Considerations for Safe Labor, Delivery, and Neonatal Care during the COVID-19 Pandemic

During the COVID-19 pandemic, maximal protection of healthcare workers in obstetric and neonatal intensive care units (NICUs) and the mothers and newborns they care for are key aspects of specialized obstetric care, but limited outcomes data are available. Authors of a systematic review (SR) that examined 385 published cases as of April 20, 2020, concluded that “COVID-19 infection during pregnancy probably has a clinical presentation and severity resembling that in non-pregnant adults and probably is not associated with poor maternal or perinatal outcomes.” Very limited data from another SR that examined 220 cases as of April 17, 2020, and 5 additional individual low-quality studies of 314 newborns suggest that the risk of mother-to-baby transmission in women with COVID-19 infection is low. However, uncertainty about whether the virus crosses the placental barrier has led many obstetric departments to prohibit the practice of delayed umbilical cord clamping in term infants to minimize newborn exposure to any virus in the immediate environment. Guidance from multiple organizations describes ways to protect staff and measures to limit transmission, provides recommendations for COVID-19 testing for pregnant women and for infants born to infected mothers, and offers recommendations for optimal maternal care and breastfeeding. We also identified 25 articles that describe safe care strategies for patients or staff. Also, COVID-19 registries are collecting further data on maternal and neonatal outcomes.

Evidence limitations. The evidence reported during the COVID-19 pandemic consists primarily of small retrospective case series describing outcomes of pregnant women with COVID-19 infection and their newborns. Most data derive from hospitals in China and Europe, and findings may not be generalizable to other countries due to differences in healthcare practices. Elshafeey et al. discussed several evidence limitations of the largest SR, including the possibility of incomplete data because some healthcare facilities may not have shared cases of COVID-19 during pregnancy, lack of study quality assessment, and the possibility of overlapping data resulting in double-counting of patients. In addition, variables unrelated to COVID-19 may have been present that were not accounted for and could have affected mother or newborn outcomes in retrospective case reviews. The included SRs have an overlap of 8 small studies (n = 81), but we included both because these SRs report on different outcomes of interest.
Executive Summary

Findings

We assessed 2 SRs and 9 additional studies not included in the SRs. Outcomes of interest include maternal and neonatal complications, maternal and neonatal mortality, and vertical transmission of COVID-19 infection from the mother to the newborn.

- **Maternal complications from COVID-19 infection:** One study (Savasi et al. 2020) of 77 women with severe acute respiratory syndrome reported that 16% underwent urgent delivery due to respiratory compromise, 12% had preterm birth, and 8% were admitted to the ICU. One study (Pierce-Williams et al. 2020) of 64 women with severe/critical COVID-19 infection reported that 50% delivered during their COVID-19 hospitalization and 88% of those with critical infection had preterm birth. One study (Yan et al. 2020) of 116 pregnant women reported that 12.5% who presented in the first and early second trimester had a missed spontaneous abortion and 21.2% had preterm birth. One study (Lokken et al. 2020) of 46 women reported that 16% required hospitalization, 2% required ICU admission, and 2% required preterm birth to improve maternal respiratory status. One study (Ferrazzi et al. 2020) of 42 women reported 57.1% delivered vaginally, 42.9% had an elective cesarean section, and 45.2% required ICU admission. One study (Yang et al. 2020) of 27 women reported 1 case of preterm birth and 1 case of severe pneumonia 3 days after delivery.

- **Maternal mortality:** One SR (Elshafeey et al. 2020) of 385 pregnant women with COVID-19 reported 1 maternal death. Five studies (Savasi et al. 2020, Pierce-Williams et al. 2020, Yan et al. 2020, Pereira et al. 2020, Yang et al. 2020) reported no maternal deaths.

- **Neonatal complications/mortality:** One SR (Elshafeey et al. 2020) reported 4 of 256 neonates born of infected mothers tested positive for the disease, 2 were stillborn, and 1 died shortly after birth. One SR (Duran et al. 2020) reported that 13 of 222 exposed newborns tested positive for SARS-CoV-2; most of the studies reported no or mild symptoms and no adverse perinatal outcomes; however, 2 studies reported that newborns who tested positive had moderate or severe clinical characteristics. One study (Fox and Melka 2020) reported a case of unexplained fetal death at 14-weeks gestation around the time of her COVID-19 symptoms. One study (Lokken et al. 2020) reported a stillbirth of unknown etiology. Two studies (Pierce-Williams et al. 2020, Yang et al. 2020) reported no perinatal deaths.

- **Vertical transmission risk:** One SR (Duran et al. 2020) concluded that due to the paucity of data, vertical transmission cannot be confirmed or denied and that current literature does not support abstaining from breastfeeding or separating mothers and newborns. One study (Ferrazzi et al. 2020) reported that 2 newborns tested positive for SARS-CoV-2 infection, including 1 that was delivered vaginally. One study (Penfield et al. 2020) reported that in 3 cases the placental or membrane swabs from infected mothers were positive; however, these infants did not develop COVID-19 symptoms or test positive on days 1 through 5 of life. Three studies (Pierce-Williams et al. 2020, Pereira et al. 2020, Yan et al. 2020) reported no cases of vertical transmission.

Evidence

Search dates: January 1, 2015, through May 29, 2020. We reviewed full text of 2 SRs and 8 additional clinical studies and the abstract of 1 clinical study reporting on outcomes of 1,082 pregnant women with COVID-19 infection or their neonates.

- We included the best available evidence from the most comprehensive SRs and additional studies reporting on at least 20 patients. The 2 included SRs have an overlap of 8 small studies (n= 81) but reported on different outcomes.
- 1 SR (Elshafeey et al. 2020; 33 retrospective studies; n = 385 women) summarized the literature on COVID-19 infection during pregnancy and childbirth.
- 1 SR (Duran et al., 2020; 20 studies; n = 222 neonates) summarized the literature on outcomes of neonates exposed to COVID-19 infection.
- 2 multicenter, cohort studies (Savasi et al. 2020, n = 77 women; Pierce-Williams et al. 2020, n = 64 women).
- 1 single-center, prospective case series (Fox and Melka 2020; n =92 women).
- 6 retrospective reviews of pregnant women (Yan et al. 2020, n = 116; Pereira et al. 2020, n = 60; Lokken et al. 2020, n = 46; Ferrazzi et al. 2020, n = 42; Penfield et al. 2020, n = 32; Yang et al. 2020, n = 27).
Guidelines

Searched PubMed, EMBASE, and ECRI Guidelines Trust® (EGT) for relevant documents published January 1, 2015, through June 1, 2020. We identified 63 documents. Note: Guidelines are continuously being updated during the COVID-19 pandemic.

- We identified 58 guidelines and 5 consensus statements. We list the guidelines supported by SRs below. Please see the full report for 13 summaries of recommendations from major U.S. and international organizations. See the Selected Resources and References section at the end of full report for links to remaining documents.

Guidelines Supported by Systematic Reviews

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Background

COVID-19 and Pregnancy

COVID-19, caused by SARS-CoV-2, was first identified during an investigation into an outbreak in Wuhan, China, in December 2019. Since then, the illness has spread throughout the world (see the Centers for Disease Control and Prevention [CDC] Fact Sheet). WHO declared it a pandemic in January 2020.

The American College of Obstetricians and Gynecologists (ACOG) recommends that pregnant women take the same steps as the general public to avoid exposure to the coronavirus infection including washing hands often with soap and water for at least 20 seconds, cleaning hands with a hand sanitizer that contains at least 60% alcohol if you can't wash them, avoiding touching eyes, nose, and mouth, staying home as much as possible, staying at least 6 feet away from other people if you need to go out, and avoiding people who are sick.

Clinicians should monitor all pregnant women for signs and symptoms of COVID-19 (i.e., fever, cough, dyspnea, sore throat, fatigue), especially if they have had close contact with a confirmed case or individuals under investigation.(1) Based on limited available data from small case series and case reports, “pregnancy and childbirth do not increase the risk of acquiring SARS-CoV-2 infection and do not worsen the clinical course of COVID-19 compared with non-pregnant individuals of the same age.”(1) However, the International Society of Infectious Disease in Obstetrics and Gynecology cautions that “pregnant women need to be considered as a high-risk population for COVID-19 infection, and if suspected or proven to be infected with the virus, they require special care to improve their survival rate and the well-being of their babies.” Maximal protection of healthcare workers in obstetric units and NICUs and the mothers and newborns they care for are key aspects of specialized obstetric care.

Infection Control Precautions

Healthcare workers who care for pregnant women are urged to use strict infection control precautions to reduce the risk of COVID-19 transmission, including the following recommendations in an Uptodate article as of May 28, 2020:(1)

- Ensuring the obstetric unit has infection control practices for pregnant patients who have confirmed or suspected COVID-19 are consistent with CDC guidelines.
- Screening all patients for signs and symptoms of COVID-19, as well as whether they have had close contact with a confirmed case or persons under investigation, before entering the hospital for admission to the labor and delivery unit.
- Prioritizing testing of pregnant women with suspected COVID-19 at admission or who develop symptoms of COVID-19 during admission.
- Testing all patients upon presentation to labor and delivery with a rapid SARS-COV-2 test in areas where community infection is widespread.
- Wearing appropriate personal protective equipment when caring for patients with known or suspected COVID-19.
- Providing patients and visitors with face coverings (medical or cloth masks) upon entry into the health care setting for universal source control.
- Caring for pregnant COVID-19-positive inpatients in specially equipped (e.g., negative-pressure) rooms in antepartum, intrapartum, and postpartum COVID-19-only units.
- Instructing pregnant patients with suspected or confirmed COVID-19 to wear a surgical mask during labor and delivery, which may be difficult during active pushing when the chances of aerosol generation are greatest.
Screening the support person for fever and other symptoms before entering the building and disallowing those with any symptoms consistent with COVID-19, exposure to a confirmed case within 14 days, or a positive test for COVID-19 within 14 days from attending the labor and birth.

Requiring the support person (if screening is negative) to wear a cloth face covering, at a minimum.

**Patient Care**

Care concerns for pregnant women with confirmed maternal COVID-19 infection include potential complications, timing/route of delivery, and issues related to postpartum care (i.e., mother-newborn separation, neonatal care, breastfeeding).

**Potential Complications**

Pregnant women with comorbid conditions (e.g., hypertension, diabetes, severe obesity, severe asthma, cardiovascular disease) who contract COVID-19 may be at increased risk of severe illness, and those who develop COVID-19 pneumonia may be at increased risk of preterm and cesarean delivery.(2)

Neonatal complications “have largely been related to preterm birth and to adverse uterine environments resulting from critical maternal disease.(2) However, according to the American Academy of Pediatrics (AAP), “Children of all ages are susceptible to COVID-19, and infants under 1 year of age are at risk for severe disease although this still is a relatively rare outcome.”

Early in the pandemic, concerns arose over potential intrauterine vertical transmission of COVID-19 from mother to baby. Due to continuing uncertainty about vertical transmission, some institutions “have chosen to prohibit the practice of delayed umbilical cord clamping in term infants to minimize newborn exposure to any virus in the immediate environment and reduce the chances that the newborn will require phototherapy for jaundice.”(2)

**Timing/Route of Delivery**

Timing of delivery depends on the severity of the mother’s COVID-19 illness. Delivery is not indicated for most women with preterm COVID-19 that is not severe and who have no medical/obstetric indications for prompt delivery. For women with severe illness, delivery timing needs to be individualized, and healthcare professionals should consider the postnatal transmission risk in the delivery room and whether delivery might improve the mother’s respiratory status. For hospitalized patients who have COVID-19 pneumonia and are not intubated, delivery of fetuses with gestational ages of >32 to 34 weeks may be considered, especially if the mother’s pulmonary status is expected to worsen, also placing the fetus at risk. For hospitalized pregnant woman who are intubated and critically ill with COVID-19, delivery of fetuses with gestational ages of 32 to 34 weeks may be considered if the patient is stable, but delivery could worsen the mother’s condition.(2)

COVID-19 infection is not a reason for clinicians to change the planned delivery route; the decision to perform a cesarean delivery should be based on usual indications.(2)

**Guidance Differs on Mother-Newborn Separation/Neonatal Care**

Temporary separation of mothers with known or suspected COVID-19 from their newborns after birth “can cause significant stress, disrupt breastfeeding, and have a negative impact on newborn stress, feeding, and mother-child bonding.”(2)

However, guidance for healthcare providers from CDC, WHO, and AAP differs on this issue. CDC guidelines state, “Temporary separation of the newborn from a mother with confirmed or suspected COVID-19 should be strongly considered to reduce the risk of transmission to the neonate.”

WHO recommends that “mothers and infants be enabled to remain together and practice skin-to-skin contact, kangaroo mother care and to remain together and to practice rooming-in throughout the day and night, especially immediately after birth during establishment of breastfeeding, whether they or their infants have suspected, probable, or confirmed COVID-19.”
According to AAP, “the safest course of action from the perspective of minimizing the likelihood of the infant becoming infected is to separate mother and infant, at least temporarily.”

**Breast Milk, SARS-CoV-2, and Transmission**

According to ACOG, to date, “the COVID-19 virus has not been found in breast milk, but there is not enough information yet on whether women who are sick can pass the virus through breast milk.” At this time, AAP and WHO continue to encourage breastfeeding in women with suspected or confirmed COVID-19 infection due to its many benefits. These organizations provide detailed guidance on this topic (see Guidelines section below).

**Guidelines, Position and Consensus Statements**

Searches of PubMed, EMBASE, EGT, and other web-based resources identified 63 relevant documents (58 guidelines and 5 consensus statements published between January 1, 2014, and June 1, 2020). We sought guidelines that are clearly supported by published SRs or included in EGT, a publicly available online repository of guidelines supported by SRs and developed by nationally and internationally recognized medical organizations and specialty societies. These guidelines must meet certain U.S. National Academy of Medicine criteria. Due to the many publications identified, we summarize below only those supported by SRs or published by major U.S. and international organizations. For more information on guidelines and consensus statements published by countries outside the United States (i.e., Australia, Canada, China, France, India, Italy, Malaysia, New Zealand, Philippines, Sri Lanka, South America, United Kingdom), see links under the Selected Resources and References section.

**Guidelines Supported by Systematic Review**

**Neonatal Care**

- AAP. *Guidance on Newborn Screening during COVID-19*. 2020. AAP recommends “that pediatricians continue to follow federal and state guidelines on newborn screening including newborn bloodspot screening, newborn hearing screening and critical congenital heart disease screening.”

- AAP. *FAQs: Management of Infants Born to Mothers with Suspected or Confirmed COVID-19*. 2020. This guidance includes the following recommendations:

  - Delayed cord clamping practices should continue per usual center practice. If infection control precautions are taken (including maternal use of mask) and the mother is able, she can briefly hold her baby during delayed cord clamping.

  - Temporary separation may be accomplished by admitting the infant to an area separate from mother and separate from unaffected infants. Gowns, gloves, standard procedural masks, and eye protection (faceshields or goggles) should be used while caring for these newborns.

  - To date, breastmilk is considered to be an unlikely source of transmission of SARS-CoV-2. Mothers may express breast milk after appropriate breast and hand hygiene, and this may be fed to the infant by other uninfected caregivers. If the mother requests to nurse her infant, she should comply with strict preventive precautions, including the use of a mask and breast and hand hygiene.

  - Infants requiring neonatal intensive care and respiratory support optimally should be admitted to a single patient room with the potential for negative room pressure (or other air filtration system).

  - If COVID-19 testing capacity is available, testing well newborns will facilitate plans for care after hospital discharge and determine the need for ongoing precautions and use of personal protective equipment for care of hospitalized infants.

  - During this COVID-19 pandemic, most NICUs have appropriately limited visitation. Restricting visitation minimizes the likelihood that vulnerable infants in the NICU will acquire an infection from a visitor with asymptomatic or symptomatic COVID-19. In addition, such policies protect the health and integrity of the specialized NICU workforce.
In most centers, discharge prior to usual practice with the intent to reduce risk of COVID-19 infection provides no advantage to the newborn or family.

General

- Emergency Cardiovascular Care Committee and Get With the Guidelines®-Resuscitation Adult and Pediatric Task Forces of the American Heart Association in Collaboration with the American Academy of Pediatrics, American Association for Respiratory Care, American College of Emergency Physicians, the Society of Critical Care Anesthesiologists, and American Society of Anesthesiologists: Supporting Organizations: American Association of Critical Care Nurses and National EMS Physicians. *Interim Guidance for Basic and Advanced Life Support in Adults, Children, and Neonates with Suspected or Confirmed COVID-19*. 2020. This guidance states:

  Neonatal resuscitation: Routine neonatal care and the initial steps of neonatal resuscitation are unlikely to be aerosol-generating... Suction of the airway after delivery should not be performed routinely for clear or meconium-stained amniotic fluid. Suctioning is an aerosol-generating procedure and is not indicated for uncomplicated deliveries. Endotracheal instillation of medications, such as surfactant or epinephrine, are aerosol-generating procedures, especially via an uncuffed tube. Intravenous delivery of epinephrine via a low-lying umbilical venous catheter is the preferred route of administration during neonatal resuscitation.

  Closed incubators: Closed incubator transfer and care should be used for neonatal intensive care patients when possible but do not protect from aerosolization of virus.

  Maternal cardiac arrest: The tenets of maternal cardiac arrest are unchanged for women with suspected or confirmed COVID-19. The cardiopulmonary physiological changes of pregnancy may increase the risk of acute decompensation in critically ill pregnant patients with COVID-19. Preparation for perimortem delivery, to occur after 4 minutes of resuscitation, should be initiated early in the resuscitation algorithm to allow the assembly of obstetrical and neonatal teams with PPE even if ROSC is achieved and perimortem delivery is not required.


  Delivery of pregnant women infected with COVID-19 should be carried out in a negative-pressure isolation room on the labor ward. Human traffic around this room should be limited when it is occupied by an infected patient.

  Both regional anesthesia and general anesthesia can be considered, depending on the clinical condition of the patient and after consultation with the obstetric anesthetist.

  Following an ultrasound scan of a suspected, probable or confirmed COVID-19-infected pregnant patient, surfaces of transducers should be cleaned and disinfected according to manufacturer specifications, taking note of the recommended ‘wet time’ for wiping transducers and other surfaces with disinfection agents.


  We recommend all pregnant women with history of contact with a person with confirmed COVID-19 be carefully monitored, considering asymptomatic transmission of COVID-19 may be possible.

  Pregnant and recently pregnant women with suspected, probable or confirmed COVID-19, should have access to woman-centred, respectful skilled care, including midwifery, obstetric, fetal medicine and neonatal care, as well as mental health and psychosocial support, with readiness to care for maternal and neonatal complications.
Mode of birth should be individualized, based on obstetric indications and the woman’s preferences. WHO recommends that induction of labour and caesarean section should only be undertaken when medically justified and based on maternal and fetal condition. COVID-19 positive status alone is not an indication for caesarean section.

We recommend that mothers with suspected or confirmed COVID-19 should be encouraged to initiate and continue breastfeeding. From the available evidence, mothers should be counselled that the benefits of breast-feeding substantially outweigh the potential risks of transmission.

Mothers should not be separated from their infants unless the mother is too sick to care for her baby. If the mother is unable to care for the infant another competent family caregiver should be identified.

Mother and infant should be enabled to remain together while rooming-in throughout the day and night and practise skin-to-skin contact, including kangaroo mother care, especially immediately after birth and during establishment of breastfeeding, whether they or their infants have suspected or confirmed COVID-19 virus infection.

Neonates born to mothers with suspected or confirmed COVID-19 should be breastfed within 1 hour of birth. Mothers should apply appropriate IPC.

Early and uninterrupted skin-to-skin contact between mothers and infants should be facilitated and encouraged as soon as possible after birth, while applying necessary measures for IPC. This applies also to infants who are born preterm or low birth weight.

If the newborn or infant is ill and requires specialist care (such as neonatal unit), arrangements should be made to allow the mother free access to the unit, with appropriate IPC measures.

Earlier initiation of breastfeeding results in greater benefits. This may be relevant to mothers who give birth by caesarean section, after an anaesthetic, or those who have medical instability that precludes initiation of breastfeeding within the first hour after birth.

In situations when severe illness in a mother prevents her from caring for her infant or prevents her from continuing direct breastfeeding, mothers should be encouraged and supported to express milk, and the breastmilk provided safely to the infant, while applying appropriate IPC measures.

In the event that the mother is too unwell to breastfeed or express breastmilk, explore the viability of feeding with donor human milk. If this is not possible, consider wet nursing (defined as another woman breastfeeds the child) or appropriate breastmilk substitutes, informed by feasibility, safety, sustainability, cultural context, acceptability to mother and service availability.

Perform frequent hand hygiene with soap and water or alcohol-based hand rub, especially before contact with her child.

Perform respiratory hygiene: sneeze or cough into a tissue and immediately dispose of the tissue. Hands should immediately be washed with soap and water or alcohol-based hand rub.

Clean and disinfect surfaces with which the mother has been in contact.

Wear a medical mask until symptom resolution and criteria for release from isolation have been met.

Additionally, breastfeeding mothers should be helped to clean her chest with soap and water if she has been coughing on it before breastfeeding. She does not need to wash her breasts prior to every breastfeed.

While mothers are recommended to wear medical masks, if the mother does not have a medical mask, she should still be encouraged to continue breastfeeding as the benefits of
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breastfeeding outweigh the potential risks of transmission of the virus when breastfeeding while applying other IPC measures.

Other Selected Documents

Labor and Delivery

Society for Maternal-Fetal Medicine and Society for Obstetric and Anesthesia and Perinatology. Labor and Delivery COVID-19 Considerations. 2020. Guidance recommendations include:

Consider staggering staff schedules (e.g., creating a patient-facing team and a home-based telehealth team that rotates responsibilities weekly or every 2 weeks) to reduce concomitant exposure risks and minimize the potential for future staffing shortages.

Hospital visitors should be restricted or eliminated for women who test positive for SARS-CoV2 or persons under investigation (PUIs.)

Women who test positive for SARS-CoV2 or PUIs should ideally be placed in an isolation room with droplet and contact precautions. Airborne infection isolation rooms (single-patient negative-pressure rooms with a minimum of 6 air changes per hour), if available, can be used if performance of aerosolizing procedures is anticipated.

Hospital facilities can inform whether specific rooms, such as operating rooms or rooms in which higher acuity evaluations are performed (e.g., when intubation may be required), can be safely converted to negative-pressure rooms. These rooms can be designated for cesarean deliveries for women who test positive for SARS-CoV2 or PUIs.

For patients with known or suspected COVID-19, HCWs should use N95 (or facemasks if N95 is not available), eye protection, gloves, and gowns during the second stage of labor, in addition to other personal protective equipment that may be typically indicated for labor and delivery. Surgical drapes could be used as an additional physical respiratory droplet barrier during the second stage and at delivery.

Each hospital should facilitate discussions between obstetric care, maternal-fetal medicine, neonatology, critical care, infectious disease, and obstetric anesthesiology providers regarding pregnancy management in the setting of worsening maternal respiratory status.

Neonates

CDC. Evaluation and Management Considerations for Neonates at Risk for COVID-19. 2020. Guidance recommendations include:

Testing is recommended for all neonates born to women with confirmed or suspected COVID-19, regardless of whether there are signs of infection in the neonate. For neonates presenting with signs of infection suggestive of COVID-19 as described above, providers should also consider an alternative diagnoses to COVID-19.

All neonates born to mothers with confirmed or suspected COVID-19 should be considered as having suspected SARS-CoV-2 infection when testing results are not available.

Infants with suspected SARS-CoV-2 infection should be isolated from other healthy neonates.

Temporary separation of the newborn from a mother with confirmed or suspected COVID-19 should be strongly considered to reduce the risk of transmission to the neonate. Temporary separation in the clinical setting can be achieved in many ways, including a separate room, maintaining a physical distance of ≥6 feet between the mother and neonate, and placing the neonate in a temperature-controlled isolette if the neonate remains in the mother's room.

Breastfeeding

AAP. Breastfeeding Guidance Post Hospital Discharge for Mothers or Infants with Suspected or Confirmed SARS-CoV-2 Infection. 2020. This guidance states:
In a family with suspected or confirmed COVID-19, counsel families to consider delaying weaning and extending the duration of breastfeeding to maximize the protection conferred via human milk during the pandemic.

If a mother and/or infant has COVID-19 and mother wants to express her milk, she should put on a mask and thoroughly clean her hands and breasts as well as any pump parts, bottles, and artificial nipples. Optimal milk expression is facilitated by use of an efficient electric double pump. She should express milk as often as her baby is eating or at least 6-8 times per 24 hours.

If a mother and/or infant has COVID-19 and mother wants to breastfeed directly, encourage proper washing of hands and breasts with soap and water prior to handling the infant and advise the mother to wear a mask while nursing.

If a mother and/or infant has COVID-19 and mother chooses not to breastfeed during the first weeks after birth, engage in a discussion about the importance of breastfeeding and expressed human milk in protecting against infections and other diseases during this most vulnerable time.

If an infant is discharged early, an in-person visit within 24-48 hours is preferred. Avoid use of waiting rooms to decrease viral exposure. Implement strategies such as seeing infants first thing in the morning, using separate entrances for well/sick, rooming upon arrival or waiting in car until appointment time.

— CDC: Care for Breastfeeding Women. 2020. This guidance states:

Breast milk is the best source of nutrition for most infants. We do not know whether mothers with COVID-19 can transmit the virus via breast milk, but the limited data available suggest this is not likely to be a source of transmission.

Whether and how to start or continue breastfeeding should be determined by the mother in coordination with her family and healthcare providers.

A mother with confirmed COVID-19 should be counseled to take all possible precautions to avoid spreading the virus to her infant, including hand hygiene and wearing a cloth face covering.

General


Pregnant women admitted with suspected COVID-19 or who develop symptoms suggestive of COVID-19 during admission should be prioritized for testing. In addition, facilities may consider additional molecular (e.g., PCR by nasopharyngeal swab) testing strategies, such as universal testing as the potential for asymptomatic patients presenting to labor and delivery units exists, particularly in high prevalence areas.

Health care professionals should follow their health care facility’s policies and their local and state health department policies for notification of a person under investigation for COVID-19. Patients with known or suspected COVID-19 should be cared for in a single-person room with the door closed. Airborne Infection Isolation Rooms may be reserved for patients undergoing aerosol-generating procedures.

Infants born to patients with known COVID-19 at the time of delivery should be considered infants with suspected COVID-19.

Infants born to a pregnant individual with suspected COVID-19 for whom testing is unknown (either pending results or not tested) are not considered to be infants with suspected COVID-19.
To reduce the risk of transmission of the virus that causes COVID-19 from the patient to the newborn, facilities may consider temporarily separating patients who have confirmed COVID-19 or are persons under investigation from their newborns until the patient's transmission-based precautions are discontinued. ACOG recognizes that separation of patients from their newborns may be linked to additional risks including, but not limited to, undue stress on the patient and disruption of breastfeeding. The determination of whether to keep patients with known or suspected COVID-19 and their infants together or separated after birth should be made on a case-by-case basis, using shared decision-making between the patient and the clinical team.

CDC. Considerations for Inpatient Obstetric Healthcare Settings. 2020. Guidance recommendations include:

Healthcare facilities should ensure recommended infection control practices for hospitalized pregnant patients who have confirmed COVID-19 or are PUIs are consistent with CDC's Interim Infection Prevention and Control Recommendations for Patients with Confirmed Coronavirus Disease 2019 (COVID-19) or Persons under Investigation for COVID-19 in Healthcare Settings.

All healthcare facilities that provide obstetric care must ensure that their personnel are correctly trained and capable of implementing recommended infection control interventions. Individual healthcare personnel should ensure they understand and can adhere to infection control requirements.

Healthcare facilities providing inpatient obstetrical care should limit visitors to pregnant women who have known or suspected COVID-19 infections.


Pregnant women with confirmed COVID-19 infection should be managed by designated tertiary hospitals and should be counseled on the risk of adverse pregnancy outcome.

Negative pressure isolation rooms should be set up for safe labor and delivery and neonatal care. This may not be possible in many low-resource settings but all possible attempts should be made for isolation and infection control.

During the COVID-19 pandemic period, a detailed history regarding exposure relevant to COVID-19 and clinical manifestations should be acquired routinely from all pregnant women attending for routine care.

Chest CT scan should be included in the work-up of pregnant women with suspected/probable/confirmed COVID-19 infection.

Suspected/probable cases should be treated in isolation and confirmed cases should be managed in a negative pressure isolation room. A woman with confirmed infection who is critically ill should be admitted to a negative pressure isolation room in the ICU.

Antenatal examination and delivery of pregnant women infected with COVID-19 should be carried out in a negative pressure isolation room on the labor ward. Human traffic around this room should be limited when it is occupied by an infected patient.

All medical staff involved in management of infected women should wear appropriate PPE as required.

Management of COVID-19-infected pregnant women should be undertaken by a multidisciplinary team (obstetricians, maternal–fetal medicine subspecialists, intensivists, obstetric anesthetists, internal medicine or respiratory physicians, midwives, virologists, microbiologists, neonatologists, infectious disease specialists).

Timing and mode of delivery should be individualized, dependent mainly on the clinical status of the patient, gestational age, and fetal condition.
At present, limited data suggest that there is no evidence of vertical mother-to-baby transmission in women who develop COVID-19 infection in late pregnancy.

There is currently insufficient evidence regarding the safety of breastfeeding and the need for mother/baby separation. If the mother is severely or critically ill, separation appears the best option, with attempts to express breastmilk to maintain milk production. If the patient is asymptomatic or mildly affected, breastfeeding and colocation (rooming-in) can be considered by the mother in coordination with healthcare providers.

Healthcare professionals engaged in obstetric care should be trained and fitted appropriately for respirators.

Clinical Literature

We searched PubMed, EMBASE, Google Scholar, the Cochrane Library, and selected web-based resources for documents relevant to this topic and published between January 1, 2015, and May 29, 2020. Our search strategies included the following keywords: birth, coronavirus, COVID19, delivery, infant, labor, newborn, pregnancy. Please see the Selected Resources and References section for detailed search strategies.

We included SRs and clinical studies (not included in the SRs) that examined outcomes of pregnant women with COVID-19 and outcomes of newborns born to women infected with COVID-19.

We excluded single case reports,(4-41) studies with fewer than 20 patients per study arm,(42-61) and conference abstracts.

We review full text of articles available through open access or our library subscriptions and abstracts of the remaining articles. We identified and reviewed full text of two SRs(62,63) and eight clinical studies (64-71) and the abstract of one clinical study(72). The two SRs have an overlap of 8 studies (n = 81), but we included both because these SRs report on different outcomes of interest. Table 1 summarizes the SR findings. Table 2 summarizes the clinical study findings.

Systematic Reviews

— 1 SR (Elshafeey et al. 2020; 33 studies; n = 385 women) summarized the literature on COVID-19 infection during pregnancy and childbirth and reported on maternal mortality, stillbirths and neonatal mortality, and vertical transmission of SARS-CoV-2 infection to a newborn.(62)
— 1 SR (Duran et al. 2020; 20 studies; n = 222 neonates) summarized the literature on outcomes in neonates exposed to COVID-19 infection and reported on neonatal complications and vertical transmission of SARS-CoV-2 infection to a newborn.(63)

Clinical Studies

— 1 multicenter, prospective cohort study (Savasi et al. 2020; n = 77 women) reported on maternal complications in pregnant women with severe respiratory syndrome from COVID-19 infection.(72)
— 1 multicenter cohort study (Pierce-Williams et al. 2020; n = 64 women) reported on maternal complications in pregnant women with a severe COVID-19 infection, neonatal complications, and vertical transmission of SARS-CoV-2 infection to a newborn.(64)
— 1 single-center, prospective case series (Fox and Melka 2020; n = 92 women) reported on maternal complications in pregnant women with a COVID-19 infection and neonatal complications.(66)
— 1 multicenter, retrospective review (Yan et al. 2020; n = 116 women) reported on maternal complications in pregnant women with a COVID-19 infection, neonatal complications, and vertical transmission of SARS-CoV-2 infection to a newborn.(65)
— 1 single-center, retrospective review (Pereira et al. 2020; n = 60 women) reported on maternal complications in pregnant women with a COVID-19 infection, neonatal complications, and vertical transmission of SARS-CoV-2 infection to a newborn.(67)
Considerations for Safe Labor, Delivery, and Neonatal Care during the COVID-19 Pandemic

- 1 multicenter, retrospective review (Lokken et al. 2020; n = 46 women) reported on maternal complications in pregnant women with a COVID-19 infection and neonatal complications.(68)
- 1 multicenter, retrospective review (Ferrazzi et al. 2020; n = 42 women) reported on maternal complications in pregnant women with a COVID-19 infection, neonatal complications, and vertical transmission of SARS-CoV-2 infection to a newborn.(69)
- 1 single-center retrospective review (Penfield et al. 2020; n = 32 women and 11 neonates born to mothers with COVID-19 infection) reported on vertical transmission of SARS-CoV-2 infection to a newborn.(70)
- 1 single-center retrospective review (Yang et al. 2020; n = 27 women) reported on maternal complications in pregnant women with a COVID-19 infection, maternal mortality, neonatal complications, and neonatal mortality.(71)

Evidence limitations. Limited evidence reported during the COVID-19 pandemic consists primarily of small retrospective reviews describing outcomes of pregnant women with COVID-19 infection and their newborns. Most data derive from hospitals in China and Europe, and findings may not be generalizable to other countries due to differences in healthcare practices. Elshafeey et al.(62) discussed several evidence limitations of the largest SR, including the possibility of incomplete data, since not every healthcare facility may have shared cases of COVID-19 during pregnancy, lack of study quality assessment, and the possibility of overlapping data resulting in double-counting of patients. In addition, variables unrelated to COVID-19 may have been present that could have affected mother or newborn outcomes and are not accounted for in retrospective reviews of cases.

Table 1. Systematic Reviews

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<thead>
<tr>
<th>Author Year</th>
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<tr>
<td>Elshafeey et al. 2020(62)</td>
<td>“Summarize the existing literature on COVID-19 infection during pregnancy and childbirth, particularly concerning clinical presentation and outcomes.”</td>
<td>LitCOVID, EBSCO MEDLINE, CENTRAL, CINAHL, Web of Science, and Scopus electronic databases were searched through April 19, 2020, for relevant studies. Outcomes, maternal complications, neonatal complications.</td>
<td>The studies “included one case-control study from China, 16 case reports (from Australia, China, Honduras, Iran, South Korea, Sweden, Turkey, and the USA) and 16 case series (from China, Italy, the Netherlands, and the USA).” “We identified 33 studies reporting 385 pregnant women with COVID-19 infection: 368 (95.6%) mild; 14 (3.6%) severe; and 3 (0.8%) critical. Seventeen women were admitted to intensive care, including six who were mechanically ventilated and one maternal mortality. A total of 252 women gave birth, comprising 175 (69.4%) cesarean and 77 (30.6%) vaginal births. Outcomes for 256 newborns included four RT-PCR [real-time polymerase chain reaction] positive neonates, two stillbirths, and one neonatal death.”</td>
<td>“COVID-19 infection during pregnancy probably has a clinical presentation and severity resembling that in non-pregnant adults. It is probably not associated with poor maternal or perinatal outcomes.”</td>
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### Considerations for Safe Labor, Delivery, and Neonatal Care during the COVID-19 Pandemic

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<td>Duran et al. 2020(63)</td>
<td>“Describe perinatal and neonatal outcomes in newborns exposed to COVID-19 infection.”</td>
<td>PubMed Central, LILACS, and Google Scholar were searched through April 17, 2020, for primary case reports, case series, and randomized controlled trials of pregnant women and newborns and infants affected by COVID-19. Outcomes: perinatal and neonatal complications, vertical transmission.</td>
<td>“20 studies met inclusion criteria and comprised neonatal outcome data for 222 newborns whose mothers were suspected or confirmed to be SARS-CoV-2 positive perinatally (17 studies) or of newborns referred to hospital with infection/pneumonia (3 studies). Most (12 studies) were case-series reports; all were from China, except three (Australia, Iran, and Spain). Of the 222 newborns, 13 were reported as positive for SARS-CoV-2; most of the studies reported no or mild symptoms and no adverse perinatal outcomes. Two papers among those from newborns who tested positive reported moderate or severe clinical characteristics. Five studies using data on umbilical cord blood, placenta, and/or amniotic fluid reported no positive results. Nine studies reported radiographic imaging, including 5 with images of pneumonia, increased lung marking, thickened texture, or high-density nodular shadow. Minor, non-specific changes in biochemical variables were reported. Studies that tested breast milk reported negative SARS-CoV-2 results.”</td>
<td>“Given the paucity of studies at this time, vertical transmission cannot be confirmed or denied. Current literature does not support abstaining from breastfeeding nor separating mothers and newborns. Further evidence and data collection networks, particularly in the Americas, are needed for establishing definitive guidelines and recommendations.”</td>
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<tr>
<td>United States and Uruguay</td>
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<tr>
<td>Overlap of 8 studies included in Elshafeey et al. 2020(62)</td>
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</table>
**Table 2. Clinical Trials**

<table>
<thead>
<tr>
<th>Author/Year</th>
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<tr>
<td>Savasi et al. 2020(72)</td>
<td>Multicenter, prospective cohort study 77 pregnant women with severe acute respiratory syndrome from COVID-19 infection</td>
<td>“Investigate the clinical evolution of COVID-19 in hospitalized pregnant women and potential factors associated with severe maternal outcomes.” Outcomes: maternal complications</td>
<td>“Seventy-seven patients were included, 14 of whom had severe disease (18%). Two thirds of the patients in the cohort were admitted during the third trimester, and 84% were symptomatic on admission. Eleven patients underwent urgent delivery for respiratory compromise (16%), and six were admitted to the ICU [intensive care unit] (8%). One woman received extracorporeal membrane oxygenation; no deaths occurred. Preterm delivery occurred in 12% of patients, and nine newborns were admitted to the neonatal intensive care unit. Patients in the severe subgroup had significantly higher pregestational body mass indexes (BMIs) and heart and respiratory rates and a greater frequency of fever or dyspnea on admission compared with women with a nonsevere disease evolution.”</td>
<td>“One in five women hospitalized with COVID-19 infection delivered urgently for respiratory compromise or were admitted to the ICU. None, however, died. Increased pregestational BMI and abnormal heart and respiratory rates on admission were associated with severe disease.”</td>
</tr>
<tr>
<td>Pierce-Williams et al. 2020(64)</td>
<td>Multicenter, retrospective cohort study 64 pregnant women hospitalized with severe or critical COVID-19 infection</td>
<td>“Describe the clinical course of severe and critical infection in hospitalized pregnant women with positive laboratory testing for SARS-CoV2.” Outcomes: maternal complications, neonatal complications, vertical transmission.</td>
<td>“Of 64 pregnant women hospitalized with COVID-19, 44 (69%) had severe and 20 (31%) critical disease. ...There was one case of maternal cardiac arrest, but no cases of cardiomyopathy and no maternal deaths. Thirty-two (50%) women in this cohort delivered during their COVID-19 hospitalization (34% of severe and 85% of critical women). Eighty-eight percent (15/17) of pregnant women with critical COVID-19 who delivered during their disease course were delivered preterm, 94% of them via cesarean; in all, 75% (15/20) of critically ill women delivered preterm. There were no stillbirths or neonatal deaths, or cases of vertical transmission.”</td>
<td>“Hospitalization for severe or critical COVID-19 infection resulted in delivery during the course of infection in 50% of this cohort, usually in the third trimester. There were no perinatal deaths in this cohort.”</td>
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</table>
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<tr>
<td>Fox and Melka 2020 (66) Review full text United States</td>
<td>Single-center case series 92 pregnant women with known or suspected COVID-19 infection</td>
<td>“Describe outcomes of pregnant women in New York City with confirmed or presumed coronavirus disease (COVID-19) infection.” Outcomes: maternal complications, neonatal complications.</td>
<td>“From March 22, 2020 until April 30, 2020, 757 pregnant women in our practice were evaluated and 92 had known or suspected COVID-19 (12.2%, 95% confidence interval [CI]: 10.0-14.7%). Of these 92 women, 33 (36%) had positive COVID-19 test results. Only one woman required hospital admission for 5 days due to COVID-19 (1.1%, 95% CI: 0.2-5.9%). One other woman received home oxygen. No women required mechanical ventilation and there were no maternal deaths. One woman had an unexplained fetal demise at 14 weeks’ gestation around the time of her COVID-19 symptoms. Twenty one of the 92 women have delivered, and all were uncomplicated.”</td>
<td>“Among 92 women with confirmed or presumed COVID-19, the overall morbidity was low. These preliminary results are encouraging for pregnant women during the COVID-19 pandemic.”</td>
</tr>
<tr>
<td>Yan et al. 2020 (65) Reviewed full text China</td>
<td>Multicenter retrospective review 116 pregnant women with COVID-19 pneumonia</td>
<td>“Evaluate the clinical characteristics and outcomes in pregnancy and the vertical transmission potential of SARS-CoV-2 infection.” Outcomes: maternal complications, neonatal complications, vertical transmission risk.</td>
<td>“The median gestational age on admission was 38(+0) (IQR 36(+0)-39(+1)) weeks. The most common symptoms were fever (50.9%, 59/116) and cough (28.4%, 33/116); 23.3% (27/116) patients presented without symptoms. Abnormal radiologic findings were found in 96.3% (104/108) of cases. There were eight cases (6.9%, 8/116) of severe pneumonia but no maternal deaths. One of eight patients (1/8) that presented in the first- and early-second-trimester had a missed spontaneous abortion. Twenty-one of 99 patients (21.2%, 21/99) that had delivered had preterm birth, including six with preterm premature ruptured of membranes. The rate of spontaneous preterm birth before 37 weeks was 6.1% (6/99). There was one case of severe neonatal asphyxia that resulted in neonatal death. Eighty-six of the 100 neonates that had testing for SARS-CoV-2 had negative results, of these ten neonates had paired amniotic fluid and cord blood samples that were tested negative for SARS-CoV-2.”</td>
<td>“SARS-CoV-2 infection during pregnancy is not associated with an increased risk of spontaneous abortion and spontaneous preterm birth. There is no evidence of vertical transmission of SARS-CoV-2 infection when the infection manifests during the third-trimester of pregnancy.”</td>
</tr>
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<tr>
<td>Pereira et al. 2020(67)</td>
<td>Single-center, retrospective review 60 pregnant women with COVID-19 infection</td>
<td>Report clinical experience in the management of COVID-19-infected pregnant women during the first 30 days of the pandemic. Outcomes: maternal complications, neonatal complications, vertical transmission.</td>
<td>“Forty-one patients (68.6%) required hospital admission (18 due to disease worsening and 23 for delivery) of whom 21 patients (35%) underwent pharmacological treatment, including hydroxychloroquine, antivirals, antibiotics and tocilizumab. No renal or cardiac failures or maternal deaths were reported. Lymphopenia (50%), thrombocytopenia (25%), and elevated C-reactive protein (CRP) (59%) were observed in the early stages of the disease. Median CRP, D-dimer and the neutrophil/lymphocyte ratio were elevated. High CRP and D-dimer levels were the parameters most frequently associated with severe pneumonia. The Neutrophil/lymphocyte ratio was found to be the most sensitive marker for disease improvement (relative risk: 6.65; 95% CI: 4.1-5.9). During the study period, 18 of 23 women (78%) delivered vaginally. All newborns tested negative for SARS-CoV-2 and none of them were infected during breastfeeding. No SARS-CoV-2 was detected in placental tissue.”</td>
<td>“Most of the pregnant COVID-19 positive patients had a favorable clinical course. However, one-third of them developed pneumonia, of whom 5% presented a critical clinical status. CRP and D-dimer levels positively correlated with severe pneumonia and the neutrophil/lymphocyte ratio decreased as the patients improved clinically. Seventy-eight percent of patients had a vaginal delivery. No vertical or horizontal transmissions were diagnosed in the neonates during labor or breastfeeding.”</td>
</tr>
<tr>
<td>Lokken et al. 2020(68)</td>
<td>Multicenter, retrospective review 46 pregnant women with COVID-19 infection</td>
<td>“Describe maternal disease and obstetrical outcomes associated with Covid-19 disease in pregnancy to rapidly inform clinical care.” Outcomes: maternal complications, neonatal complications.</td>
<td>“A total of 46 pregnant patients with a SARS-CoV-2 infection were identified from hospital systems capturing 40% of births in Washington State. Nearly all pregnant individuals with a SARS-CoV-2 infection were symptomatic (93.5%, n=43) and the majority were in their second or third trimester (43.5%, n=20 and 50.0%, n=23, respectively). Symptoms resolved in a median of 24 days (interquartile range 13-37). Seven women were hospitalized (16%) including one admitted to the intensive care unit. Six cases (15%) were categorized as severe Covid-19 disease with nearly all patients being either overweight or obese prior to pregnancy, asthma or other co-morbidities. Eight deliveries occurred during the study period, including a preterm birth at 33 weeks to improve pulmonary status in a woman with Class III obesity. One stillbirth occurred of unknown etiology.”</td>
<td>“Nearly 15% of pregnant patients developed severe Covid-19, which occurred primarily in overweight or obese women with underlying conditions. Obesity and Covid-19 may synergistically increase risk for a medically-indicated preterm birth to improve maternal pulmonary status in late pregnancy. Collectively, these findings support categorizing pregnant patients as a higher risk group, particularly for those with chronic co-morbidities.”</td>
</tr>
<tr>
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<tr>
<td>Ferrazzi et al. 2020(69)</td>
<td>Multicenter retrospective review 42 pregnant women with COVID-19 infection</td>
<td>“Report mode of delivery and immediate neonatal outcome in women infected with COVID-19.” Outcomes: maternal complications, neonatal complications, vertical transmission.</td>
<td>“In all, 42 women with COVID-19 delivered at the participating centres; 24 (57.1%, 95% CI 41.0-72.3) delivered vaginally. An elective caesarean section was performed in 18/42 (42.9%, 95% CI 27.7-59.0) cases: in eight cases the indication was unrelated to COVID-19 infection. Pneumonia was diagnosed in 19/42 (45.2%, 95% CI 29.8-61.3) cases: of these, 7/19 (36.8%, 95% CI 16.3-61.6) required oxygen support and 4/19 (21.1%, 95% CI 6.1-45.6) were admitted to a critical care unit. Two women with COVID-19 breastfed without a mask because infection was diagnosed in the postpartum period: their newborns tested positive for SARS-CoV-2 infection. In one case, a newborn had a positive test after a vaginal operative delivery.”</td>
<td>“Although postpartum infection cannot be excluded with 100% certainty, these findings suggest that vaginal delivery is associated with a low risk of intrapartum SARS-CoV-2 transmission to the newborn.”</td>
</tr>
<tr>
<td>Penfield et al. 2020(70)</td>
<td>Single-center retrospective review 32 symptomatic mothers with confirmed COVID-19 infection during pregnancy</td>
<td>“Report experience with placental/membrane SARS-CoV2 RNA PCR swab results after delivery.” Outcome: vertical transmission</td>
<td>“Of 32 COVID-19 positive pregnant patients who gave birth in this timeframe, placental or membrane swabs were sent from 11 patients. Three of 11 swabs were positive. None of the infants tested positive for SARS-CoV2 on days of life 1 through 5, and none demonstrated symptoms of COVID-19 infection.</td>
<td>“Of 11 placental or membrane swabs sent following delivery, 3 swabs were positive for SARS-CoV-2, all in women with moderate to severe COVID-19 illness at time of delivery...The presence of viral RNA by RT-PCR [real-time polymerase chain reaction] in placenta/membranes at the time of delivery suggests the need for further research into the possibility of vertical transmission.”</td>
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## Clinical Evidence Assessment

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<tr>
<td>Yang et al. 2020(71)</td>
<td>Single-center retrospective review of 27 pregnant women (4 early pregnancies included) with suspected or confirmed COVID-19 infection and 24 neonates born to the 23 late pregnant mothers.</td>
<td>“Investigate the effect of the COVID-19 infection on maternal, fetal, and neonatal morbidity and other poor obstetric outcomes.”</td>
<td>One mother developed severe pneumonia three days after her delivery. No maternal and perinatal death occurred. Moreover, one early preterm newborn, born to a mother with complication of premature rupture of fetal membranes, highly suspected with SARS-CoV-2 infection, was SARS-CoV-2 negative after repeated real-time reverse transcriptase polymerase chain reaction testing. Statistical difference was observed between the groups of early pregnant and late pregnant women with COVID-19 in the occurrence of lymphopenia and thrombocytopenia.</td>
<td>“No major complication were reported among the studied cohort, though one serious case and one perinatal infection were observed. Much effort should be done to reduce the pathogenic effect of COVID-19 infection in pregnancies.”</td>
</tr>
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</table>

### Other Resources

Our literature searches also identified 25 articles that describe:

- Infection-control measures for COVID-19 in the labor and delivery and neonate units.(73)
- The effectiveness of COVID-19 screening for pregnant women entering an obstetric unit.(74)
- The response of a large health system for care of pregnant women during the COVID-19 pandemic.(75)
- Simulation-guided preparations for managing suspected or confirmed COVID-19 cases in obstetric emergencies.(76)
- Strategies to reduce the potential risk of vertical transmission during vaginal delivery.(77)
- Guidance for the COVID-19-positive or suspected pregnant woman in labor and delivery and those who are critically ill.(78)
- Practice recommendations for the anesthetic management of pregnant women with suspected or confirmed COVID-19.(79)
- Changing U.S. maternity practices due to the COVID-19 pandemic.(80)
- The importance of social and emotional support during important milestones such as pregnancy and childbirth.(81)
- Neonatal emergency transport during the COVID-19 pandemic.(82)
- Managing a tertiary NICU in the time of COVID-19.(83)
- Potential strategies to reduce stress, preserve family-centered care, and to gain knowledge and experience during the COVID-19 outbreak.(84)
- A triage algorithm for managing newborns exposed to mothers with confirmed or suspected COVID-19.(85)
- A contingency plan for managing a COVID-19 outbreak in a NICU.(86)
- A support tool for the planning of delivery and neonatal resuscitation of infants born by mothers with suspected or confirmed COVID-19 infection.(87)
- A stepwise informed approach to rapidly establish an obstetric unit for patients with suspected COVID-19 within existing resources.(88)
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- A classification system for maternal-fetal-neonatal SARS-CoV-2 infections. (89)
- Safe handling of containers of expressed human milk in all settings during the SARS-CoV-2 (COVID-19) pandemic. (90)
- Strategies to implement on labor and delivery units to reduce the risk of healthcare-associated transmission. (91)
- Neonatal resuscitation and postresuscitation care of infants born to mothers with suspected or confirmed SARS-CoV-2 infection. (92)
- Reorganization tips for preparing an obstetric unit in the heart of the epidemic strike of COVID-19. (93)
- A protocol for intrapartum care of pregnant women with COVID-19 during labor and delivery. (94)
- An operating room guide for pregnant patients with confirmed or suspected COVID-19 requiring cesarean delivery. 2020. (95)
- Recommended ways to protect labor and delivery personnel from COVID-19 during the second stage of labor. (96)
- Considerations for supporting the emotional, mental, and physical health needs of maternity care providers in the context of the COVID-19 crisis. (97)

Selected Resources and Reference
Search Summaries
Our master’s-level medical librarians searched the following databases to identify the literature and related materials.

ECRI Resources [searched January 1, 2015, through June 1, 2020]

Search Strategy:
(COVID OR coronavirus) AND (labor OR deliver* OR pregnan* OR infant* OR neonat*)

Scan of COVID-19 Resource Center
Results: We identified three related report.

- Educate parents: childhood vaccinations are as important as ever. [Ambulatory Care Risk, Quality, & Safety Guidance]. 2020 May 26.
- People who are at higher risk for severe COVID-19 complications. [Clinical Risk Management Services]. 2020 Apr 14.
- Study says maternity patients in New York tested positive for COVID-19 even after negative prescreening. [Risk Management News]. 2020 May 27.


Search Strategy:

#3 (coronavirus OR “corona virus” OR coronavirinae OR coronaviridae OR betacoronavirus OR COVID19 OR “COVID 19” OR nCoV OR “CoV 2” OR CoV2 OR sarscov2 OR 2019nCoV OR “novel CoV” OR “wuhan virus”) OR ((wuhan OR hubei OR huanan) AND (“severe acute respiratory” OR pneumonia) AND (outbreak)) OR “Coronavirus”[Mesh] OR “Coronavirus Infections”[Mesh] OR “COVID-19” [Supplementary Concept] OR “severe acute respiratory syndrome coronavirus 2” [Supplementary Concept] OR “Betacoronavirus”[Mesh]
#4 (#1 OR #2) AND #3

Results: We identified 222 records.
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Search Strategy:

- #1 'childbirth'/exp OR ((labor*:ti,ab OR labour*:ti,ab OR deliver*:ti,ab) AND (obstetric*:ti,ab OR pregnan*:ti,ab)) OR 'obstetric delivery'/exp OR caesarean*:ti,ab OR cesarean*:ti,ab OR birth:ti,ab OR births:ti,ab OR childbirth:ti,ab OR 'child birth':ti,ab OR birth/de OR parturition:ti,ab
- #2 'newborn'/exp OR ((new:ti,ab OR newb*:ti,ab OR newly:ti,ab) AND (infant:ti,ab OR infants:ti,ab)) OR neonate*:ti,ab OR newborn*:ti,ab OR neonatal:ti,ab
- #3 'coronavirus' OR 'corona virus' OR coronavirinae OR coronaviridae OR 'beta coronavirus' OR 'COVID19' OR 'COVID 19' OR nCoV OR 'cov 2' OR 'cov2' OR 'sarscov2' OR '2019ncov' OR 'novel cov' OR 'wuhan virus' OR ((wuhan OR hubei OR huanan) AND ('severe acute respiratory' OR 'pneumonia') AND outbreak) OR 'coronavirinae'/exp OR 'coronavirus infection'/exp OR 'COVID 19'/exp OR 'severe acute respiratory syndrome coronavirus 2'/exp OR 'beta coronavirus'/exp
- #4 (#1 OR #2) AND #3

Results: We identified 20 unique records.


Search Strategy:

- #1 (coronavirus OR "corona virus" OR coronavirinae OR coronaviridae OR betacoronavirus OR COVID19 OR "COVID 19" OR nCoV OR "CoV 2" OR CoV2 OR sarscov2 OR nCoV OR "novel CoV" OR "wuhan virus") OR ((wuhan OR hubei OR huanan) AND ("severe acute respiratory" OR "pneumonia") AND (outbreak)) OR [mh Coronavirus] OR [mh "Coronavirus Infections"] OR [mh Betacoronavirus]

Results: We did not identify any unique relevant publications.

Guidelines, Position and Consensus Statements [searched January 1, 2015, through June 1, 2020]

Search Strategy:

coronavirus OR "corona virus" OR coronavirinae OR coronaviridae OR betacoronavirus OR COVID19 OR "COVID 19" OR nCoV OR "CoV 2" OR CoV2 OR sarscov2 OR nCoV OR "novel CoV" OR "wuhan virus" (coronavirus OR corona OR COVID) AND (pregnan* OR labor OR labour OR deliver* OR neonat* OR infant*)

Scanned relevant society websites

Results: We identified 63 relevant documents.

Selected Standards and Guidelines

  - Breastfeeding guidance post hospital discharge for mothers or infants with suspected or confirmed SARS-CoV-2 infection. [last updated 2020 Apr 23].
  - FAQs: management of infants born to mothers with suspected or confirmed COVID-19. [last updated 2020 May 21].
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  - Breastfeeding when mothers have suspected or proven COVID-19. [updated 2020 May 6].
  - Delivery room considerations for infants born to mothers with suspected or proven COVID-19. [updated 2020 May 6].
  - NICU care for infants born to mothers with suspected or proven COVID-19. [updated 2020 May 12].
- Centers for Disease Control and Prevention (CDC). [cited 2020 Apr 28]
  - Care for breastfeeding women. [last reviewed 2020 May 5].
  - Considerations for inpatient obstetric healthcare settings. [revised 2020 Apr 6].
  - Coronavirus disease (COVID-19) and breastfeeding. [last reviewed 2020 Mar 18].
  - Evaluation and management considerations for neonates at risk for COVID-19. [last reviewed 2020 May 20].
- Department of Health (Western Australia). [cited 1 Jun 2020].
- Expert consensus for managing pregnant women and neonates born to mothers with suspected or confirmed novel coronavirus (COVID-19) infection. 2020.
- Expert recommendations for the care of new borns of mothers with COVID-19. 2020
- Federation of Obstetric and Gynecological Societies of India (FOGSI), National Neonatology Forum of India (NNF), and Indian Academy of Pediatrics (IAP). Perinatal-neonatal management of COVID-19 infection: Guidelines of the Federation of Obstetric and Gynecological Societies of India (FOGSI), National Neonatology Forum of India (NNF), and Indian Academy of Pediatrics (IAP). 2020 Apr.
- International Federation of Gynecology and Obstetrics (FIGO).
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  - Guidance for neonatal services. [updated 2020 May 1].
  - Guidance for the statewide infant screening – hearing (SWiSH) program. [updated 2020 May 1].
  - Maternity and newborn care. [updated 2020 Apr 20].
  - Choice of PPE for obstetric anaesthetists according to mode of transmission risk. 2020 Apr 11.
- Management of pregnant women with known or suspected COVID-19. 2020 Mar 16.
- Perinatal-neonatal management of COVID-19 infection - guidelines of the Federation of Obstetric and Gynecological Societies of India (FOGSI), National Neonatology Forum of India (NNF), and Indian Academy of Pediatrics (IAP). 2020.
- Queensland Health. [cited 2020 Apr 28].
- Royal College of Paediatrics and Child Health. COVID-19 - guidance for neonatal settings. [last modified 2020 May 12].
  - Coronavirus (COVID-19) and pregnancy: what maternal-fetal medicine subspecialists need to know. 2020 Apr 11.
- Society for Maternal-Fetal Medicine (SMFM) and Society for Obstetric and Anesthesia and Perinatology (SOAP). Labor and delivery COVID-19 considerations. [last updated 2020 Apr 14].
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Society of Obstetricians and Gynaecologists of Canada (SOGC). [cited 1 Jun 2020].

- COVID-19 technical brief for maternity services. 2020 May.


Selected Web Resources. [searched June 2, 2020].
  - Coronavirus (COVID-19), pregnancy and breastfeeding: a message for patients. [last updated 2020 Apr 16].
  - COVID-19 FAQs for obstetrician-gynecologists, obstetrics. [cited 2020 June 2].
- National Institutes of Health. NIH-funded study to investigate pregnancy outcomes resulting from COVID-19 pandemic. 2020 May 19.
- Royal College of Obstetricians & Gynaecologists. Coronavirus infection and pregnancy. [updated 2020 May 29].
- UptoDate. [cited 2020 Apr 28]. Note: subscription required to access full text.

We identified registered clinical trials on this topic. See the list of ongoing trials and the comprehensive list of ongoing and completed trials. [Note: ongoing and comprehensive trial lists may contain trials that are outside the scope of this Clinical Evidence Assessment.]

References Reviewed (PubMed and EMBASE search dates were January 1, 2015, through May 29, 2020)
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Considerations for Safe Labor, Delivery, and Neonatal Care during the COVID-19 Pandemic


Policy Statement

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