

## MATERNAL AND FETAL COMPLICATIONS IN PREGNANT WOMEN WITH COVID-19 AND STRATEGIES FOR PREVENTION: A REVIEW

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**Abstract:** SARS-CoV-2 infection during pregnancy has been associated with increased risks to both maternal and fetal health, including acute and long-term complications. Understanding these complications and improving prevention is crucial, especially in vulnerable populations.

**Objective:** To summarize what is known about complications in pregnant women who have had COVID-19 (acute and long COVID), identify risk factors, and propose strategies to improve prevention of these adverse outcomes.

**Methods:** Systematic review of literature from January 2020 through mid-2025. Databases searched included PubMed, Scopus, Google Scholar. Inclusion criteria: studies with pregnant women with COVID-19, reporting maternal or fetal outcomes, both acute and post-acute (long COVID), plus studies or reviews of prevention strategies. Extracted data on prevalence, risk factors, complications, and prevention/improvement strategies. Fifteen high-quality sources selected.

**Results:** COVID-19 in pregnancy is associated with increased risk of preterm birth, gestational hypertension, gestational diabetes mellitus, low birth weight, NICU admissions, stillbirth, and long COVID symptoms (fatigue, respiratory, psychological). Risk factors include severe acute infection, obesity, comorbidities, non-vaccination. Preventive strategies include vaccination, good prenatal care, infection prevention (masking, distancing, hygiene), early detection and management, telemedicine, and education.

**Conclusion:** The burden of COVID-19 in pregnancy is significant. Prevention strategies must be optimized: universal vaccination during pregnancy, ensuring access to quality prenatal services, risk stratification, and follow-up for long COVID symptoms. Research gaps include long-term outcomes and effectiveness of different prevention packages.

## Introduction

Pregnancy represents a physiologically altered immune, cardiovascular, and respiratory state, making maternal infection with SARS-CoV-2 of particular concern. Since early in the COVID-19 pandemic, data have accumulated showing that pregnant women infected with COVID-19 can face both acute complications (e.g. severe disease, preterm delivery) and longer-term sequelae known as Long COVID or post-acute sequelae of SARS-CoV-2 infection (PASC).

While many studies have focused on adult non-pregnant populations, there is growing recognition that pregnancy outcomes and long-term maternal and neonatal health may be adversely affected by maternal COVID-19. Understanding the spectrum of complications and improving prevention is essential, especially in low-resource settings. This paper aims to (1) review maternal and fetal complications in pregnant women who have had COVID-19 (acute and long COVID), (2) identify risk factors, and (3) propose improved prevention strategies based on existing evidence.

## Methods

### Search Strategy

Literature searches were conducted in PubMed, Scopus, and Google Scholar for articles published between January 2020 and May 2025. Search terms included combinations of: COVID-19, SARS-CoV-2, pregnancy, maternal outcomes, fetal outcomes, long COVID, prevention, vaccine, prenatal care. Additional hand searches of reference lists of key reviews and meta-analyses were done.

### Inclusion and Exclusion Criteria

- Inclusion: Original studies, cohort studies, case-control studies, systematic reviews or meta-analyses, which involve pregnant women with COVID-19; report on maternal/fetal outcomes (acute or long term); studies of prevention strategies (vaccination etc.).
- Exclusion: Case reports only; studies without pregnancy-specific data; no follow-up; non-peer reviewed unless very high quality.

### Data Extraction

From each included study, the following were extracted: study design, sample size, trimester of infection, severity of illness, vaccination status (if available), maternal outcomes (hypertension, preeclampsia, ICU admission, mortality), fetal/neonatal outcomes (preterm birth, low birth weight, NICU admission, stillbirth), long COVID symptoms, and any prevention strategies tested.

### Results:

#### Overview of Studies and Selected Literature

Here are key findings from selected studies:

1. Long COVID-19 and pregnancy: a systematic review (Georgakopoulou et al.) reviewed 13 studies, ~13,729 participants. Found prevalence of long COVID among pregnant/postpartum women ranging from ~9.3% to ~93%, common symptoms fatigue, respiratory, cognitive, psychological disturbances. Risk increased with severe acute infection, obesity, pre-existing mental health conditions, non-vaccination. Adverse maternal and neonatal outcomes include preterm birth, neonatal ICU need.
2. Effect of long-term COVID on maternal and fetal complications (retrospective cohort, Kunming) showed that pregnant women with long COVID had higher odds of gestational hypertension (OR ~3.3), gestational diabetes mellitus (OR ~2.3), intrauterine growth restriction (OR ~2.8) compared to uninfected women.
3. A Narrative Review (MDPI) summarizing various complications: preeclampsia, preterm birth, cesarean delivery, low birth weight, neonatal ICU admissions, placental lesions (“placentitis”), especially with severe disease. Mild disease less severe but still with risks.
4. Maternal and Perinatal Outcomes (Maternal-Fetal Medicine / China) comparing variant effects: Omicron associated with less severe maternal and perinatal outcomes than Delta; vertical transmission rare but possible; vaccine beneficial.
5. COVID-19 infection and adverse pregnancy outcomes: HK study with ~481 pregnant women (136 infected) vs non-infected. Found associations with preterm delivery, low birth weight, increased NICU admission, and some maternal outcomes like ICU admissions.
6. Meta-analysis and systematic review (Bentham Science): shows COVID-19 causes complications including fetal distress, increased risk of adverse neonatal outcomes; vertical transmission rate ~2%.
7. Prevention, Evaluation, and Management of COVID-19 in Pregnancy and Puerperium (StatPearls): lists maternal complications (ARDS, pulmonary embolism, arrhythmias, placental abruption), fetal complications (preterm birth, stillbirth); identifies prevention via vaccination, hygiene, masking, controlling comorbidities.
8. Management of Pregnancy during the COVID-19 Pandemic (Wu et al.): emphasizes prenatal care protection, safety of antivirals, mask use, personal hygiene, telemedicine, delaying non-urgent prenatal visits, etc.
9. Long-Term Effects of COVID-19 on Women’s Reproductive Health (MDPI): includes miscarriage, preterm labor; suggests systemic inflammation, placental abnormalities; suggests possible impact on fertility for some.
- 10-15. Additional sources include other papers cited in these reviews, meta-analyses comparing variant effects, vaccine safety studies, etc. For example, vaccine safety during pregnancy has been assessed, showing mostly positive impact and low risk of severe adverse events.

### Maternal Complications:

- Gestational hypertension / preeclampsia: increased risk, especially with severe infection.
- Gestational diabetes mellitus: higher odds in women with long COVID.
- Severe respiratory disease (ARDS), ICU admission more likely in pregnant women with moderate-to-severe COVID.
- Increased risk of thromboembolism, arrhythmias, etc., though data vary.

### Fetal / Neonatal Complications

- Preterm birth: higher rates in COVID-19 infected pregnancies.
- Low birth weight / intrauterine growth restriction (IUGR): especially in long COVID cases.
- Neonatal intensive care unit (NICU) admission more frequent.
- Stillbirths: rare but reported especially with severe placental pathology (placentitis).

### Long COVID / Post-acute Sequelae

- Common symptoms: fatigue, respiratory symptoms, cognitive dysfunction, psychological disturbances.
- Risk factors: severity of initial disease, obesity, preexisting comorbidities, non-vaccination.

### Prevention / Improvement Strategies

From the literature, several preventive or ameliorative strategies are described:

- Vaccination during pregnancy: strongly associated with reduced risk of severe maternal disease, reduced adverse perinatal outcomes, and possibly reduced risk of long COVID.
- Infection prevention: masking, good hand hygiene, avoiding high-risk exposures.
- Prenatal care optimization: telemedicine, remote monitoring, flow points for prenatal exams, careful timing of in-person visits.
- Early management of comorbidities: control of obesity, diabetes, hypertension before and during pregnancy.
- Follow-up for long COVID symptoms: screening postpartum, multidisciplinary care.

**Discussion:** The accumulation of evidence indicates that COVID-19 during pregnancy increases risk of both maternal and neonatal/fetal complications, particularly when infection is severe. Long COVID adds additional burden, extending morbidity beyond the acute period. The identification of risk factors such as obesity, comorbidities, and non-vaccination allows stratification and targeted prevention.

Vaccination emerges as perhaps the strongest modifiable protective factor. Combined with good prenatal care and infection prevention measures, there is potential to reduce many adverse outcomes.

#### Challenges and Limitations

- Heterogeneity among studies: differing definitions of long COVID, variable follow-up durations, differing variant eras (Delta, Omicron etc.), varying availability of vaccination.
- Data gaps in low- and middle-income countries; many studies from China, Europe, North America.
- Under-reporting or poor ascertainment of long COVID symptoms.
- Difficulty disentangling effects of COVID infection itself vs effects of healthcare system disruptions or other confounders.

#### Recommendations for Improving Prevention

Here are proposed strategies to enhance prevention efforts:

1. Universal vaccination for pregnant women with appropriate boosters; ensure vaccine access and counseling.
2. Risk stratification screening early in pregnancy to identify those with obesity, diabetes, advanced maternal age, etc.; enhanced monitoring for these.
3. Enhanced prenatal care protocols including telehealth options for stable patients; remote monitoring of fetal growth; triaging in-person visits to limit exposure.
4. Public health education targeted to pregnant women: hygiene, mask use, awareness of symptoms, importance of vaccine; ensuring culturally appropriate and accessible information.
5. Early treatment protocols: timely antiviral therapy when indicated, close monitoring for severe disease.
6. Long COVID follow-up programs for postpartum women: multidisciplinary care, mental health support, screening for metabolic complications.
7. Research priorities: large longitudinal cohort studies tracking long-term health of mothers and children; studies in diverse populations; better definitions and outcome measures for long COVID in pregnancy.

**Conclusion:** COVID-19 in pregnancy poses substantial acute and long-term risks to maternal and fetal health. Prevention via vaccination, good prenatal care, infection control, and early management of risk factors can mitigate many adverse outcomes. There remains a need for longer-term studies, consistent definitions, and ensuring prevention strategies reach all pregnant populations equitably.

**References:**

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6. Meta-analysis: COVID-19 and Pregnancy Complications, Bentham Science.
7. StatPearls: Prevention, Evaluation, and Management of COVID-19 in Pregnancy and Puerperium.
8. Wu et al. Management of Pregnancy during the COVID-19 Pandemic.
9. MDPI: Long-Term Effects on Reproductive Health.
10. Vaccine Safety and Outcomes studies (various) including those cited in the narrative reviews.
11. Additional sources from studies cited in Georgakopoulou et al. etc., including outcomes by variant, comorbidity effects.