), *American Journal of Obstetrics & Gynecology MFM* vol 3, no 4, July 2021, 100352

### BACKGROUND

Since coronavirus disease 2019 vaccines have been distributed, a debate has raised on whether pregnant women should get the vaccine. No available data exist so far regarding the safety, efficacy, and toxicology of these vaccines when administered during pregnancy. Most of the Obstetrics and Gynecology societies suggested that pregnant could

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agree to be vaccinated, after a thorough counseling of risks and benefits with their gynecologists, thus leading to an autonomous decision.

## OBJECTIVE

This study aimed to evaluate the attitude to coronavirus disease 2019 vaccination in pregnant and breastfeeding women in Italy.

## STUDY DESIGN

A survey was made at the University of Naples Federico II and the Ospedale Cristo Re, Tor Vergata University of Rome, on pregnant and breastfeeding women asking their perspectives on the available vaccines after reading the recommendations issued by our national Obstetrics, Gynecology, and Neonatology societies. The questionnaire included 12 items finalized to evaluate general features of the women and 6 items specifically correlated to their attitudes toward the severe acute respiratory syndrome coronavirus 2 vaccination. Chi-square or Fisher's exact tests were used to compare group differences of categorical variables and Wilcoxon signed rank or Mann-Whitney U test for continuous variables. The study was approved by the institutional review boards of the University of Naples Federico II (ref. no. 409/2020) and the Ospedale Cristo Re, Tor Vergata University of Rome (ref. #Ost4-2020).

## RESULTS

Most of the included women did not agree to eventually receive severe acute respiratory syndrome coronavirus 2 vaccine during pregnancy (40 [28.2%] vs 102 [71.8%]). Being pregnant was considered a determinant factor to refuse the vaccine prophylaxis (99 [69.7%] vs 43 [30.3%]; chi-square test=24.187;  $P<.001$ ), even if a very large percentage declared to be generally in favor of vaccines (128 [90.1%] vs 14 [9.9%]; chi-square test=6.091;  $P=.014$ ) and most of them confirmed they received or would receive other recommended vaccines during pregnancy (75 [52.8%] vs 67 [47.2%]; chi-square test=10.996;  $P=.001$ ).

## CONCLUSION

Urgent data are needed on the safety, efficacy, and toxicology of severe acute respiratory syndrome coronavirus 2 vaccines during pregnancy to modify this trend and to help obstetricians during the counseling. Furthermore, pregnant women should be included in future vaccine development trials to not incur again in such uncertainty.

(Author)

**Full URL:** <https://doi.org/10.1016/j.ajogmf.2021.100352>

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## 2021-04599

### **Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Antibodies in Neonatal Cord Blood After Vaccination in Pregnancy.** Gill L, Jones CW (2021), *Obstetrics & Gynecology* vol 137, no 6, June 2021, pp 894-896

#### BACKGROUND:

Studies evaluating the safety and efficacy of currently available vaccines for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) do not include pregnant participants. No data are available to counsel on vaccine safety and potential for neonatal passive immunity.

#### CASE:

A 34-year-old multigravid patient working in health care received the Pfizer-BioNTech (BNT162b2) mRNA vaccine for SARS-CoV-2 in the third trimester of pregnancy. Uncomplicated spontaneous vaginal delivery of a female neonate with Apgar scores of 9 and 9 occurred at term. The patient's blood as well as neonatal cord blood were evaluated for SARS-CoV-2-specific antibodies. Both the patient and the neonate were positive for antibodies at a titer of 1:25,600.

#### CONCLUSION:

In this case, passage of transplacental antibodies for SARS-CoV-2 was shown after vaccination in the third trimester of pregnancy. (Author)

**Full URL:** <https://doi.org/10.1097/AOG.0000000000004367>

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**2021-04580**

**Vaccination: Children [written answer].** House of Commons (2021), Hansard Written question 5192, 21 May 2021

Jo Churchill responds to a written question from Mr Jonathan Lord to the Secretary of State for Health and Social Care, regarding what lessons he has learned from the covid-19 vaccine deployment that can be applied to the routine childhood immunisation programme. (JSM)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2021-05-21/5192>

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**2021-04500**

**Maternity Colleges express concern over vaccine hesitancy in pregnant women.** Royal College of Obstetricians & Gynaecologists (2021), London: RCOG 10 June 2021

Reports that the Royal College of Obstetricians and Gynaecologists (RCOG) and the Royal College of Midwives (RCM) are urging pregnant women to seek advice from their health care professional about getting vaccinated against COVID-19, after the results of a recent survey conducted on social media revealed the majority of pregnant women declined the vaccine when it was offered to them. Concerns have been raised by the RCOG and the RCM following research which has shown pregnant women, particularly those in the third trimester, are at risk of becoming severely ill if they contract COVID-19, and this then increases the chances of prematurity and stillbirth. (JSM)

Full URL: <https://www.rcog.org.uk/en/news/maternity-colleges-express-concern-over-vaccine-hesitancy-in-pregnant-women/>

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**2021-04498**

**US college covid-19 vaccine mandates don't consider immunity or pregnancy, and may run foul of the law.** Block J (2021), BMJ vol 373, 2 June 2021, n1397

The requirement for vaccination with products under emergency use authorisation is new legal territory, finds Jennifer Block. (Author)

Full URL: <https://doi.org/10.1136/bmi.n1397>

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**2021-04135**

**Pregnancy: Coronavirus [written answer].** House of Commons (2021), Hansard Written question 7236, 25 May 2021

Nadhim Zahawi responds to a written question from Catherine West to the Secretary of State for Health and Social Care, regarding what steps his Department is taking to help ensure that pregnant women are supported to access to the covid-19 vaccine. (JSM)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2021-05-25/7236>

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**2021-04013**

**Frequently asked questions for health-care providers providing care to pregnant patients and their newborns during the COVID-19 pandemic.** Perinatal Services BC (2021), Vancouver: Perinatal Services BC 21 May 2021

Brief fact sheet aimed at health care providers on the care of pregnant women and their newborns during the COVID-19 pandemic. Includes information on women who have tested positive, placental pathology and vaccination. (LDO)

Full URL: <http://www.perinatalservicesbc.ca>

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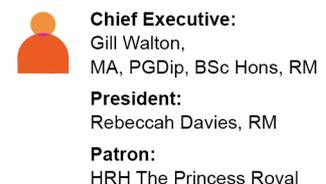
**2021-03900**

**The Effects of the COVID 19 Pandemic on Vaccine Decisions in Pregnant Women.** Gencer H, Özkan S, Vardar O, et al (2022), Women and Birth: Journal of the Australian College of Midwives vol 35, no 3, May 2022, pp 317-323

Background

Pregnancy is an important time for developing attitudes and beliefs about childhood vaccinations. Vaccinations are among the most effective way of preventing some infectious diseases. Discussions on vaccinations have increased due

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to the Covid-19 pandemic and there is an opportunity to give society correct information on vaccinations.

#### Aim

The aim of the study was to determine the opinions of pregnant women on vaccinations in pregnancy and childhood and the effect of the Covid-19 pandemic on these views.

#### Methods

The study was conducted as a cross-sectional study. The sample included 152 pregnant women. Data were collected through a 25-item online questionnaire created by the researchers.

#### Results

It was found in our study that 29.6% of pregnant women using forum websites exhibited hesitant attitudes towards vaccinations. The vaccine hesitancy rate was found to be high in pregnant women who said that their economic level was low and who worried about the risks of vaccination. The Covid-19 pandemic was reported to be the cause of a decrease in vaccine hesitancy in 28.9% of the participants.

#### Conclusion

The events surrounding the pandemic provided an opportunity to explain how pregnant women feel about vaccinations. Providing pregnant women with access to correct information from health workers may reduce the problem of trust, which is among the most important reasons for vaccine hesitancy. (Author)

**Full URL:** <https://doi.org/10.1016/j.wombi.2021.05.003>

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#### 2021-03845

**Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Vaccination in Pregnancy: Measures of Immunity and Placental Histopathology.** Shanes ED, Otero S, Mithal LB, et al (2021), *Obstetrics & Gynecology* vol 138, no 2, August 2021, pp 281-283

Receipt of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) vaccination was not associated with placental histopathologic lesions. (Author)

**Full URL:** <https://doi.org/10.1097/AOG.0000000000004457>

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#### 2021-03791

**Women perception of SARS-CoV-2 vaccination during pregnancy and subsequent maternal anxiety: a prospective observational study.** Mappa I, Luviso M, Distefano FA, et al (2022), *Journal of Maternal-Fetal and Neonatal Medicine* vol 35, no 25, 2022, pp 6302-6305

#### Objective

The use of Coronavirus 2 (SARS-CoV-2) vaccine in pregnant women is controversial and still not performed in Italy. Our objective was to evaluate the propensity of a population of Italian women to receive the vaccine and its psychological impact.

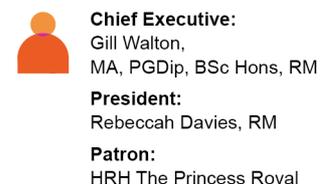
#### Methods

A prospective, observational study was performed on pregnant women attending Ospedale Cristo Re Università Roma TorVergata. A multi-section questionnaire was sent to each included woman on the first day of available SARS-CoV-2 vaccination. Part-A was finalized to acquire maternal characteristics and to test the women's perception of vaccinations in pregnancy and their fear-induced by vaccines. Part-B included the State-Trait-Anxiety-Inventory (STAI) a validated test for scoring trait anxiety (basal anxiety, STAI-T) and state anxiety (STAI-S). An abnormal value of STAI was considered when  $\geq 40$ . Comparisons of maternal variables were performed according to their vaccine attitude.

#### Results

The questionnaire was completed by 161 women (80.5% of the population considered). A positive attitude toward the vaccine was present in 136 (84.5%) women (positive) while the remaining 25.5% considered the vaccine not useful (negative). Among the former group 52.9% were favorable to obtain the vaccine during pregnancy despite the current national limitations, a percentage significantly higher ( $p = .02$ ) than in the negative groups. Women with a negative attitude to the vaccine had a lower educational ( $p = .002$ ) and employment level ( $p = .016$ ) when compared to the

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positive group. In all the women a significant increase of STAI-S from STAI-T values was evidenced ( $p < .0001$ ). The incidence of abnormal STAI T values (basal anxiety) was similar between the 2 groups ( $p = .81$ ), while there was a significant increase of STAI-S values in the negative group (negative 88.0%; vs positive 63.4%;  $p = .018$ )

#### Conclusions

The majority of pregnant women considered have a positive attitude to SARS-CoV-2 vaccine. Vaccine campaign seems to increase the maternal level of anxiety and this increase is more marked with a negative attitude toward the vaccine. (Author)

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#### 2021-03610

**Pregnancy: Coronavirus [written answer].** House of Commons (2021), Hansard Written question 1201, 13 May 2021

Nadhim Zawahi responds to a written question asked by Munira Wilson to the Secretary of State for Health and Social Care, regarding what steps he is taking to ensure that pregnant women are offered the Pfizer/BioNTech or Moderna COVID-19 vaccine. (LDO)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2021-05-13/1201>

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#### 2021-03598

**Maternal and perinatal outcomes of pregnant women with SARS-CoV-2 infection at the time of birth in England: national cohort study.** Gurol-Urganci I, Jardine JE, Carroll F, et al (2021), American Journal of Obstetrics & Gynecology (AJOG) vol 225, no 5, November 2021, pp 522.e1-522.e11

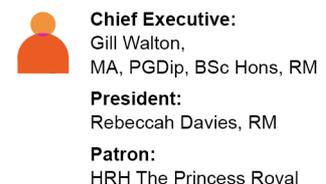
Objective: The aim of this study was to determine the association between SARS-CoV-2 infection at the time of birth and maternal and perinatal outcomes.

Methods: This is a population-based cohort study in England. The inclusion criteria were women with a recorded singleton birth between 29th May 2020 and 31st 29 January 2021 in a national database of hospital admissions. Maternal and perinatal outcomes were compared between pregnant women with a laboratory-confirmed SARS-CoV-2 infection recorded in the birth episode and those without. Study outcomes were fetal death at or beyond 24 weeks' gestation (stillbirth), preterm birth (<37 weeks gestation), small for gestational age infant (SGA; birthweight <10th centile), preeclampsia/eclampsia, induction of labor, mode of birth, specialist neonatal care, composite neonatal adverse outcome indicator, maternal and neonatal length of hospital stay following birth (3 days or more), 28-day neonatal and 42-day maternal hospital readmission. Adjusted odds ratios (aOR) and their 95% confidence interval (CI) for the association between SARS-CoV-2 infection status and outcomes were calculated using logistic regression, adjusting for maternal age, ethnicity, parity, pre-existing diabetes, pre-existing hypertension and socioeconomic deprivation measured using Index of Multiple Deprivation 2019. Models were fitted with robust standard errors to account for hospital-level clustering. The analysis of the neonatal outcomes was repeated for those born at term ( $\geq 37$  weeks' gestation) since preterm birth has been reported to be more common in pregnant women with SARS-CoV-2 infection.

Results: The analysis included 342,080 women, of whom 3,527 had laboratory confirmed SARS-CoV-2 infection. Laboratory-confirmed SARS-CoV-2 infection was more common in women who were younger, of non-white ethnicity, primiparous, residing in the most deprived areas, or had comorbidities. Fetal death (aOR, 2.21, 95% CI 1.58-3.11;  $P < 0.001$ ) and preterm birth (aOR 2.17, 95% CI 1.96-2.42;  $P < 0.001$ ) occurred more frequently in women with SARS-CoV-2 infection than those without. Risk of preeclampsia/eclampsia (aOR 1.55, 95% CI 1.29-1.85;  $P < 0.001$ ), birth by emergency Cesarean delivery (aOR 1.63, 95% CI 1.51-1.76;  $P < 0.001$ ) and prolonged admission following birth (aOR 1.57, 95% CI 1.44-1.72;  $P < 0.001$ ) were significantly higher for women with SARS-CoV-2 infection than those without. There were no significant differences in the rate of other maternal outcomes.

Risk of neonatal adverse outcome (aOR 1.45, 95% CI 1.27-1.66;  $P < 0.001$ ), need for specialist neonatal care (aOR 1.24, 95% CI 1.02-1.51;  $P = 0.03$ ) and prolonged neonatal admission following birth (aOR 1.61, 95% CI 1.49-1.75;  $P < 0.001$ ) were all significantly higher for infants with mothers with laboratory-confirmed SARS-CoV-2 infection. When the analysis was restricted to pregnancies delivered at term ( $\geq 37$  weeks), there were no significant differences in neonatal adverse outcome ( $P = 0.78$ ), need for specialist neonatal care after birth ( $P = 0.22$ ) or neonatal readmission within four weeks of

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birth (P=0.05). Neonates born at term to mothers with laboratory-confirmed SARS-CoV-2 infection were more likely to have prolonged admission following birth (21.1% compared to 14.6%, aOR 1.61, 95% CI 1.49-1.75; P<0.001).

Conclusions: SARS-CoV-2 infection at the time of birth is associated with higher rates of fetal death, preterm birth, preeclampsia and emergency Cesarean delivery. There were no additional adverse neonatal outcomes, other than those related to preterm delivery. Pregnant women should be counseled regarding risks of SARS-COV-2 infection and should be considered a priority for vaccination. (Author)

Full URL: <https://doi.org/10.1016/i.ajog.2021.05.016>

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#### 2021-03458

**Covid-19: Pregnant women should be offered Pfizer or Moderna vaccine, says UK advisory committee.** Mahase E (2021), BMJ vol 373, no 8288, 19 April 2021, n1013

Pregnant women should be offered the Pfizer BioNTech or Moderna covid-19 vaccine at the same time as the rest of the population, with priority based on age and clinical risk group, the government's vaccine advisory committee has said. (Author)

Full URL: <https://doi.org/10.1136/bmj.n1013>

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#### 2021-03246

**Advocate for the COVID-19 Vaccine for Pregnant and Breastfeeding Women.** Spatz DL (2021), MCN - American Journal of Maternal/Child Nursing vol 46, no 3, May/June 2021, p 178

Many professional organizations and agencies have advocated for pregnant women and breastfeeding women to be offered the COVID-19 vaccine. Our breastfeeding expert, Dr. Spatz, reviews their recommendations and ways nurses can advocate for this population to receive the vaccine. (Author)

Full URL: <https://doi.org/10.1097/NMC.0000000000000719>

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#### 2021-03147

**Covid and pregnancy - should you get the vaccine?.** Foster L (2021), BBC News 7 May 2021

As the Covid vaccine is rolled out to younger age groups, what should you do if you're expecting a baby?

The guidance for pregnant people in the UK was changed last month following new data from the USA involving the Pfizer and Moderna vaccines.

BBC News Health Reporter Laura Foster looks at what the science says. (Author)

Full URL: <https://www.bbc.co.uk/news/av/health-57013743>

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#### 2021-02984

**Antibody Response to Coronavirus Disease 2019 (COVID-19) Messenger RNA Vaccination in Pregnant Women and Transplacental Passage Into Cord Blood.** Prabhu M, Murphy EA, Sukhu AC, et al (2021), Obstetrics & Gynecology vol 138, no 2, August 2021, pp 278-280

Coronavirus disease 2019 (COVID-19) vaccination in pregnancy induces a robust maternal immune response, with transplacental antibody transfer detectable in cord blood as early as 16 days after the first dose. (Author)

Full URL: <https://doi.org/10.1097/AOG.0000000000004438>

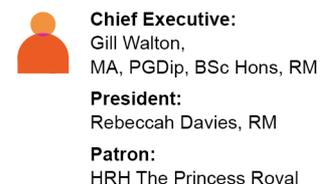
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#### 2021-02946

**JCVI gives green light for pregnant women to be offered Covid-19 vaccine.** Mitchell G (2021), Nursing Times 16 April 2021, online

Pregnant women will be offered the Covid-19 vaccine at the same time as their peers in the wider population following a change in guidance announced today. (Author)

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## 2021-02918

**Severe acute respiratory syndrome coronavirus 2 serology levels in pregnant women and their neonates.** Kubiak JM, Murphy EA, Yee J, et al (2021), American Journal of Obstetrics & Gynecology (AJOG) vol 225, no 1, July 2021, pp 73.e1-73.e7

### Background

Pregnant women and their neonates represent 2 vulnerable populations with an interdependent immune system that are highly susceptible to viral infections. The immune response of pregnant women to severe acute respiratory syndrome coronavirus 2 and the interplay of how the maternal immune response affects the neonatal passive immunity have not been studied systematically.

### Objective

We characterized the serologic response in pregnant women and studied how this serologic response correlates with the maternal clinical presentation and with the rate and level of passive immunity that the neonate received from the mother.

### Study Design

Women who gave birth and who tested positive for immunoglobulin M or immunoglobulin G against severe acute respiratory syndrome coronavirus 2 using semiquantitative detection in a New York City hospital between March 22, 2020, and May 31, 2020, were included in this study. A retrospective chart review of the cases that met the inclusion criteria was conducted to determine the presence of coronavirus disease 2019 symptoms and the use of oxygen support. Serology levels were compared between the symptomatic and asymptomatic patients using a Welch 2 sample t test. Further chart review of the same patient cohort was conducted to identify the dates of self-reported onset of coronavirus disease 2019 symptoms and the timing of the peak immunoglobulin M and immunoglobulin G antibody levels after symptom onset was visualized using local polynomial regression smoothing on log<sub>2</sub>-scaled serologic values. To study the neonatal serology response, umbilical cord blood samples of the neonates born to the subset of serology positive pregnant women were tested for serologic antibody responses. The maternal antibody levels of serology positive vs the maternal antibody levels of serology negative neonates were compared using the Welch 2 sample t test. The relationship between the quantitative maternal and quantitative neonatal serologic data was studied using a Pearson correlation and linear regression. A multiple linear regression analysis was conducted using maternal symptoms, maternal serology levels, and maternal use of oxygen support to determine the predictors of neonatal immunoglobulin G levels.

### Results

A total of 88 serology positive pregnant women were included in this study. The antibody levels were higher in symptomatic pregnant women than in asymptomatic pregnant women. Serology studies in 34 women with symptom onset data revealed that the maternal immunoglobulin M and immunoglobulin G levels peak around 15 and 30 days after the onset of coronavirus disease 2019 symptoms, respectively. Furthermore, studies of 50 neonates born to this subset of serology positive women showed that passive immunity in the form of immunoglobulin G is conferred in 78% of all neonates. The presence of passive immunity is dependent on the maternal antibody levels, and the levels of neonatal immunoglobulin G correlate with maternal immunoglobulin G levels. The maternal immunoglobulin G levels and maternal use of oxygen support were predictive of the neonatal immunoglobulin G levels.

### Conclusion

We demonstrated that maternal serologies correlate with symptomatic maternal infection, and higher levels of maternal antibodies are associated with passive neonatal immunity. The maternal immunoglobulin G levels and maternal use of oxygen support, a marker of disease severity, predicted the neonatal immunoglobulin G levels. These data will further guide the screening for this uniquely linked population of mothers and their neonates and can aid in developing maternal vaccination strategies. (Author)

Full URL: <https://doi.org/10.1016/j.ajog.2021.01.016>

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## 2021-02906

**The coronavirus disease 2019 vaccine in pregnancy: risks, benefits, and recommendations.** Stafford IA, Parchem JG, Sibai

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The coronavirus disease 2019 has caused over 2 million deaths worldwide, with over 412,000 deaths reported in United States. To date, at least 57,786 pregnant women in the United States have been infected, and 71 pregnant women have died. Although pregnant women are at higher risk of severe coronavirus disease 2019–related illness, clinical trials for the available vaccines excluded pregnant and lactating women. The safety and efficacy of the vaccines for pregnant women, the fetus, and the newborn remain unknown. A review of maternal and neonatal coronavirus disease 2019 morbidity and mortality data along with perinatal vaccine safety considerations are presented to assist providers with shared decision-making regarding vaccine administration for this group, including the healthcare worker who is pregnant, lactating, or considering pregnancy. The coronavirus disease 2019 vaccine should be offered to pregnant women after discussing the lack of safety data, with preferential administration for those at highest risk of severe infection, until safety and efficacy of these novel vaccines are validated. (Author)

Full URL: <https://doi.org/10.1016/j.ajog.2021.01.022>

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## 2021-02901

**Balancing risks: making decisions for maternal treatment without data on fetal safety.** Minkoff H, Ecker J (2021), American Journal of Obstetrics & Gynecology (AJOG) vol 224, no 5, May 2021, pp 479-483

Challenges arise when treatment to improve maternal health brings the possibility of risk to fetal health. The coronavirus disease 2019 (COVID-19) vaccine is the most recent, but hardly the only, example. Because pregnant patients are often specifically excluded from trials of new therapies, this is often the dilemma that patients and providers face when considering new treatments. In this study, we used the COVID-19 vaccine as an exemplar to question the broader issue of how society, in general, and obstetricians, in particular, should balance obligations to pregnant women's right of access to new therapeutic agents with the physician's desire to protect the fetus from potential risks. We will argue that in almost all circumstances (with few exceptions, as will also be discussed), maternal benefit and respect for autonomy create the uncertainty that absent safety data bring. Consequently, if pregnant women choose to try new interventions and treatments, such as the COVID-19 vaccination, they should be offered those new regimens and their decision supported. In addition, we will argue that the right solution to avoid the dilemma of absent data is to include pregnant individuals in clinical trials studying new treatments, drugs, and other therapies. We will also discuss the basis for our opinion, which are mainstream obstetrical ethics, precedents in law (supreme court ruling that forbids companies to exclude women from jobs that might pose a risk to the fetus), and historic events (thalidomide). The ethical framework includes the supposition that sacrifice to improve fetal outcome is a virtue and not a mandate. Denying a pregnant patient treatment because of threats to their life can create absurd and paradoxical consequences. Either requiring abortion or premature delivery before proceeding with treatments to optimize maternal health, or risking a patient's own life and ability to parent a child by delaying treatment brings clear and significant risks to fetal and/or neonatal outcomes. With rare exceptions, properly and ethically balancing such consequential actions cannot be undertaken without considering the values and goals of the pregnant patient. Therefore, active participation of both the pregnant patient and their physician in shared decision making is needed. (Author)

Full URL: <https://doi.org/10.1016/j.ajog.2021.01.025>

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## 2021-02900

**Professionally responsible coronavirus disease 2019 vaccination counseling of obstetrical and gynecologic patients.**

Chervenak FA, McCullough LB, Bornstein E, et al (2021), American Journal of Obstetrics & Gynecology (AJOG) vol 224, no 5, May 2021, pp 470-478

The development of coronavirus disease 2019 vaccines in the current and planned clinical trials is essential for the success of a public health response. This paper focuses on how physicians should implement the results of these clinical trials when counseling patients who are pregnant, planning to become pregnant, breastfeeding or planning to breastfeed about vaccines with government authorization for clinical use. Determining the most effective approach to counsel patients about coronavirus disease 2019 vaccination is challenging. We address the professionally responsible counseling of 3 groups of patients—those who are pregnant, those planning to become pregnant, and those breastfeeding or planning to breastfeed. We begin with an evidence-based account of the following 5 major

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challenges: the limited evidence base, the documented increased risk for severe disease among pregnant coronavirus disease 2019-infected patients, conflicting guidance from government agencies and professional associations, false information about coronavirus disease 2019 vaccines, and maternal mistrust and vaccine hesitancy. We subsequently provide evidence-based, ethically justified, practical guidance for meeting these challenges in the professionally responsible counseling of patients about coronavirus disease 2019 vaccination. To guide the professionally responsible counseling of patients who are pregnant, planning to become pregnant, and breastfeeding or planning to breastfeed, we explain how obstetrician-gynecologists should evaluate the current clinical information, why a recommendation of coronavirus disease 2019 vaccination should be made, and how this assessment should be presented to patients during the informed consent process with the goal of empowering them to make informed decisions. We also present a proactive account of how to respond when patients refuse the recommended vaccination, including the elements of the legal obligation of informed refusal and the ethical obligation to ask patients to reconsider. During this process, the physician should be alert to vaccine hesitancy, ask patients to express their hesitation and reasons for it, and respectfully address them. In contrast to the conflicting guidance from government agencies and professional associations, evidence-based professional ethics in obstetrics and gynecology provides unequivocal and clear guidance: Physicians should recommend coronavirus disease 2019 vaccination to patients who are pregnant, planning to become pregnant, and breastfeeding or planning to breastfeed. To prevent widening of the health inequities, build trust in the health benefits of vaccination, and encourage coronavirus disease 2019 vaccine and treatment uptake, in addition to recommending coronavirus disease 2019 vaccinations, physicians should engage with communities to tailor strategies to overcome mistrust and deliver evidence-based information, robust educational campaigns, and novel approaches to immunization. (Author)

Full URL: <https://doi.org/10.1016/j.ajog.2021.01.027>

## 2021-02893

**Higher severe acute respiratory syndrome coronavirus 2 infection rate in pregnant patients.** Lokken EM, Taylor G, Huebner EM, et al (2021), American Journal of Obstetrics & Gynecology (AJOG) vol 225, no 1, July 2021, pp 75.e1-75.e16

### Background

During the early months of the coronavirus disease 2019 pandemic, risks associated with severe acute respiratory syndrome coronavirus 2 in pregnancy were uncertain. Pregnant patients can serve as a model for the success of clinical and public health responses during public health emergencies as they are typically in frequent contact with the medical system. Population-based estimates of severe acute respiratory syndrome coronavirus 2 infections in pregnancy are unknown because of incomplete ascertainment of pregnancy status or inclusion of only single centers or hospitalized cases. Whether pregnant women were protected by the public health response or through their interactions with obstetrical providers in the early months of pandemic is not clearly understood.

### Objective

This study aimed to estimate the severe acute respiratory syndrome coronavirus 2 infection rate in pregnancy and to examine the disparities by race and ethnicity and English language proficiency in Washington State.

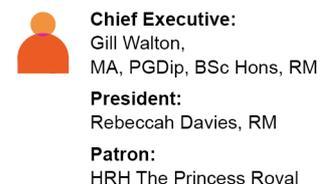
### Study Design

Pregnant patients with a polymerase chain reaction–confirmed severe acute respiratory syndrome coronavirus 2 infection diagnosed between March 1, 2020, and June 30, 2020 were identified within 35 hospitals and clinics, capturing 61% of annual deliveries in Washington State. Infection rates in pregnancy were estimated overall and by Washington State Accountable Community of Health region and cross-sectionally compared with severe acute respiratory syndrome coronavirus 2 infection rates in similarly aged adults in Washington State. Race and ethnicity and language used for medical care of pregnant patients were compared with recent data from Washington State.

### Results

A total of 240 pregnant patients with severe acute respiratory syndrome coronavirus 2 infections were identified during the study period with 70.7% from minority racial and ethnic groups. The principal findings in our study were as follows: (1) the severe acute respiratory syndrome coronavirus 2 infection rate was 13.9 per 1000 deliveries in pregnant patients (95% confidence interval, 8.3–23.2) compared with 7.3 per 1000 (95% confidence interval, 7.2–7.4) in adults aged 20 to 39 years in Washington State (rate ratio, 1.7; 95% confidence interval, 1.3–2.3); (2) the severe acute respiratory syndrome coronavirus 2 infection rate reduced to 11.3 per 1000 deliveries (95% confidence interval,

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6.3–20.3) when excluding 45 cases of severe acute respiratory syndrome coronavirus disease 2 detected through asymptomatic screening (rate ratio, 1.3; 95% confidence interval, 0.96–1.9); (3) the proportion of pregnant patients in non-White racial and ethnic groups with severe acute respiratory syndrome coronavirus disease 2 infection was 2- to 4-fold higher than the race and ethnicity distribution of women in Washington State who delivered live births in 2018; and (4) the proportion of pregnant patients with severe acute respiratory syndrome coronavirus 2 infection receiving medical care in a non-English language was higher than estimates of pregnant patients receiving care with limited English proficiency in Washington State (30.4% vs 7.6%).

#### Conclusion

The severe acute respiratory syndrome coronavirus 2 infection rate in pregnant people was 70% higher than similarly aged adults in Washington State, which could not be completely explained by universal screening at delivery. Pregnant patients from nearly all racial and ethnic minority groups and patients receiving medical care in a non-English language were overrepresented. Pregnant women were not protected from severe acute respiratory syndrome coronavirus 2 infection in the early months of the pandemic. Moreover, the greatest burden of infections occurred in nearly all racial and ethnic minority groups. These data coupled with a broader recognition that pregnancy is a risk factor for severe illness and maternal mortality strongly suggested that pregnant people should be broadly prioritized for coronavirus disease 2019 vaccine allocation in the United States similar to some states. (Author)

**Full URL:** <https://doi.org/10.1016/j.ajog.2021.02.011>

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#### 2021-02795

**Vaccine Update.** Public Health England (2021), London: PHE no 319, April 2021

This special edition of Vaccine Update includes information on COVID-19 vaccination guidelines and deliveries. It highlights the advice given to pregnant women about the risks and benefits of vaccination. (LDO)

**Full URL:** <https://www.gov.uk/government/publications/vaccine-update-issue-319-april-2021-covid-19-phase-2-special-edition/vaccine-update-issue-319-april-2021-covid-19-phase-2-special-edition>

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#### 2021-02705

**Pregnancy: Employment [written answer].** House of Commons (2021), Hansard Written question 185871, 22 April 2021

Ms Nadine Dorries responds to a written question from the Secretary of State for Health and Social Care, with reference to the new advice on covid-19 vaccination for pregnant women from Public Health England issued on 16 April 2021, what steps he is taking to issue updated guidance for pregnant employees; and when that guidance will be available. (Author, edited)

**Full URL:** <https://questions-statements.parliament.uk/written-questions/detail/2021-04-22/185871>

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#### 2021-02690

**Coronavirus: Vaccination [written answer].** House of Commons (2021), Hansard Written question 137241, 13 January 2021

Nadhim Zahawi responds to a written question from Rachael Maskell to the Secretary of State for Health and Social Care, regarding what discussions he has had with Public Health England on requiring NHS and social care staff to have the covid-19 vaccine in order to keep patients and care residents safe. (JSM)

**Full URL:** <https://questions-statements.parliament.uk/written-questions/detail/2021-01-13/137241>

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#### 2021-02511

**SOGC Statement on the COVID-19 vaccines and rare adverse outcomes of thrombosis associated with low platelets.**

Society of Obstetricians and Gynaecologists of Canada (2021), Ottawa, Canada: SOGC 20 April 2021

Statement from the Society of Obstetricians and Gynaecologists of Canada (SOGC) on COVID-19 vaccination in pregnancy and rare adverse outcomes. SOGC supports the use of all available COVID-19 vaccines approved in Canada in any pregnancy trimester and during breastfeeding in accordance with regional eligibility. (LDO)

**Full URL:** [https://sogc.org/common/Uploaded%20files/Latest%20News/EN\\_Statement-COVID-19\\_vaccines\\_rare\\_adverse\\_thrombosis.pdf](https://sogc.org/common/Uploaded%20files/Latest%20News/EN_Statement-COVID-19_vaccines_rare_adverse_thrombosis.pdf)

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## 2021-02301

**SARS-CoV-2–Specific Antibodies in Breast Milk After COVID-19 Vaccination of Breastfeeding Women.** Perl SH, Uzan-Yulzari A, Klainer H, et al (2021), JAMA (Journal of the American Medical Association) vol 325, no 19, 18 May 2021, pp 2013-2014

Research letter exploring whether maternal immunisation results in secretion of SARS-CoV-2 antibodies into breast milk, and evaluating any potential adverse outcomes among women and their infants. (LDO)

Full URL: <https://doi.org/10.1001/jama.2021.5782>

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## 2021-02083

**Pregnant women should be offered Covid vaccine.** Anon (2021), BBC News 17 April 2021

Pregnant women should be offered a Covid jab when other people their age get one, the UK's vaccine advisers say.

(Author)

Full URL: <https://www.bbc.co.uk/news/health-56778146>

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## 2021-02064

**Pregnant People's Paradox—Excluded From Vaccine Trials Despite Having a Higher Risk of COVID-19 Complications.**

Rubin R (2021), JAMA (Journal of the American Medical Association) Vol 325, no 11, 16 March 2021, pp 1027-1028

This Medical News Quick Uptake discusses the evidence in favor of administering COVID-19 vaccines to pregnant individuals.

Full URL: <https://doi.org/10.1001/jama.2021.2264>

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## 2021-02063

**Involving Pregnant Individuals in Clinical Research on COVID-19 Vaccines.** Bianchi DW, Kaeser L, Cernich AN (2021), JAMA (Journal of the American Medical Association) Vol 325, no 11, 16 March 2021, pp 1041-1042

This Viewpoint from the National Institute of Child Health and Human Development emphasizes the need to use existing data sources and develop partnerships, infrastructure, and ethical and regulatory standards to generate data about the safety and efficacy of COVID-19 vaccination in pregnant individuals.

Full URL: <https://doi.org/10.1001/jama.2021.1865>

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## 2021-02062

**Pregnancy, Postpartum Care, and COVID-19 Vaccination in 2021.** Rasmussen SA, Jamieson DJ (2021), JAMA (Journal of the American Medical Association) Vol 325, no 11, 16 March 2021, pp 1099-1100

This JAMA Insights review summarizes the epidemiology of SARS-CoV-2 infection in pregnant and lactating women, its effects on perinatal outcomes, and compiles guidance from the CDC, FDA, and obstetrics-gynecology specialty organizations on the safety of coronavirus vaccines during pregnancy and while breastfeeding.

Full URL: <https://doi.org/10.1001/jama.2021.1683>

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## 2021-02061

**COVID-19 Vaccination in Pregnant and Lactating Women.** Adhikari EH, Spong CY (2021), JAMA (Journal of the American Medical Association) Vol 325, no 11, 16 March 2021, pp 1039-1040

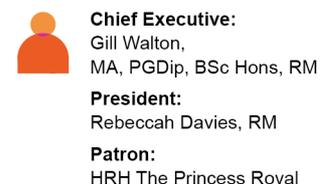
This Viewpoint discusses the need for shared decision-making when counseling pregnant and nursing women about the unstudied benefits and risks COVID-19 vaccination, calling for rigorously designed studies with real-time, proactive data collection to establish evidence as quickly as possible about coronavirus vaccine safety in mothers and their infants.

Full URL: <https://doi.org/10.1001/jama.2021.1658>

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## 2021-01663

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**COVID-19 vaccination guidance.** Australian Breastfeeding Association, New Zealand Breastfeeding Alliance, Royal Australian and New Zealand College of Obstetricians and Gynaecologists (2021), Australian Breastfeeding Association 6 April 2021

Up to date information for breastfeeding mothers about compatibility of the COVID-19 vaccine with breastfeeding.

The guidance, in the form of an infographic, was launched by the Australian Breastfeeding Association (ABA), the New Zealand Breastfeeding Alliance (NZBA) and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG). (Author)

**Full URL:** <https://www.breastfeeding.asn.au/system/files/RANZCOG-ABA-NZBA%20COVID-19%20vaccination%20and%20breastfeeding%20infographic%20final.pdf>

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#### 2021-01597

**'No evidence' Covid-19 vaccine will affect fertility, say unions.** Ford M (2021), Nursing Times 21 January 2021

Leading unions have come together to put a stop to misinformation that appears to be circulating in relation to Covid-19 vaccines and fertility. (Author)

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#### 2021-01453

**Coronavirus Disease 2019 (COVID-19) Vaccines and Pregnancy: What Obstetricians Need to Know.** Rasmussen SA, Kelley CF, Horton JP, et al (2021), Obstetrics & Gynecology vol 137, no 3, March 2021, pp 408-414

Coronavirus disease 2019 (COVID-19) vaccines have begun to be distributed across the United States and to be offered initially to priority groups including health care personnel and persons living in long-term care facilities. Guidance regarding whether pregnant persons should receive a COVID-19 vaccine is needed. Because pregnant persons were excluded from the initial phase 3 clinical trials of COVID-19 vaccines, limited data are available on their efficacy and safety during pregnancy. After developmental and reproductive toxicology studies are completed, some companies are expected to conduct clinical trials in pregnant persons. Until then, pregnant persons and their obstetricians will need to use available data to weigh the benefits and risks of COVID-19 vaccines. Issues to be considered when counseling pregnant persons include data from animal studies and inadvertently exposed pregnancies during vaccine clinical trials when available, potential risks to pregnancy of vaccine reactogenicity, timing of vaccination during pregnancy, evidence for safety of other vaccines during pregnancy, risk of COVID-19 complications due to pregnancy and the pregnant person's underlying conditions, and risk of exposure to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and potential for risk mitigation. The Centers for Disease Control and Prevention, the American College of Obstetricians and Gynecologists, and the Society for Maternal-Fetal Medicine have each issued guidance supportive of offering COVID-19 vaccine to pregnant persons. As additional information from clinical trials and from data collected on vaccinated pregnant persons becomes available, it will be critical for obstetricians to keep up to date with this information. (Author) [Erratum: Obstetrics & Gynecology, vol 137, no 5, May 2021, p 962]

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#### 2021-01434

**Newborn antibodies to SARS-CoV-2 detected in cord blood after maternal vaccination – a case report.** Paul G, Chad R (2021), BMC Pediatrics vol 21, no 138, 22 March 2021

##### Background

Maternal vaccination for Influenza and Tetanus, Diphtheria, acellular Pertussis (TDaP) have been well studied in terms of safety and efficacy for protection of the newborn by placental passage of antibodies. Similar newborn protection would be expected after maternal vaccination against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus responsible for coronavirus disease 2019 (COVID-19). There is a significant and urgent need for research regarding safety and efficacy of vaccination against SARS-CoV-2 during pregnancy.

##### Case presentation

A vigorous, healthy, full-term female was born to a COVID-19 naïve mother who had received a single dose of messenger RNA (mRNA) vaccine for SARS-CoV-2 3 weeks prior to delivery. IgG cord blood antibodies were detected to SARS-CoV-2 at the time of birth.

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## Conclusion

Here, we report the first known case of an infant with SARS-CoV-2 IgG antibodies detectable in cord blood after maternal vaccination. (Author)

Full URL: <https://doi.org/10.1186/s12887-021-02618-y>

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## 20210125-14\*

**Vaccination: Coronavirus [written answer].** House of Commons (2021), Hansard Written question 137333, 13 January 2021

Ms Nadine Dorries responds to a written question from Marco Longhi to the Secretary of State for Health and Social Care, regarding whether his Department has made an assessment of the potential effect of covid-19 vaccines on fertility. (JSM)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2021-01-13/137333>

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## 20210108-2\*

**Coronavirus latest: Young women are the unlikely new face of vaccine resistance.** Speed B (2021), iNews 6 January 2021

News item reporting that young women between the ages of 18 and 34 are the most likely population group to refuse the Pfizer/BioNTech COVID-19 vaccine, amid fears sparked by misinformation concerning damage to their fertility. States that no study has been undertaken to support this claim, and Dr Victoria Male, a lecturer in reproductive immunology at Imperial College London, has said that it is not usual for full fertility studies to be undertaken before vaccines and medications are rolled out because of the length of time this would take. States that this vaccine could be particularly important for women who are planning a pregnancy, because pregnancy and COVID-19 put pressure on the lungs and heart. (JSM)

Full URL: <https://inews.co.uk/news/health/coronavirus-latest-experts-debunk-vaccine-fertility-myths-women-819783>

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## 20210106-22\*

**Considerations for COVID-19 Vaccination in Lactation.** Stuebe A (2021), Breastfeeding Medicine vol 16, no 1, January 2021, p 2

Statement from the Academy of Breastfeeding Medicine on the safety of the Pfizer/BioNtech and Moderna mRNA vaccines for breastfeeding women. Recommends that future research studies include pregnant and lactating participants. (LDO)

Full URL: <https://doi.org/10.1089/bfm.2020.29172.abm>

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## 20210106-21\*

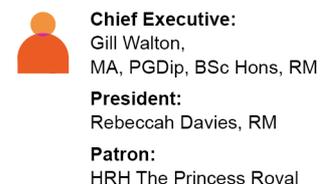
**President's Corner: Introduction to ABM's Statement on Considerations for COVID-19 Vaccination in Lactation.** Stuebe A (2021), Breastfeeding Medicine vol 16, no 1, January 2021, p 1

The recent emergency use authorization of novel mRNA vaccines to prevent COVID-19 is a triumph for science. Less than a year after the SARS-CoV-2 virus was first identified, we have a 95% effective vaccine in production. There is much to celebrate, and there is also a yawning gap: phase 3 trials of these novel mRNA-based vaccines excluded pregnant and lactating women. This void is the product of decisions made >40 years ago to exclude pregnant and lactating women from research, with the goal of avoiding any risk to the fetus or nursing child. In the short term, this strategy avoided liability; in the long term, it has left providers and patients without clinical data to make informed decisions. Without clinical data, the Academy of Breastfeeding Medicine relied on biological plausibility and expert opinion to craft a statement on considerations for mRNA COVID-19 vaccines during lactation. The available information is reassuring; however, pregnant and lactating people deserve better than plausibility to guide medical decisions. Henceforward, phase 3 clinical trials should routinely include pregnant and lactating participants. It is time to protect pregnant and breastfeeding individuals through research, not from research. (Author)

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## 20210105-34\*

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**Coronavirus disease 2019 vaccines in pregnancy.** Craig AM, Hughes BL, Swamy GK (2021), American Journal of Obstetrics & Gynecology MFM vol 3, no 2, March 2021, 100295

As of December 1, 2020, nearly 64 million people have been infected with COVID-19 worldwide with nearly 1.5 million global deaths. The impact of this virus has continued to overwhelm hospital infrastructure and demanded remodeling of healthcare systems. With rising concerns for a third, and possibly the largest, wave of infected individuals, national leaders are continuing to seek avenues by which we can further limit disease transmission and prevent infection with the use of vaccination. To our knowledge, no clinical trial evaluating vaccines to prevent COVID-19 has included pregnant women. By December 2020, it's anticipated that the FDA will approve at least one or two mRNA-based COVID-19 vaccine under emergency use authorization (EUA) based on Phase 3 clinical trial efficacy data. Both Pfizer and Moderna have manufactured mRNA-based vaccines with 95% and 94.1% efficacy against COVID-19. [1, 2] AstraZeneca has manufactured a vaccine using a viral-vector demonstrating early efficacy as well and this next generation platform has previously been utilized with the Ebola vaccine and safely administered during pregnancy with an acceptable safety profile [3]. Approval of these vaccines will have a tremendous impact on the ongoing pandemic, yet there remains a lack of data for use of COVID-19 vaccine in pregnant women. In this article we seek to discuss the available data regarding treatment and prevention of COVID-19 in pregnancy and address the growing questions regarding how best to approach vaccine access and administration in the pregnant population. (Author)

Full URL: <https://doi.org/10.1016/j.ajogmf.2020.100295>

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#### 20210104-22\*

**Coronavirus: Vaccination [written answer].** House of Commons (2020), Hansard Written question 126063, 7 December 2020  
Nadhim Zahawi responds to a written question from Alison Thewliss the Secretary of State for Health and Social Care, regarding what the Government's official advice is on covid-19 vaccination for people who are (a) pregnant and (b) lactating. (JSM)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2020-12-07/126063>

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#### 20210104-21\*

**Coronavirus: Vaccination [written answer].** House of Commons (2020), Hansard Written question 124187, 2 December 2020  
Nadhim Zahawi responds to a written question from Jim Shannon to the Secretary of State for Health and Social Care, whether it is his policy that (a) the elderly and (b) pregnant women will receive the covid-19 vaccine first. (JSM)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2020-12-02/124187>

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#### 20210104-13\*

**Pregnancy: Coronavirus [written answer].** House of Lords (2020), Hansard Written question HL11361, 10 December 2020  
Lord Bethell responds to a written question from Baroness Manzoor to Her Majesty's Government, regarding what research they have undertaken on the impact of the COVID-19 (1) virus, and (2) vaccines, on the development of embryos in the (a) first, (b) second, and (c) third, trimesters of pregnancy. (JSM)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2020-12-10/HL11361>

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#### 2021-00859

**Baby Care Units: Coronavirus [written answer].** House of Commons (2020), Hansard Written question 126073, 7 December 2020

Nadhim Zahawi responds to a written question asked by Vicky Foxcroft to the Secretary of State for Health and Social Care, regarding whether parents of babies in neonatal units will be given priority access to a COVID-19 vaccination. (LDO)

Full URL: <https://questions-statements.parliament.uk/written-questions/detail/2020-12-07/126073>

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#### 2021-00766

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**Equity in coronavirus disease 2019 vaccine development and deployment.** Modi N, Ayres-de-Campos D, Bancalari E, et al (2021), American Journal of Obstetrics & Gynecology (AJOG) vol 224, no 5, May 2021, pp 423-427

The coronavirus disease 2019 pandemic exposed weaknesses in multiple domains and widened gender-based inequalities across the world. It also stimulated extraordinary scientific achievement by bringing vaccines to the public in less than a year. In this article, we discuss the implications of current vaccination guidance for pregnant and lactating women, if their exclusion from the first wave of vaccine trials was justified, and if a change in the current vaccine development pathway is necessary. Pregnant and lactating women were not included in the initial severe acute respiratory syndrome coronavirus 2 vaccine trials. Therefore, perhaps unsurprisingly, the first vaccine regulatory approvals have been accompanied by inconsistent advice from public health, governmental, and professional authorities around the world. Denying vaccination to women who, although pregnant or breastfeeding, are fully capable of autonomous decision making is a throwback to a paternalistic era. Conversely, lack of evidence generated in a timely manner, upon which to make an informed decision, shifts responsibility from research sponsors and regulators and places the burden of decision making upon the woman and her healthcare advisor. The World Health Organization, the Task Force on Research Specific to Pregnant Women and Lactating Women, and others have highlighted the long-standing disadvantage experienced by women in relation to the development of vaccines and medicines. It is uncertain whether there was sufficient justification for excluding pregnant and lactating women from the initial severe acute respiratory syndrome coronavirus 2 vaccine trials. In future, we recommend that regulators mandate plans that describe the development pathway for new vaccines and medicines that address the needs of women who are pregnant or lactating. These should incorporate, at the outset, a careful consideration of the balance of the risks of exclusion from or inclusion in initial studies, patient and public perspectives, details of “developmental and reproductive toxicity” studies, and approaches to collect data systematically from participants who are unknowingly pregnant at the time of exposure. This requires careful consideration of any previous knowledge about the mode of action of the vaccine and the likelihood of toxicity or teratogenicity. We also support the view that the default position should be a “presumption of inclusion,” with exclusion of women who are pregnant or lactating only if justified on specific, not generic, grounds. Finally, we recommend closer coordination across countries with the aim of issuing consistent public health advice. (Author)

**Full URL:** <https://doi.org/10.1016/j.ajog.2021.01.006>

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#### 2021-00761

**Inclusion of pregnant individuals among priority populations for coronavirus disease 2019 vaccination for all 50 states in the United States.** Grünebaum A, McCullough LB, Litvak A, et al (2021), American Journal of Obstetrics & Gynecology (AJOG) vol 224, no 5, May 2021, pp 536-539

Research letter exploring whether pregnant women were uniformly included in priority COVID-19 vaccination phase one allocations across the United States of America. Results demonstrate substantial variations in how pregnancy is classified for COVID-19 vaccination. (LDO)

**Full URL:** <https://doi.org/10.1016/j.ajog.2021.01.026>

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#### 2021-00217

**Pregnancy, breastfeeding and the SARS-CoV-2 vaccine: an ethics-based framework for shared decision-making.**

Zipursky JS, Greenberg RA, Maxwell C, et al (2021), Canadian Medical Association Journal (CMAJ) vol 193, no 7, 16 February 2021, 202833

Proposes that women who are pregnant or breastfeeding should be offered the SARS-CoV-2 vaccine on ethical grounds, and discusses how health care providers and patients can use a shared decision-making approach to guide these discussions. (Author, edited)

**Full URL:** <https://doi.org/10.1503/cmaj.202833>

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#### 20201221-1\*

**SOGC Statement on COVID-19 Vaccination in Pregnancy [Reaffirmed 3 March 2021].** Society of Obstetricians and Gynaecologists of Canada (2020), Ottawa, Canada: SOGC 18 December 2020

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Consensus statement from the Society of Obstetricians and Gynaecologists of Canada (SOGC) on COVID-19 vaccination in pregnancy. Recommends that the COVID-19 vaccine should be offered as the documented risk of not getting the vaccine outweighs the theorised risk of being vaccinated during pregnancy or while breastfeeding. (LDO)

**Full URL:** [https://www.sogc.org/common/Uploaded%20files/Latest%20News/SOGC\\_Statement\\_COVID-19\\_Vaccination\\_in\\_Pregnancy.pdf](https://www.sogc.org/common/Uploaded%20files/Latest%20News/SOGC_Statement_COVID-19_Vaccination_in_Pregnancy.pdf)

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#### 20201218-24\*

**Safety of COVID-19 vaccines when given in pregnancy [Last updated 30 April 2021].** Public Health England (2020), London: PHE 18 December 2020

This advice provides information on the safety of COVID-19 vaccines when given in pregnancy. It is designed for health professionals to share with women who were vaccinated before they knew they were pregnant. (Author)

**Full URL:** <https://www.gov.uk/government/publications/safety-of-covid-19-vaccines-when-given-in-pregnancy>

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#### 20201217-55\*

**COVID-19 vaccination and pregnancy.** Royal College of Obstetricians and Gynaecologists (2020), London: RCOG 17 December 2020

Short news item reporting that the Royal College of Obstetricians and Gynaecologists is advising against the use of the new Pfizer-BioNTech COVID-19 vaccine in pregnancy and in breastfeeding women, until more information about it is available. (JSM)

**Full URL:** <https://www.rcog.org.uk/en/news/covid-19-vaccination-and-pregnancy/>

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#### 20201207-1\*

**COVID-19 vaccination: women of childbearing age, currently pregnant or breastfeeding [Last updated 2 February 2022].** UK Health Security Agency (2020), London: UKHSA 6 December 2020

Information for all women of childbearing age, those currently pregnant or breastfeeding on coronavirus (COVID-19) vaccination. (Author)

**Full URL:** <https://www.gov.uk/government/publications/covid-19-vaccination-women-of-childbearing-age-currently-pregnant-planning-a-pregnancy-or-breastfeeding>

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#### 20201127-1\*

**Maternal and child healthcare in India during COVID-19 pandemic.** Paul P, Mondal D (2021), Midwifery vol 92, January 2021, 102865

Editorial discussing maternal and child healthcare in India during the COVID-19 pandemic. Highlights the high rates of maternal and infant mortality prior to the pandemic and outlines strategies to minimise further adverse outcomes.

(LDO)

**Full URL:** <https://doi.org/10.1016/j.midw.2020.102865>

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#### 20201028-22\*

**During the second wave of COVID-19, don't forget about influenza: a call to action.** Atallah F, Minkoff H (2021), BJOG: An International Journal of Obstetrics and Gynaecology vol 128, no 1, January 2021, pp 12-13

Discusses the importance of improving influenza vaccine uptake in pregnancy, in particular as co-infection with COVID-19 may increase morbidity. (MB)

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#### 20200824-48\*

**Inclusion of pregnant women in COVID-19 vaccine development.** Heath PT, Le Doare K, Khalil A (2020), The Lancet Infectious Diseases vol 20, no 9, September 2020, pp 1007-1008

Examines the issues involved in the inclusion of pregnant and lactating women in the development and deployment of COVID-19 vaccines. (MB)

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**20200525-22\***

**Potential Maternal and Infant Outcomes From (Wuhan) Coronavirus 2019-nCoV Infecting Pregnant Women: Lessons From SARS, MERS, and Other Human Coronavirus Infections.** Schwartz DA, Graham AL (2020), Viruses vol 12, no 2, February 2020, Article no: 194

In early December 2019 a cluster of cases of pneumonia of unknown cause was identified in Wuhan, a city of 11 million persons in the People's Republic of China. Further investigation revealed these cases to result from infection with a newly identified coronavirus, termed the 2019-nCoV. The infection moved rapidly through China, spread to Thailand and Japan, extended into adjacent countries through infected persons travelling by air, eventually reaching multiple countries and continents. Similar to such other coronaviruses as those causing the Middle East respiratory syndrome (MERS) and severe acute respiratory syndrome (SARS), the new coronavirus was reported to spread via natural aerosols from human-to-human. In the early stages of this epidemic the case fatality rate is estimated to be approximately 2%, with the majority of deaths occurring in special populations. Unfortunately, there is limited experience with coronavirus infections during pregnancy, and it now appears certain that pregnant women have become infected during the present 2019-nCoV epidemic. In order to assess the potential of the Wuhan 2019-nCoV to cause maternal, fetal and neonatal morbidity and other poor obstetrical outcomes, this communication reviews the published data addressing the epidemiological and clinical effects of SARS, MERS, and other coronavirus infections on pregnant women and their infants. Recommendations are also made for the consideration of pregnant women in the design, clinical trials, and implementation of future 2019-nCoV vaccines. (Author)

Full URL: <https://doi.org/10.3390/v12020194>

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**20200515-7\***

**Consider pregnancy in COVID-19 therapeutic drug and vaccine trials.** Whitehead CL, Walker SP (2020), The Lancet vol 395, no 10237, 23 May 2020, p E92

Correspondence urging researchers to afford pregnant women the same autonomy offered to other adults to decide about participation in clinical trials. (MB)

Full URL: [https://doi.org/10.1016/S0140-6736\(20\)31029-1](https://doi.org/10.1016/S0140-6736(20)31029-1)

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**20200501-1\***

**Vaccine Update.** Public Health England (2020), London: PHE no 307, April 2020, pp 1-14

A special edition of Vaccine Update to mark World Immunization Week (WIW), which this year runs from 26th-30th April, and is the World Health Organization's annual celebration of immunisation, best practice, new advances and the work of immunisers, held with the aim of promoting the use of vaccines to protect people of all ages from disease, reflected in the name of this year's theme #VaccinesWork for All. In this, The International Year of the Nurse and Midwife, WHO and Public Health England acknowledge the crucial role played by nurses and midwives as advocates of vaccination throughout the life course. Includes sections on the delivery of immunisation services during the coronavirus pandemic, and vaccinations offered during the antenatal and postnatal periods. (JSM)

Full URL: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/882560/PHE\\_11652\\_VU\\_307\\_April\\_2020.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/882560/PHE_11652_VU_307_April_2020.pdf)

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**20200429-36\***

**Protection by Exclusion: Another Missed Opportunity to Include Pregnant Women in Research During the Coronavirus Disease 2019 (COVID-19) Pandemic.** Costantine MM, Landon MB, Saade GR (2020), Obstetrics & Gynecology vol 136, no 1, July 2020, pp 26-28

Coronavirus disease 2019 (COVID-19) is a novel infectious disease that started in Wuhan, China, and has rapidly spread all across the world. With limited ability to contain the virus and relatively high transmissibility and case fatality rates, governmental institutions and pharmaceutical companies are racing to find therapeutics and vaccines that target this

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novel coronavirus. However, once again, pregnant and breastfeeding women are excluded from participating in clinical trials during this pandemic. This 'protection by exclusion' of pregnant women from drug development and clinical therapeutic trials, even during epidemics and pandemics, is not unprecedented. Moreover, it is both misguided and not justifiable and may have excluded them from potentially beneficial interventions. This is another missed opportunity to obtain pregnancy-specific safety and efficacy data, because therapeutics developed for men and nonpregnant women may not be generalizable to pregnant women. Therefore, we recommend and urge the scientific community and professional societies that, without clear justification for exclusion, pregnant women should be given the opportunity to be included in clinical trials for COVID-19 based on the concepts of justice, equity, autonomy, and informed consent. (Author)

Full URL: <https://doi.org/10.1097/AOG.0000000000003924>

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#### 20200407-14\*

**Coronavirus Disease 2019 (COVID-19) Pandemic and Pregnancy.** Dashraath P, Wong JIJ, Lim MXK, et al (2020), American Journal of Obstetrics & Gynecology (AJOG) vol 222, no 6, June 2020, pp 521-531

The current coronavirus disease 2019 (COVID-19) pneumonia pandemic, caused by the severe acute respiratory syndrome 2 (SARS-CoV-2) virus, is spreading globally at an accelerated rate, with a basic reproduction number (R0) of 2 - 2.5, indicating that 2 - 3 persons will be infected from an index patient. A serious public health emergency, it is particularly deadly in vulnerable populations and communities in which healthcare providers are insufficiently prepared to manage the infection. As of March 16, 2020, there are more than 180,000 confirmed cases of COVID-19 worldwide, with over 7,000 related deaths. The SARS-CoV-2 virus has been isolated from asymptomatic individuals, and affected patients continue to be infectious two weeks after cessation of symptoms. The substantial morbidity and socioeconomic impact have necessitated drastic measures across all continents, including nationwide lockdowns and border closures.

Pregnant women and their fetuses represent a high-risk population during infectious disease outbreaks. To date, the outcomes of 55 pregnant women infected with COVID-19 and 46 neonates have been reported in the literature, with no definite evidence of vertical transmission. Physiological and mechanical changes in pregnancy increase susceptibility to infections in general, particularly when the cardiorespiratory system is affected, and encourage rapid progression to respiratory failure in the gravida. Furthermore, the pregnancy bias towards T-helper 2 (Th2) system dominance which protects the fetus, leaves the mother vulnerable to viral infections, which are more effectively contained by the Th1 system. These unique challenges mandate an integrated approach to pregnancies affected by SARS-CoV-2.

Here we present a review of COVID-19 in pregnancy, bringing together the various factors integral to the understanding of pathophysiology and susceptibility, diagnostic challenges with real-time reverse transcriptase polymerase chain reaction (RT-PCR) assays, therapeutic controversies, intrauterine transmission and maternal-fetal complications. We discuss the latest options in antiviral therapy and vaccine development, including the novel use of chloroquine in the management of COVID-19. Fetal surveillance, in view of the predisposition to growth restriction and special considerations during labor and delivery are addressed. Additionally, we focus on keeping frontline obstetric care providers safe while continuing to provide essential services. Our clinical service model is built around the principles of workplace segregation, responsible social distancing, containment of cross-infection to healthcare providers, judicious use of personal protective equipment and telemedicine. Our aim is to share a framework which can be adopted by tertiary maternity units managing pregnant women in the flux of a pandemic while maintaining the safety of the patient and healthcare provider at its core. (Author)

Full URL: <https://doi.org/10.1016/j.ajog.2020.03.021>

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#### 20200122-1\*

**Inadvertent vaccination in pregnancy (VIP) [Last updated 18 June 2021].** Public Health England (2010), London: PHE 1 May 2010

Advice for health professionals on pregnant women who are inadvertently vaccinated against coronavirus (COVID-19), chicken pox (varicella), shingles or measles, mumps, rubella. (Author)

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