Ultrasound Obstet Gynecol 2020
Published online in Wiley Online Library (wileyonlinelibrary.com). **DOI:** 10.1002/uog.22013

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INTERIM GUIDANCE

ISUOG Interim Guidance on 2019 novel coronavirus infection during pregnancy and puerperium: information for healthcare professionals

In response to the World Health Organization (WHO) statements and international concerns regarding the novel coronavirus infection (COVID-19) outbreak, the International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) is issuing the following guidance for management during pregnancy and puerperium.

With the current uncertainty regarding many aspects of the clinical course of COVID-19 infection in pregnancy, potentially valuable information is likely to be obtained by obstetricians and ultrasound practitioners that may help in counseling pregnant women and further improve our understanding of the pathophysiology of COVID-19 infection in pregnancy. This statement is not intended to replace previously published interim guidance on evaluation and management of COVID-19-exposed pregnant women. It should, therefore, be considered in conjunction with other relevant advice from organizations such as:

WHO: https://www.who.int/emergencies/diseases/novel-coronavirus-2019

Centers for Disease Control and Prevention (CDC): https://www.cdc.gov/coronavirus/2019-ncov/specific-groups/pregnancy-faq.html

Pan American Health Organization (PAHO): http://www.paho.org

European Centre for Disease Prevention and Control (ECDC): https://www.ecdc.europa.eu

Public Health England: https://www.gov.uk/guidance/coronavirus-covid-19-information-for-the-public

National Health Commission of the People's Republic of China: http://www.nhc.gov.cn

Perinatal Medicine Branch of Chinese Medical Association: https://mp.weixin.qq.com/s/11hbxlPh317es1XtfWG2qg

Indicazioni ad interim della Societa Italiana di Neonatologia (SIN): https://www.policlinico.mi.it/uploads/fom/attachments/pagine/pagine_m/79/files/allegati/539/allattamento_e_infezione_da_sars-cov-2_indicazioni_ad_interim_della_societ___italiana_di_neonatologia_sin__2_.pdf

Santé Publique France https://www.santepubliquefrance.fr/

Sociedad Española de Ginecología y Obstetricia S.E.G.O.: https://mcusercontent.com/fbf1db3cf76a76d43c634a0e7/files/1abd1fa8-1a6f-409d-b622-c50e2b29eca9/RECOMENDACIONES_PARA_LA_PREVENCIO_N_DE_LA_INFECCIO_N_Y_EL_CONTROL_DE_LA_ENFERMEDAD_POR_CORONAVIRUS_2019_COVID_19_EN_LA_PACIENTE_OBSTE_TRICA.pdf

Royal College of Obstetricians and Gynaecologists (RCOG): https://www.rcog.org.uk/globalassets/documents/guidelines/coronavirus-covid-19-infection-in-pregnancy-v3-20-03-18.pdf

BACKGROUND

The novel coronavirus infection (COVID-19), also termed SARS-CoV-2, is a global public health emergency. Since the first case of COVID-19 pneumonia was reported in Wuhan, Hubei Province, China, in December 2019, the infection has spread rapidly to the rest of China and beyond[1–3].

Coronaviruses are enveloped, non-segmented, positive-sense ribonucleic acid (RNA) viruses belonging to the family Coronaviridae, order Nidovirales[4]. The epidemics of the two β-coronaviruses, severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV), have caused more than 10 000 cumulative cases in the past two decades, with mortality rates of 10% for SARS-CoV and 37% for MERS-CoV[5–9]. COVID-19 belongs to the same β-coronavirus subgroup and it has genome similarity of about 80% and 50% with SARS-CoV and MERS-CoV, respectively[10]. COVID-19 is spread by respiratory droplets and direct contact (when bodily fluids touch another person's eyes, nose or mouth, or an open cut, wound or abrasion). The Report of the World Health Organization (WHO)-China Joint Mission on Coronavirus Disease 2019 (COVID-19)[11] estimated a high R_0 (reproduction number) of 2–2.5. The latest report from WHO[12], on March 3rd, estimated the global mortality rate of COVID-19 infection to be 3.4%.

Huang *et al.*[1] first reported on a cohort of 41 patients with laboratory-confirmed COVID-19 pneumonia. They described the epidemiological, clinical, laboratory and radiological characteristics, as well as treatment and clinical outcome of the patients. Subsequent studies with

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larger sample sizes have shown similar findings[13,14]. The most common symptoms reported are fever (43.8% of cases on admission and 88.7% during hospitalization) and cough (67.8%)[15]. Diarrhea is uncommon (3.8%). On admission, ground-glass opacity is the most common radiologic finding on computed tomography (CT) of the chest (56.4%). No radiographic or CT abnormality was found in 157 of 877 (17.9%) patients with non-severe disease and in five of 173 (2.9%) patients with severe disease. Lymphocytopenia was reported to be present in 83.2% of patients on admission[15].

Pregnancy is a physiological state that predisposes women to respiratory complications of viral infection. Due to the physiological changes in their immune and cardiopulmonary systems, pregnant women are more likely to develop severe illness after infection with respiratory viruses. In 2009, pregnant women accounted for 1% of patients infected with influenza A subtype H1N1 virus, but they accounted for 5% of all H1N1-related deaths[16]. In addition, SARS-CoV and MERS-CoV are both known to be responsible for severe complications during pregnancy, including the need for endotracheal intubation, admission to an intensive care unit (ICU), renal failure and death[9,17]. The case fatality rate of SARS-CoV infection among pregnant women is up to 25%[9]. Currently, however, there is no evidence that pregnant women are more susceptible to COVID-19 infection or that those with COVID-19 infection are more prone to developing severe pneumonia.

Over and above the impact of COVID-19 infection on a pregnant woman, there are concerns relating to the potential effect on fetal and neonatal outcome; therefore, pregnant women require special attention in relation to prevention, diagnosis and management. Based on the limited information available as yet and our knowledge of other similar viral pulmonary infections, the following expert opinions are offered to guide clinical management.

DIAGNOSIS OF INFECTION AND CLINICAL CLASSIFICATION

Case definitions are those included in the WHO's interim guidance, 'Global surveillance for COVID-19 disease caused by human infection with the 2019 novel coronavirus'[18].

Suspected case

- A patient with acute respiratory illness (fever and at least one sign/symptom of respiratory disease (e.g. cough, shortness of breath)) AND with no other etiology that fully explains the clinical presentation AND a history of travel to or residence in a country/area or territory reporting local transmission of COVID-19 infection during the 14 days prior to symptom onset; OR
- A patient with any acute respiratory illness AND who has been in contact (see definition of contact below) with a confirmed or probable case of COVID-19 infection in the 14 days prior to onset of symptoms; OR
- A patient with severe acute respiratory infection (fever and at least one sign/symptom of respiratory disease (e.g. cough, shortness breath)) AND who requires hospitalization AND who has no other etiology that fully explains the clinical presentation.

Probable case

A suspected case for which laboratory testing for COVID-19 is inconclusive.

Confirmed case

A person with laboratory confirmation of COVID-19 infection, irrespective of clinical signs and symptoms.

It is plausible that a proportion of transmissions occurs from cases with mild symptoms that do not provoke healthcare-seeking behavior. Under these circumstances, in areas in which local transmission occurs, an increasing number of cases without a defined chain of transmission is observed[19] and a lower threshold for suspicion in patients with severe acute respiratory infection may be recommended by health authorities.

Any suspected case should be tested for COVID-19 infection using available molecular tests, such as quantitative reverse transcription polymerase chain reaction (qRT-PCR). Lower-respiratory-tract specimens likely have a higher diagnostic value compared with upper-respiratory-tract specimens for detecting COVID-19 infection. The WHO recommends that, if possible, lower-respiratory-tract specimens, such as sputum, endotracheal aspirate or bronchoalveolar lavage, be collected for COVID-19 testing. If patients do not have signs or symptoms of lower-respiratory-tract disease or specimen collection for lower-respiratory-tract disease is clinically indicated but collection is not possible, upper-respiratory-tract specimens of combined nasopharyngeal and oropharyngeal swabs should be collected. If initial testing is negative in a patient who is strongly suspected of having COVID-19 infection, the patient should be resampled, with a sampling time interval of at least 1 day and specimens collected from multiple respiratory-tract sites (nose, sputum, endotracheal aspirate). Additional specimens, such as blood, urine and stool, may be collected to monitor the presence of virus and the shedding of virus from different body compartments. When qRT-PCR analysis is negative for two consecutive tests, COVID-19 infection can be ruled out.

A contact is defined as a person involved in any of the following:

- Providing direct care for COVID-19 patients without using proper personal protective equipment (PPE)
- Being in the same close environment as a COVID-19 patient (including sharing workplace, classroom or household, or attending the same gathering)
- Traveling in close proximity (within 1–2 meters) to a COVID-19 patient in any kind of conveyance

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The WHO has provided guidance on the rational use of PPE for COVID-19. When conducting aerosol-generating procedures (e.g. tracheal intubation, non-invasive ventilation, cardiopulmonary resuscitation, manual ventilation before intubation), healthcare workers are advised to use respirators (e.g. N95, FFP2 or equivalent standard) with their PPE[20,21]. CDC additionally considers procedures that are likely to induce coughing (e.g. sputum induction, collection of nasopharyngeal swabs and suctioning) as aerosol-generating procedures and CDC guidance includes the option of using a powered air-purifying respirator (PAPR).

CHEST RADIOGRAPHY DURING PREGNANCY

Chest imaging, especially CT scan, is essential for evaluation of the clinical condition of a pregnant woman with COVID-19 infection[22–24]. Fetal growth restriction (FGR), microcephaly and intellectual disability are the most common adverse effects from high-dose (> 610 mGy) radiation exposure[25–27]. According to data from the American College of Radiology and American College of Obstetricians and Gynecologists, when a pregnant woman undergoes a single chest X-ray examination, the radiation dose to the fetus is 0.0005–0.01 mGy, which is negligible, while the radiation dose to the fetus is 0.01–0.66 mGy from a single chest CT or CT pulmonary angiogram[28–30].

Chest CT scanning has high sensitivity for diagnosis of COVID-19[24]. In a pregnant woman with suspected COVID-19 infection, a chest CT scan may be considered as a primary tool for the detection of COVID-19 in epidemic areas[24]. Informed consent should be acquired (shared decision-making) and a radiation shield be applied over the gravid uterus.

TREATMENT DURING PREGNANCY

Place of care

Suspected, probable and confirmed cases of COVID-19 infection should be managed initially by designated tertiary hospitals with effective isolation facilities and protection equipment. Suspected/probable cases should be treated in isolation and confirmed cases should be managed in a negative-pressure isolation room. A confirmed case that is critically ill should be admitted to a negative-pressure isolation room in an ICU[31]. Designated hospitals should set up a dedicated negative-pressure operating room and a neonatal isolation ward. All attending medical staff should don PPE (respirator, goggle, face protective shield, surgical gown and gloves) when providing care for confirmed cases of COVID-19 infection[32].

However, in areas with widespread local transmission of the disease, health services may be unable to provide such levels of care to all suspected, probable or confirmed cases. Pregnant women with a mild clinical presentation may not initially require hospital admission and home confinement can be considered, provided that this is possible logistically and that monitoring of the woman's condition can be ensured[33]. If negative-pressure isolation rooms are not available, patients should be isolated in single rooms, or grouped together once COVID-19 infection has been confirmed.

For transfer of confirmed cases, the attending medical team should don PPE and keep themselves and their patient a minimum distance of 1–2 meters from any individuals without PPE.

Suspected/probable cases

a. General treatment: maintain fluid and electrolyte balance; symptomatic treatment, such as antipyrexic, antidiarrheal medicines.
b. (1) Surveillance: close and vigilant monitoring of vital signs and oxygen saturation level to minimize maternal hypoxia; conduct arterial blood-gas analysis; repeat chest imaging (when indicated); regular evaluation of complete blood count, renal- and liver-function testing and coagulation testing. (2) Fetal monitoring: undertake cardiotocography (CTG) for fetal heart rate (FHR) monitoring when pregnancy is ≥ 26 or ≥ 28 weeks of gestation (depending on local practice), and ultrasound assessment of fetal growth and amniotic fluid volume with umbilical artery Doppler if necessary. Note that monitoring devices and ultrasound equipment should be disinfected adequately before further use. (3) The pregnancy should be managed according to the clinical and ultrasound findings, regardless of the timing of infection during pregnancy. All visits for obstetric emergencies should be offered in agreement with current local guidelines. All routine follow-up appointments should be postponed by 14 days or until positive test results (or two consecutive negative test results) are available.

Confirmed cases

a. Non-severe disease. (1) The approach to maintaining fluid and electrolyte balance, symptomatic treatment and surveillance is the same as for suspected/probable cases. (2) Currently there is no proven antiviral treatment for COVID-19 patients, although antiretroviral drugs are being trialed therapeutically on patients with severe symptoms[34,35]. If antiviral treatment is to be considered, this should be done following careful discussion with virologists; pregnant patients should be counseled thoroughly on the potential adverse effects of antiviral treatment for the patient herself as well as on the risk of FGR. (3) Monitoring for bacterial infection (blood culture, mid-stream or catheterized-specimen urine microscopy and culture) should be done, with timely use of appropriate antibiotics when there is evidence of secondary bacterial infection. When there is no clear evidence

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of secondary bacterial infection, empirical or inappropriate use of antibiotics should be avoided. (4) Fetal monitoring: undertake CTG for FHR monitoring when pregnancy is ≥26–28 weeks of gestation, and ultrasound assessment of fetal growth and amniotic fluid volume with umbilical artery Doppler if necessary.

b. Severe and critical disease. (1) The degree of severity of COVID-19 pneumonia is defined by the Infectious Diseases Society of America/American Thoracic Society guidelines for community-acquired pneumonia (Appendix 1)[36]. (2) Severe pneumonia is associated with a high maternal and perinatal mortality rate, therefore, aggressive treatment is required, including supporting measures with hydration, oxygen therapy and chest physiotherapy. The case should be managed in a negative-pressure isolation room in the ICU, preferably with the woman in a left lateral position, with the support of a multidisciplinary team (obstetricians, maternal–fetal-medicine subspecialists, intensivists, obstetric anesthetists, midwives, virologists, microbiologists, neonatologists, infectious-disease specialists)[37]. (3) Antibacterial treatment: appropriate antibiotic treatment in combination with antiviral treatment should be used promptly when there is suspected or confirmed secondary bacterial infection, following discussion with microbiologists. (4) Blood-pressure monitoring and fluid-balance management: in patients without septic shock, conservative fluid management measures should be undertaken[38]; in patients with septic shock, fluid resuscitation and inotropes are required to maintain an average arterial pressure ≥60 mmHg (1 mmHg = 0.133 kPa) and a lactate level <2 mmol/L[39]. (5) Oxygen therapy: supplemental oxygen should be used to maintain oxygen saturation ≥95%[40,41]; oxygen should be given promptly to patients with hypoxemia and/or shock[42], and method of ventilation should be according to the patient's condition and following guidance from the intensivists and obstetric anesthetists. (6) Fetal monitoring: if appropriate, CTG for FHR monitoring should be undertaken when pregnancy is ≥26–28 weeks of gestation, and ultrasound assessment of fetal growth and amniotic fluid volume with umbilical artery Doppler should be performed, if necessary, once the patient is stabilized. (7) Medically indicated preterm delivery should be considered by the multidisciplinary team on a case-by-case basis.

MANAGEMENT DURING PREGNANCY

Currently, there are limited data on the impact on the fetus of maternal COVID-19 infection. It has been reported that viral pneumonia in pregnant women is associated with an increased risk of preterm birth, FGR and perinatal mortality[43]. Based on nationwide population-based data, it was demonstrated that pregnant women with other viral pneumonias ($n = 1462$) had an increased risk of preterm birth, FGR and having a newborn with low birth weight and Apgar score < 7 at 5 min, compared with those without pneumonia ($n = 7310$)[44]. In 2004, a case series of 12 pregnant women with SARS-CoV in Hong Kong, China, reported three maternal deaths, that four of seven patients who presented in the first trimester had spontaneous miscarriage, four of five patients who presented after 24 weeks had preterm birth and two mothers recovered without delivery but their ongoing pregnancies were complicated by FGR[9]. Pregnant women with suspected/probable COVID-19 infection, or those with confirmed infection who are asymptomatic or recovering from mild illness, should be monitored with 2–4-weekly ultrasound assessment of fetal growth and amniotic fluid volume, with umbilical artery Doppler if necessary[45]. At present, it is uncertain whether there is a risk of vertical mother-to-baby transmission. In a study by Chen *et al.*[46], of nine pregnant women with COVID-19 in the third trimester, amniotic fluid, cord blood and neonatal throat-swab samples collected from six patients tested negative for COVID-19, suggesting there was no evidence of intrauterine infection caused by vertical transmission in women who developed COVID-19 pneumonia in late pregnancy. However, there are currently no data on perinatal outcome when the infection is acquired in the first and early second trimester of pregnancy, and these pregnancies should be monitored carefully after recovery.

ULTRASOUND EQUIPMENT

Following ultrasound examination, ensure surfaces of transducers are cleaned and disinfected according to manufacturer specifications, taking note of the recommended 'wet time' for wiping transducers and other surfaces with disinfection agents[47]. Consider using protective covers for probes and cables, especially when there are infected skin lesions or when a transvaginal scan is necessary. In the case of high infectivity, a 'deep clean' of the equipment is necessary. A bedside scan is preferred; if the patient needs to be scanned in the clinic, this should be done at the end of the list, as the room and equipment will subsequently require a deep clean. Reprocessing of the probes should be documented for traceability[47].

MANAGEMENT DURING CHILDBIRTH

1. COVID-19 infection itself is not an indication for delivery, unless there is a need to improve maternal oxygenation. For suspected, probable and confirmed cases of COVID-19 infection, delivery should be conducted in a negative-pressure isolation room. The timing and mode of delivery should be individualized, dependent mainly on the clinical status of the patient, gestational age and fetal condition[48]. In the event that an infected woman has spontaneous onset of labor with optimal progress, she can be allowed to deliver vaginally. Shortening the second stage by operative vaginal delivery can be considered, as active pushing while wearing a surgical mask may be difficult for

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the woman to achieve[49]. With respect to a pregnant woman without a diagnosis of COVID-19 infection, but who might be a silent carrier of the virus, we urge caution regarding the practice of active pushing while wearing a surgical mask, as it is unclear if there is an increased risk of exposure to any healthcare professional attending the delivery without PPE, because forceful exhalation may significantly reduce the effectiveness of a mask in preventing the spread of the virus by respiratory droplets[49]. Induction of labor can be considered when the cervix is favorable, but there should be a low threshold to expedite the delivery when there is fetal distress, poor progress in labor and/or deterioration in maternal condition. Septic shock, acute organ failure or fetal distress should prompt emergency Cesarean delivery (or termination, if legal, before fetal viability)[45]. For the protection of the medical team, water birth should be avoided. Both regional anesthesia and general anesthesia can be considered, depending on the clinical condition of the patient and after consultation with the obstetric anesthetist.

2. For preterm cases requiring delivery, we urge caution regarding the use of antenatal steroids (dexamethasone or betamethasone) for fetal lung maturation in a critically ill patient, because this can potentially worsen the clinical condition[50] and the administration of antenatal steroids would delay the delivery that is necessary for management of the patient. The use of antenatal steroids should be considered in discussion with infectious-disease specialists, maternal–fetal-medicine subspecialists and neonatologists[37,51]. In the case of an infected woman presenting with spontaneous preterm labor, tocolysis should not be used in an attempt to delay delivery in order to administer antenatal steroids.
3. Miscarried embryos/fetuses and placentae of COVID-19-infected pregnant women should be treated as infectious tissues and they should be disposed of appropriately; if possible, testing of these tissues for COVID-19 by qRT-PCR should be undertaken.
4. Regarding neonatal management of suspected, probable and confirmed cases of maternal COVID-19 infection, the umbilical cord should be clamped promptly and the neonate should be transferred to the resuscitation area for assessment by the attending pediatric team. There is insufficient evidence regarding whether delayed cord clamping increases the risk of infection to the newborn via direct contact[51]. In units in which delayed cord clamping is recommended, clinicians should consider carefully whether this practice should be continued. There is currently insufficient evidence regarding the safety of breastfeeding and the need for mother–baby separation[46,52]. If the mother is severely or critically ill, separation appears to be the best option, with attempts to express breastmilk in order to maintain milk production. Precautions should be taken when cleaning the breast pumps. If the patient is asymptomatic or mildly affected, breastfeeding and colocation (also called rooming-in) can be considered by the mother in coordination with healthcare providers, or may be necessary if facility limitations prevent mother–baby separation. Since the main concern is that the virus may be transmitted by respiratory droplets rather than breastmilk, breastfeeding mothers should ensure to wash their hands and wear a three-ply surgical mask before touching the baby. In case of rooming-in, the baby's cot should be kept at least 2 meters from the mother's bed, and a physical barrier such as a curtain may be used[53,54].
5. The need to separate mothers with COVID-19 infection from their newborns, with the consequence that they are unable to breastfeed directly, may impede early bonding as well as establishment of lactation[55]. These factors will inevitably cause additional stress for mothers in the postpartum period. As well as caring for their physical wellbeing, medical teams should consider the mental wellbeing of these mothers, showing appropriate concern and providing support when needed[55].

PERINATAL EFFECT OF COVID-19 INFECTION

Fever is common in COVID-19-infected patients. Previous data have demonstrated that maternal fever in early pregnancy can cause congenital structural abnormalities involving the neural tube, heart, kidney and other organs[56–59]. However, a recent study[60], including 80 321 pregnant women, reported that the rate of fever in early pregnancy was 10%, while the incidence of fetal malformation in this group was 3.7%. Among the 77 344 viable pregnancies with data collected at 16–29 weeks of gestation, in the 8321 pregnant women with a reported temperature > 38°C lasting 1–4 days in early pregnancy, compared to those without a fever in early pregnancy, the overall risk of fetal malformation was not increased (odds ratio = 0.99 (95% CI, 0.88–1.12))[60]. Previous studies have reported no evidence of congenital infection with SARS-CoV[61], and currently there are no data on the risk of congenital malformation when COVID-19 infection is acquired during the first or early second trimester of pregnancy. Nonetheless, a detailed morphology scan at 18–24 weeks of gestation is indicated for pregnant women with suspected, probable or confirmed COVID-19 infection.

GENERAL PRECAUTIONS

Currently, there are no effective drugs or vaccines to prevent COVID-19. Therefore, personal protection should be considered in order to minimize the risk of contracting the virus[62].

Patients and healthcare providers

a. Maintain good personal hygiene: consciously avoid close contact with others during the COVID-19

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epidemic period, reduce participation in any gathering in which a distance of at least 1 meter between individuals cannot be maintained, pay attention to hand washing and use hand sanitizer (with 70% alcohol concentration[63]) frequently.

b. Some national health authorities and some hospital systems recommend wearing a three-ply surgical mask when visiting a hospital or other high-risk area.
c. Seek medical assistance promptly for timely diagnosis and treatment when experiencing symptoms such as fever and cough.

Healthcare providers

d. Consider providing educational information (brochures, posters) in waiting areas.
e. Set up triage plans for screening. In units in which triage areas have been set up, staff should have appropriate protective equipment and be strictly compliant with hand hygiene.
f. All pregnant patients who present to the hospital and for outpatient visits should be assessed and screened for symptoms and risk factors based on travel history, occupation, significant contact and cluster (TOCC) (Appendix 2).
g. Pregnant patients with known TOCC risk factors and those with mild or asymptomatic COVID-19 infection should delay antenatal visit and routine ultrasound assessment by 14 days.
h. Consider reducing the number of visitors to the department.
i. In units in which routine group-B streptococcus (GBS) screening is practiced, acquisition of vaginal and/or anal swabs should be delayed by 14 days in pregnant women with TOCC risk factors or should be performed only after a suspected/probable case tests negative or after recovery in a confirmed case. Intrapartum prophylactic antibiotic cover for women with ante- or intrapartum risk factors for GBS is an alternative.
j. On presentation to triage areas, pregnant patients with TOCC risk factors should be placed in an isolation room for further assessment.
k. Medical staff who are caring for suspected, probable or confirmed cases of COVID-19 patients should be monitored closely for fever or other signs of infection and should not be working if they have any COVID-19 symptoms. Common symptoms at onset of illness include fever, dry cough, myalgia, fatigue, dyspnea and anorexia. Some national health authorities and hospital systems recommend that medical staff assigned to care for suspected, probable or confirmed cases of COVID-19 patients should minimize contact with other patients and colleagues, with the aim of reducing the risk of exposure and potential transmission.
l. Medical staff who have been exposed unexpectedly, while without PPE, to a COVID-19-infected pregnant patient, should be quarantined or self-isolate for 14 days.
m. Pregnant healthcare professionals should follow risk-assessment and infection-control guidelines following exposure to patients with suspected, probable or confirmed COVID-19.

KEY POINTS FOR CONSIDERATION

1. Pregnant women with confirmed COVID-19 infection should be managed by designated tertiary hospitals, and they should be informed of the risk of adverse pregnancy outcome.
2. Negative-pressure isolation rooms should be set up for safe labor and delivery and neonatal care.
3. During the COVID-19 epidemic period, a detailed history regarding recent travel, occupation, significant contact and cluster (i.e. TOCC) and clinical manifestations should be acquired routinely from all pregnant women attending for routine care.
4. Chest imaging, especially CT scan, should be included in the work-up of pregnant women with suspected, probable or confirmed COVID-19 infection.
5. 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.
6. 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.
7. All medical staff involved in management of infected women should don PPE as required.
8. Management of COVID-19-infected pregnant women should be undertaken by a multidisciplinary team (obstetricians, maternal–fetal-medicine subspecialists, intensivists, obstetric anesthetists, midwives, virologists, microbiologists, neonatologists, infectious-disease specialists).
9. Timing and mode of delivery should be individualized, dependent mainly on the clinical status of the patient, gestational age and fetal condition.
10. Both regional anesthesia and general anesthesia can be considered, depending on the clinical condition of the patient and after consultation with the obstetric anesthetist.
11. 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.
12. 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 in order to maintain milk production. If the patient is asymptomatic or mildly affected, breastfeeding and colocation (rooming-in)

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can be considered by the mother in coordination with healthcare providers.

13. Healthcare professionals engaged in obstetric care and those who perform obstetric ultrasound examinations should be trained and fitted appropriately for respirators and/or PAPR.
14. 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.

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CITATION

This Interim Guidance should be cited as: Poon LC, Yang H, Lee JCS, Copel JA, Leung TY, Zhang Y, Chen D, Prefumo F. ISUOG Interim Guidance on 2019 novel coronavirus infection during pregnancy and puerperium: information for healthcare professionals. *Ultrasound Obstet Gynecol* 2020. DOI: 10.1002/uog.22013.

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APPENDICES

Appendix 1 2007 Infectious Diseases Society of America/American Thoracic Society criteria for defining severe community-acquired pneumonia. Validated definition includes either one major criterion or three or more minor criteria.

Minor criteria
Respiratory rate $\geq$ 30 breaths/min
Pa_{O2}/FI_{O2} ratio $\leq$ 250 Multilobar infiltrates
Confusion/disorientation
Uremia (blood urea nitrogen level $\geq$ 20 mg/dL)
Leukopenia*(white blood cell count < 4000 cells/mL)
Thrombocytopenia (platelet count < 100 000/mL)
Hypothermia (core temperature < 36°C)
Hypotension requiring aggressive fluid resuscitation
Major criteria
Septic shock with need for vasopressors
Respiratory failure requiring mechanical ventilation

*i.e. not chemotherapy-induced.

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Appendix 2 Example of symptoms and TOCC (travel history, occupation, significant contact and cluster) checklist

Checklist for Symptoms and TOCC

1	**Influenza-like illness symptoms**	
☐	Fever	→ **Droplet Precautions** for patient with respiratory symptoms
☐	Cough	
☐	Sore throat	
☐	Shortness of breath	
☐	Diarrhea and/or vomiting	→ **Contact Precautions**
☐	None of above	
☐	Information cannot be obtained	
2	**TOCC: 14 days before onset of symptoms**	
☐	History of recent Travel to the affected areas Date of travel: from _____ to _____ Area: _____	* If influenza-like-illness symptoms +ve plus TOCC +ve ➔ **Prompt isolation** ➔ **Airborne, Droplet & Contact Precautions**
☐	High risk Occupation (e.g. laboratory workers, healthcare workers, wild animals related work)	
☐	History of unprotected Contact with: a Human case confirmed with COVID-19, OR b Consumption of wild animals in areas known to have COVID-19 infection	
☐	Clustering of influenza-like illness / pneumonia (≥ 2 affected persons)	
☐	None of above	
☐	Information cannot be obtained	
3	**Types of Isolation Precautions required:**	
☐ Droplet Precautions	☐ Contact Precautions	☐ Airborne Precautions ☐ Nil
Date:		
Name & Signature:		
Designation:		

Droplet precautions: put a mask on the patient; single room; healthcare worker uses PPE appropriately, including a mask, upon entry to room[64].
Contact precautions: single room; healthcare worker uses PPE appropriately upon entry to room, including gloves and gown; use disposable equipment[64].
Airborne precautions: put a mask on the patient; negative-pressure isolation room; healthcare worker uses PPE appropriately upon entry to room, including wearing a fit-test approved respirator, gloves, gowns, face and eye protection; negative-pressure isolation room; restrict susceptible healthcare workers from entering the room; use disposable equipment[64].

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